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Effect of potassium monosilicate liquid on growth and yield of paddy (*Oryza sativa*)

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Abstract
An experiment entitled "Effect of Potassium mono silicate liquid on growth and yield of paddy (*Oryza sativa*)" was conducted during *kharif* season of 2018-19 at Agronomy Farm, College of Agriculture, Nagpur. The experiment was laid out in factorial randomized block design with two factors viz. different levels of potassium mono silicate and time and number of applications of potassium mono silicate replicated thrice. Growth attributing characters such as plant height, leaf area index, chlorophyll content plant^{-1}, dry matter production plant^{-1} , number of tillers plant^{-1} and yield attributing characters like effective tillers plant^{-1}, number of panicles plant^{-1}, test weight(g), grain yield plant^{-1} (g), and grain and straw yield (kg ha^{-1}) were significantly increased with application of potassium mono silicate @ 250 ppm at 30 DAT, panicle initiation and 20 days after panicle initiation. However it was found at par with application of potassium mono silicate @200 ppm and applied at 30 DAT, and at panicle initiation.

Keywords: Potassium mono silicate, application time

Introduction
Rice (*Oryza sativa* L.) is an important cereal crop and grown across the world. It is a staple food of more than 60% of World's population and provides more calories per hectare than any other crop. Rice is the world's leading food crop, cultivated over an area of about 155 million hectares with a production of about 596 million tons (paddy). In terms of area and production it is second to wheat. It provides about 22 per cent of the world's supply of calories and 17 per cent of the proteins. Rice (*Oryza sativa* L.), a widely adapted and cosmopolitan crop is grown over a diverse set of climatic, topographic and environmental conditions. India has the world's largest area under rice with 44 million ha^{-1}followed by China and Indonesia and contributes 21% of global rice production. Within the country, rice occupies 1/3 of the total cropped area, contributes about 40 to 43% of total food grain production and continues to play a key role in the national food and livelihood security system. India is the second largest producer of rice in world (96.0 million tones – FAO, 2010) [6] next to China. However, productivity of rice is only 2.1 tonnes / ha (milled rice) which is lower than worlds average productivity of 2.9 tonnes/ha (FAO, 2009) [5].

Hence a significant portion of the world's agricultural research has been focused on rice. This lead to development of modern rice varieties and their improved technologies that have greatly increased the global rice production.

Potassium (K) is an essential nutrient required by the plant to perform important plant functions, needed for osmo-regulation, enzyme activation, regulation of cellular pH, cellular cation-anion balance, regulation of transpiration by stomata, and the transport of the products of photosynthesis. Several beneficial effects of Si have been reported, including increased photosynthetic activity, increased insect and disease resistance, reduced mineral toxicity, improvement of nutrient imbalance, and enhanced drought and frost tolerance. Overall, the beneficial effects of Si show two characteristics. One is that the beneficial effects vary with the plant species. Soluble silicon was found to enhance plant growth and yield of many crop plants, protect them from pests and diseases and hence accepted as an agronomically beneficial element (Epstein, 1999) [4].

Material and Methods
The field experiment was carried out to study the effect of Potassium mono silicate liquid on growth and yield of paddy (*Oryza sativa*) during *kharif* season of 2018-19 at Agronomy Section Farm, College of Agriculture, Nagpur. The soil of experimental plot was medium in available nitrogen, moderately high in available phosphorus and organic carbon, moderately high in available potassium and slightly alkaline in reaction, and moderate in available silicon. The experiment was laid out in factorial randomized block design with two factors, the first factor

is different levels of potassium mono silicate viz. P_1 (100 ppm), P_2 (150 ppm), P_3 (200 ppm) and P_4 (250 ppm), and the second factor is time and number of applications of potassium mono silicate viz. T_1 (30 DAT), T_2 (30 DAT, and at panicle initiation stage) and T_3 (30 DAT, at panicle initiation stage, and 20 days after panicle initiation stage). There were 12 treatments combinations replicated thrice. Medium duration paddy variety SKL-9 was used for the experiment. The Paddy (variety SKL-9) seeds were treated with 3% brine solution (300g salt in the 10 lit of water) to reject lighter seeds. The healthy seeds which sunk at the bottom were washed with water,2-3 times and dried in shadow for 24 hours and that seeds are treated with Bavistin (3g Kg^{-1}) and bio fertilizer (azotobacter) @ 25 gms per kg of paddy seed and dried for one hour later broad casted on seed bed (3×2m). After 21-25 days paddy seedlings are transplanted in main field.

Result and Discussions

Growth attributes

The data given in Table no. 1 revealed that growth attributing characters viz. plant height, leaf area index, chlorophyll content $plant^{-1}$, dry matter production $plant^{-1}$, number of tillers $plant^{-1}$ was significantly influenced by different levels of potassium mono silicate and time and number of applications of potassium mono silicate. Application of potassium mono silicate @ 250 ppm (P_4) recorded significantly higher plant height (124.43 cm) as compared to other treatments however found at par with application of potassium mono silicate @ 200 ppm. It is also studied that leaf area index (2.74), chlorophyll content $plant^{-1}$ (7.70), dry matter production $plant^{-1}$ (41.59), number of tillers $plant^{-1}$ (22.93) was significantly influenced by application of potassium mono silicate @ 250 ppm (P_4) found significantly superior over all other treatments and found at par with application of potassium mono silicate @ 200 ppm. This might be due to that potassium mono silicate enhances the uptake of nitrogen, phosphorous, potassium and micro nutrients in balanced manner by reducing nutrient imbalance in plant and these essential nutrients involved in metabolism of paddy, it is directly related with cell division, enlargement, and elongation, vigorous root growth and formation of chlorophyll resulting in higher photosynthesis. These results are in conformity with the findings of Babu rao *et al.* (2018) [2], Jan *et al*. (2018) [8], and Gerami *et al*. (2012) [7].

As regards time and number of application of potassium mono silicate, application of potassium mono silicate at 30 DAT, panicle initiation and 20 days after panicle initiation (T_3) significantly increased the growth attributes viz. plant height (122.14 cm), leaf area $index^{-1}$ (2.68), chlorophyll content $plant^{-1}$ (7.06), dry matter production $plant^{-1}$ (41.22 g) and number of tillers $plant^{-1}$ (22.55) as against application of potassium mono silicate applied at 30 DAT, where as it was at par when applied at 30 DAT, and at panicle initiation (T_2). This might be due to application of potassium mono silicate (foliar spray) with increasing levels at different growth stages enhances the uptake of essential nutrients involved in metabolism of paddy, which is directly related with cell division, vigorous root growth and formation of chlorophyll resulting in higher photosynthesis which leads to increase growth attributing character. These results are in conformity with the findings of Shaymaa *et al.* (2018) [11], Nagula *et al*. (2015) [10] and kalyan singh *et al*. (2006) [9]. They reported that with application of Potassium silicate @ 0.5% spray 3 rounds holds immense potentiality to boost the productivity and profitability of rice.

Yield attributes and yield

The data presented in table no. 2 revealed that application of potassium mono silicate @ 250 ppm produced significantly higher yield attributing characters *viz.* effective tillers $plant^{-1}$ (16.28), number of panicles $plant^{-1}$ (16.28), test weight (18.30g), grain yield $plant^{-1}$ (35.05 g), and grain yield (3821 kg ha^{-1}), straw yield (5798 kg ha^{-1}) compared to application of potassium mono silicate @100 ppm and 150 ppm. However it was found at par with the application of potassium mono silicate @ 200 ppm. This might be due to foliar application of potassium mono silicate increased leaf area index leading to more translocation of photosynthetic products from leaf (source) to grain (sink) finally it increases yield attributes and yield. These results are in conformity with the findings of Babu Rao *et al.* (2018a) [2] and Dehaghi *et al.* (2015) [3]. They observed that spraying potassium silicate on rice leaves had a increased the rice yield up to 4.5, 10.8, 13.1, 25.4, and 28.2% in response to the application of Si at concentrations 50, 100, 150, 200, and 250 mg l^{-1}, respectively. The highest amount of GY was obtained at 250 mg l^{-1} concentration of Silicate.

As regard time of application, yield attributing characters like effective tillers $plant^{-1}$ (15.34), number of panicles $plant^{-1}$ (15.34), test weight (18.20g), grain yield $plant^{-1}$ (34.88 g), grain yield (3709 kg ha^{-1}) and straw yield (5593 kg ha^{-1}) were influenced by application of potassium mono silicate at 30 DAT, at panicle initiation stage, and at 20 days after panicle initiation stage, which was significantly superior over application of potassium mono silicate at 30 DAT, however it was found at par with the application of potassium mono silicate at 30 DAT, and panicle initiation. This may be due to that foliar application of potassium mono silicate with increasing levels at different growth stages enhances the uptake of essential nutrients in balanced manner which leads to more translocation of essential nutrients in plants helps to increase the yield and yield attributes. These results are in conformity with the findings of Babu Rao *et al*. (2018a) [2] and Zahra *et al.* (2015) [12] who reported that the higher quantity of silicon supplied through foliar application of potassium silicate at maximum tillering stage (80 DAT) enhanced the yield attributes. Also, Ahmad *et al*. (2013) [1] reported that foliar application of silicon @ 1% at 30 DAT resulted in increasing yield attributes.

Conclusion

The growth attributing characters viz. plant height, leaf area $index^{-1}$,chlorophyll content $plant^{-1}$, dry matter production $plant^{-1}$, number of tillers $plant^{-1}$ and yield attributing characters like effective tillers $plant^{-1}$, number of panicles $plant^{-1}$, test weight, grain yield $plant^{-1}$, and grain yield, straw yield were increased by application of potassium mono silicate@ 250 ppm. As regards time of application, application of potassium mono silicate at 30 DAT, at panicle initiation stage, and at 20 days after panicle initiation stage, was significantly superior over all other applications.

Table 1: Growth and growth attributes influenced by various treatments

Sr. no.	Treatment	Plant height cm	No. of tillers plant^{-1}	Leaf area index	Chlorophyll content plant^{1} %	Dry matter accumulation plant^{-1} g
A	**Levels of potassium mono silicate**					
	P_1-100 ppm	117.20	20.33	2.39	4.90	39.12
	P_2-150 ppm	119.27	21.44	2.51	6.51	40.65
	P_3- 200 ppm	123.80	22.33	2.67	7.53	41.15
	P_4- 250ppm	124.43	22.93	2.74	7.70	41.59
	S.E (m)±	0.27	0.22	0.05	0.10	0.25
	C.D. at 5%	0.79	0.66	0.13	0.30	0.74
B	**Time and number of applications of potassium mono silicate**					
	T_1-30 DAT	119.64	20.72	2.44	5.98	39.66
	T_2- 30 DAT and at Panicle initiation	121.74	22.00	2.60	6.95	41.00
	T_3-30 DAT and at panicle intiation and 20 days after panicle initiation	122.14	22.55	2.68	7.06	41.22
	S.E.(m)±	0.23	0.19	0.04	0.09	0.22
	C.D. at 5%	0.68	0.57	0.12	0.26	0.64
C	**Interaction**					
	S.E (m)	0.47	0.39	0.08	0.18	0.44
	C.D. at 5%	NS	NS	NS	NS	NS
	GM	121.17	21.75	2.57	6.66	40.62

Table 2: Yield and yield attributes influenced by various treatments

Sr. no.	Treatment	Effective tillers plant^{-1}	No. of panicles plant^{-1}	Test weight (g)	Grain yield plant^{-1} (g)	Grain yield kg ha^{-1}	Straw yield kg ha^{-1}
A	**Levels of potassium mono silicate**						
	P_1-100 ppm	12.17	12.17	17.47	30.03	3009	4521
	P_2-150 ppm	13.81	13.81	18.10	32.14	3695	5496
	P_3- 200 ppm	15.71	15.71	18.19	34.22	3738	5600
	P_4- 250ppm	16.28	16.28	18.30	35.05	3821	5798
	S.E (m)±	0.24	0.24	0.22	0.33	39	71
	C.D. at 5%	0.69	0.69	NS	0.96	114	209
B	**Time and number of applications of potassium mono silicate**						
	T_1-30 DAT	13.25	13.25	17.76	29.60	3366	5055
	T_2- 30 DAT and at Panicle initiation	14.90	14.90	18.08	34.10	3621	5413
	T_3-30 DAT and at panicle intiation and 20 days after panicle initiation	15.34	15.34	18.20	34.88	3709	5593
	S.E.(m)±	0.20	0.20	0.19	0.28	34	62
	C.D. at 5%	0.60	0.60	NS	0.83	98	181
C	**Interaction**						
	S.E (m)	0.41	0.41	0.39	0.57	67	124
	C.D. at 5%	NS	NS	NS	NS	NS	NS
	GM	14.49	14.49	18.01	32.69	3565	5353

Reference

1. Ahmad A, Afzal M, Ahmad AUH, Tahir M. Effect Of Foliar Application Of Silicon On Yield And Quality Of Rice (*Oryza sativa* L). Cercetări Agronomice în Moldova 2013; 3(155): XLVI
2. Babu Rao G, Poornima Yadav PI, Elizabeth K Syriac. Effect of silicon fertilization on yield attributing factors, yield and economics of rice cultivation. Journal of Pharmacognosy and Phytochemistry. 2018a; 7(2):1381-1383.
3. Dehaghi MA, Kayvan Agahi, Soghra Kiani. Agromorphological response of rice (*Oryza sativa* L.) to foliar application of potassium silicate. Biharean Biologist. 2015; 12(1):33-36.
4. Epstein E. Silicon. Annu. Rev. Pl. Physiol. Mol. Biol. 1999; 50:641-664
5. Food and Agriculture Organization, Crop Prospects & Food Situation, February. Rome. 2009.
6. Food Agriculture Organization (FAO), FAOSTAT. www.fao.org/corp/statistics, 2010.
7. Gerami M, Allahyar Fallah, Mohammad Reza Khatami Moghadam. Study of potassium and sodium silicate on the morphological and chlorophyll content on the rice plant in pot experiment (*Oryza sativa* L.). Intl J Agri Crop Sci. 2012; 4(10):658-661.
8. Jan R, Farooq Ahmad, Aga, Fayaz Ahmad Bahar, Talwinder Singh, Rafiq Lone. Effect of nitrogen and silicon on growth and yield attributes of transplanted rice (*Oryza sativa* L.) under Kashmir conditions. Journal of Pharmacognosy and Phytochemistry. 2018; 7(1):328-332.
9. Kalyan Singh, Raghavendra Singh, Jp Singh, Yogeshwar Singh, Singh KK. Effect of level and time of silicon application on growth, yield and its uptake by rice (*Oryza sativa*) Indian Journal of Agricultural Sciences. 2006; 76(7):410
10. Nagula S, Biju Joseph R, Gladis, Venkata Ramana P. Effect of Silicon and Boron Fertilization on Yield, Nutrient Uptake and Economics of Rice. Research Journal of Agricultural Sciences. 2015; 6(3):554-556.
11. Shaymaa I Shedeed. Assessing effect of potassium silicate consecutive application on forage maize plants (*Zea mays* L.). JIPBS. 2018; 5(2):119-127.
12. Zahra N, Ghulam Sarwar. Comparison of Gypsum and Potassium Silicate for Improving Yield and Yield Components of Rice. Int. J Agric. Appl. Sci. 2015; 7(1).