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Response of soybean to silicon in vertisol

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Abstract
A Field experiment was conducted in *kharif* season 2018-19 at experimental farm of College of Agriculture, Badnapur to study effect of silicon on soybean. The results emerged out clearly indicated that various parameters like plant height, number of pods, number of nodules, dry matter kg ha^{-1}, oil content, seed yield and straw yield was increased due to foliar application of potassium silicate @ 2 %. Along with RDF.

Keywords: Soybean, silicon, yield, quality

Introduction
Although Si has not been recognised as an essential element for plant growth, the beneficial effects of silicon have been observed in wide variety of plant species. Silicon nutrition manages many abiotic stresses including physical stresses like salt, metal toxicity and nutrient in (Epstein 1994) [2]. It plays a role in phosphors nutrition (Silva 1971) [11]. It increases yield, reduces pests and diseases.

Materials and Methods
A Field experiment was conducted during 2018-19 at experimental farm of Department of Soil Science and Agricultural Chemistry, College of Agriculture, Badnapur to study effect of silicon on soybean varieties. The experiment was conducted in randomized block design with 5 treatments combinations (Control i.e. RDF 30:60:30 kg NPK ha^{-1}(T_1), (T_2)-RDF + foliar application of potassium silicate @ 1 %, (T_3)- RDF + foliar application of potassium silicate @ 2 %, (T_4)- RDF + soil application of Ca silicate @ 50 Kg ha^{-1}, (T_5) -RDF + soil application of Ca silicate @ 100 Kg ha^{-1}). Each experimental unit was replicated two times. Randomly five plants were taken from each treatment for counting of number of nodules and plant height. Plant and soil samples were analysed for nutrient content by following standard methods described by Jackson (1967) [3] and Piper (1966) [8]. The oil content was estimated by using Soxhlet apparatus.

Results and Discussion
Plant height the height of soybean was monitored at harvesting of crop. Periodical observations.

Table 1: Initial physico-chemical properties of experimental soil

S. No.	Particulars	Value
A)	**Physical properties**	
1)	Soil texture	Silty Clay
B)	**Chemical properties**	
1)	pH	7.86
2)	EC(dSm^{-1})	0.28
3)	Organic carbon (g kg^{-1})	0.50
4)	Calcium carbonate (g kg^{-1})	52.00
5)	Available Nitrogen(Kg ha^{-1})	126.75
6)	Available Phosphorus (Kg ha^{-1})	16.22
7)	Available Potassium (Kg ha^{-1})	567.07

recorded under different treatments are presented in Table 2. It was observed that there was continuous increase in plant height of crop due to each additional nutrients application. The plant height was significantly highest in treatment RDF+ Foliar application of potassium silicate @ 2 % (T_3) (43.49 cm) at harvesting stage over the RDF (30:60:30 Kg ha^{-1}) (T_1), followed by treatment (T_5) i.e. RDF+ soil application of calcium silicate @100 kg ha^{-1} (42.30 cm). However, minimum height (41.40cm) was observed in RDF (30:60:30 Kg ha^{-1}) (T_1) treatment after the harvesting stages. The increase in plant height could be partly being attributed to the beneficial effect of treatment T_3.

These varied responses of plant height to foliar application of potassium silicate may be attributed to variation in native available Si content and response to the additional Si fertilizer. The improvement in growth parameters by silicon has also been reported in rice by Anderson (1991) [1], Raid *et al*., (1992) [9].

Number of nodules plant^{-1} the data presented in Table 2 indicates significant impact of silicon on number of nodules per plant. At harvesting maximum number of nodules per plant (23.50) were observed in the plot which was treated with RDF+ Foliar application of potassium silicate @2 % (T_3) (23.50) which was at par with RDF+ soil application of calcium silicate @100 kg ha^{-1} (T_5) (23.00). While, minimum number of nodules per plant (21.20) was observed in the control plot. Treatment T_3 shows significant effect over the treatment T_1 RDF (30:60:30 Kg ha^{-1}). The positive response in the formation root nodule may be related to the beneficial effect of silicon on biosynthesis and metabolism of phenolic compounds such as isoflavonoid. The isoflavonoids released by legume roots have been reported to play multiple roles at distinct stages of the nodulation process especially because it act as chemoacttractants of *Bradyrhizobium* and regulates the node gene expression. Mukherjee and Sen (2005) [5], Rombo *et al*. (2011) had recorded same results.

Total dry matter The mean dry matter was found to be highest due to application of RDF+ Foliar application of potassium silicate @ 2 % (T_3) (1801.50 kg ha^{-1}) which was at par with RDF+ soil application of calcium silicate @ 100 kg ha^{-1} (T_5) (1787.25 kg ha^{-1}). Whereas lowest dry matter was found in absolute RDF (30:60:30 Kg ha^{-1}) treatment (T_1) (1497.26 kg ha^{-1}).

The increase leaf area and leaf weight ratio with the silicon addition indicate that there was greater allocation of photo assimilates to leaves in determinant to the other organs of the plant such as stem and root similar result found by Mukherjee and Sen (2005) [5], Rombo *et al*. (2011).

Test weight Application of RDF+ Foliar application of potassium silicate @ 2 % (T_3) recorded the highest test weight i.e (8.95 g 100^{-1}seeds). It was at par with RDF+ soil application of calcium silicate @ 100 kg ha^{-1} i.e. (8.74 g 100^{-1}seeds) the results are in conformity with Jawahar *et al*. (2015) [4].

Grain yield Potassium silicate application showed significantly increase in grain yield of soybean in all the treatments over RDF (30:60:30 Kg ha^{-1}) (T_1). The highest yield was obtained by the application of RDF+ Foliar application of potassium silicate @ 2 % (T_3)(1323.00 kg ha^{-1}) followed by RDF+ soil application of calcium silicate @ 100 kg ha^{-1} (T_5) i.e. (1307.50 kg ha^{-1}) Similar observations had been made by Nwite *et al.* (2011) [7].

Straw yield [1] An application application of RDF + Foliar application of potassium silicate @ 2 % (T_3) had recorded highest straw yield (1900.25 kg ha^{-1}). Which was at par with RDF+ soil application of calcium silicate @100 kg ha^{-1} (T_5) (1890.85 kg ha^{-1}). The lowest grain yield was (1596.25 kg ha^{-1}) observed in absolute RDF (30:60:30 Kg ha^{-1}) treatment (T_1). Tanaka and Kawano (1965) also reported same finding.

Oil content Silicon application did not shown any significant increase in oil content of soybean.

Table 2: Effect of different fertilizer levels on growth parameters, yield attributes, quality and grain yield of soybean

Treatments	Plant height (cm plant^{-1})	No of nodules plant^{-1}	Total dry matter (kg ha^{-1})	Test weight (g 100^{-1} seeds)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Oil (%)
T_1:RDF (30:60:30 Kg ha^{-1})	41.40	21.20	1497.26	7.09	995.50	1596.25	18.60
T_2: RDF+ Foliar application of potassium silicate @ 1%	42.00	21.80	1595.00	7.57	1113.25	1640.00	19.10
T_3: RDF+ Foliar application of potassium silicate @ 2%	43.49	23.50	1801.50	8.95	1323.00	1900.25	19.87
T_4: RDF+ soil application of calcium silicate @50 kg ha^{-1}	42.20	22.50	1672.25	7.83	1134.75	1766.25	19.28
T_5: RDF+ soil application of calcium silicate @100 kg ha^{-1}	42.30	23.00	1787.25	8.74	1307.50	1890.85	19.52
S.Em.±	0.2614	0.2855	14.3184	0.246	15.2438	9.41	0.35
C.D.@5%	0.8055	0.8795	44.1232	0.7581	46.9749	29.02	NS

References

1. Anderson DL. Soil and Leaf nutrient interactions following application of calcium silicate slag to sugarcane. Fert. Res 1991;30(1):9-18.
2. Epstein E. The anomaly of silicon in plant biology. Proceedings of the National Academy of Sciences of the United States of America 1994;91:11-17.
3. Jackson ML. Soil chemical analysis. Prentice-Hall of India Pvt. Ltd., New Delhi 1967, 498.
4. Jawahar S, Vijayakumar D, Bommera R, Jain N. Effect of silixol granules on growth and yield of rice. Int J Curr Res Aca Rev 2015;3:168-174.
5. Mukherjee D, Sen A. Influence of rice husk and fertility levels on the growth and yield of wetland Paddy (*Oryza Sativa* L.) Agric. Sci. Digest 2005;23(4):284-286.
6. Nayer PK, Misra AK, Patnaik SI. Silica in rice and flooded rice soils. II) Uptake of silica in relation to growth of rice varieties of different duration grown on an Inceptisols. Oryza 1982;19:88-92.
7. Nwite JC, Obalum SE, Igwe CA, Wakatsuki T. Properties and potential of selected ash sources for improving soil conditions and Sawah rice yields in a degraded inland valley in southeastern Nigeria. World J Agric. Sci 2011;7(3):304-310.
8. Piper CS. Soil and plant analysis. Hans publishers, Bombay 1966, 368.
9. Raid RN, Anderson DL, Ulloa MF. Influence of cultivar and amendment of soil with calcium silicate slag on foliar disease development and yield of sugarcane. Crop protection 1992;11(1):84-88.

10. Rambo MKD, Cardoso AL, Bevilaqua DB, Rizzetti TM, Ramos LA, Korndorfer GH, *et al*. Silica from rice husk as an additive for rice plant. J Agron 2011;10(3):99-104.
11. Silva JA. Possible mechanism of crop response to silicate applications Proc. Int. Symp. Soil Fert. Evaluation 1971;1:805-814.
12. Tanaka A, Kawano K. Leaf characters relating to nitrogen response in the rice plant soil science. Pl. Nutr 1965;11:251-258.