Effect Of Silixol Plus On Germination And Growth Of Rice

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Abstract- A Seed germination study was conducted at Department of Agronomy, Annamalai University, India during February 2019 to study the effect of silixol plus on germination and growth of rice. The treatments comprised of five levels of silixol plus viz., 0 ppm (T_1), 1ppm (T_2), 2 ppm (T_3), 3 ppm (T_4) and 4 ppm (T_5) and were laid out by adopting randomized block design (RBD) with four replications. Among the different levels, seed soaking with Silixol plus @ 2 ppm recorded higher values for seed germination percentage on 3, 5, 7 and 9th day after sowing. The same treatment recorded higher values for growth parameters of rice seedling viz., shoot length, root length, vigour index, fresh weight, relative root and shoot elongation rate on 9th day after sowing. This was followed by silixol plus @ 1 ppm and on par with each other. When the concentration of silixol plus exceed @ 2 ppm, the germination and growth on rice seedlings were gradually decreased, even lesser than control (0 ppm) at Silixol plus @ 4 ppm. Therefore, this study showed seed soaking with silixol plus @ 1 ppm concentration is a viable practice to enhance the germination and growth of rice.

***Index Terms*-** silicon, rice, germination, growth

I. Introduction

Rice is the world's major food crop next to wheat. It has been cultivated in more than 100 countries in an area of 155 m.ha with the production of 596 m.t. India ranks second next to china in term of rice production. In India, it is grown in 44.80 m.ha and contributes 131 m.t food grains to the nation, but the productivity is 2929 kg ha^{-1}. Rice is widely grown in all India's agro-climate zones. In recent year, rice production in India is started shrinking due to late commencement of monsoon particularly in south India and farmers are moving towards direct dry sowing of rice especially in Cauvery delta region. But direct dry seeded rice recorded lesser productivity due to different biotic and abiotic stresses. Lesser plant population due to poor germination, insect pests, diseases and moisture stress greatly are the prime factors affect the productivity of rice under this condition. Therefore, it is essential to maintain optimum plant population by enhancing the seeds germination and to induce biotic and abiotic resistant to rice crop. Seed treatment with agro chemicals is a common practice to increase seed germination and manage insect pests and diseases in rice at the early stages, but traditional agro chemicals will not induce abiotic and biotic resistant to crop. It is therefore important to find a solution to the above stresses.

Silicon (Si) is a beneficial element for plant growth and also found effective in resistance of biotic, abiotic stress and elevate the crop productivity (Sommer et al., 2006). Application of Si produces more biomass which helps to improves light interception and photosynthetic efficiency. Malav *et al*, (2018) reported that addition of silicon strengthens the root canal and supply efficient oxygen to roots and also prevents water loss by evapotranspiration. Enrichment of silicon plant minimized the incidence of various rice pest and diseases (Chandramani et at., 2010 and Jawahar et al., 2019b). Among the cereals, rice is the only one crop accumulates more amount of silicon; an average absorption of silicon by rice is 150-300 kg per hectare and produce high production and productivity. Therefore, from 20th century silicon has been used in Japan very widely and it has been identified as an agronomically essential element and silicate fertilizers have been applied to paddy soils (Ma et al 2001). Generally, silicon supplemented through traditional silicate fertilizer to crops, where silicon is present in amorphous form. But silicon absorb by the plant from the soil in the plant form of ortho silicic acid, which is not widely investigated on rice. The beneficial role of silicon on rice was earlier documented by Jawahar *et al*.(2019a) in rice, but its influence on germination behaviour on rice is still studied. Keeping the above fact in mind, this study was conducted to study the effect of silixol plus on germination and growth of rice.

II. MATERIALS AND METHODS

A germination study on rice due to silicon (silixol plus) was conducted at Department of Agronomy, Annamalai University, India during February 2019. The treatments comprised of five levels of silixol plus viz.,0 ppm (T_1),1ppm (T_2), 2 ppm (T_3), 3 ppm (T_4) and 4 ppm (T_5) and were laid out by adopting RBD and replicated four times.

Silixol Plus: The sample, silixol plus was obtained as a gift sample from Dr.Neeru Jain, Head-Application Research , Privi Life Sciences Pvt.Ltd., Navi Mumbai, India. It contains 0.6 % ortho silicic acid.

Germination and Measurements

Rice (Variety: ADT 43) seeds were obtained from Annamalai University Experimental Farm. The seeds are cleaned and hundred per cent filled grains were used for sowing. As per the treatment, seed soaking was done for twelve hours in their respective solution before sowing. Fifteen numbers of good quality seeds were sown in petri plate of 9 cm diameter lined with filter paper and moisten with 5ml of distilled water and kept at room temperature. Seed germination was recorded on 3, 5, 7 and 9th after sowing. The growth parameters of seedlings viz., shoot length, root length; vigour index and fresh weight of individual seedling were recorded on 9th after sowing.

Vigour index was worked out as suggested by Abdul- Baki and Anderson (1970).

Vigour Index = $\frac{\text{GP x MSH}}{100}$

Where,

GP = germination percentage

MSH = sum of shoot and root length.

Relative elongation rate of shoot and root rate were calculated by using the following equation suggested by Rho and Kil (1986).

RSER = $\frac{Ms}{Mc}$ x 100

Where,

RSER = Relative elongation rate of shoot

Ms= Mean of shoot length of tested plant

Mc= Mean of length of control

RRER= $\frac{Mr}{Mc}$ x100

Where,

RRER= Relative elongation rate of root

Mr= Mean of root length of tested plant

Mc= Mean of length of control.

Statistical analysis

The data on germination and growth of rice was statistically analyzed and critical difference was calculated at 5 % probability level (Gomez and Gomez, 1994).

III. RESULTS AND DISCUSSION

Effect of Silixol plus on germination of rice.

Seeds soaking with silixol plus greatly influenced the germination of rice on 3, 5, 7 and 9th day after sowing(Table 1). The germination percentage ranged from 52.33 to 74.99, 68.33 to 93.32, 73.32 to 94.99 and 76.66 to 96.66 per cent on 3,5,7 and 9th day after sowing, respectively. Among the levels, seeds soaking with silixol @ 2ppm recorded higher germination percentage in all the days of observation. It was 74.99, 93.32,94.99 and 96.66 per cent is increased over 0 ppm on 3,5,7 and 9 days after sowing (Fig.1).This was followed by silixol plus @ 1ppm and were on par with each other. Increased germination percentage due to seed soaking with silicon through silixol plus enhanced the cell extension through formatting Si-polyphenol complexes and lignin which caused loosening of cell wall which caused higher germination percentage. Nita Babaso Patil *et al.* (2018) revealed that the concentration of silixol plus exceeds 2ppm, the germination percentage was gradually decreased. It was found that seed soaking with silixol plus @ 4ppm recorded lesser germination percentage than 0 ppm. The lesser germination under silixol plus @ 4 ppm might be due to higher accumulation of silicon on the seed coat increased the cell wall sustainability by forming a hard layer may be delayed the emergence of radical resulted in lesser germination percentage at 4 ppm. This result was accordance with the earlier reports of Sahebi *et al.* (2015).

Effect of Silixol plus on growth of rice.

The data observed on seedlings growth parameters (Shoot length, root length, vigour index and fresh weight) Table 2. Seed soaking with silixol plus significantly influenced on seedling growth of rice. The shoot length ranges from 1.25 to 4.09 cm and root length ranged from 2.5 to 7.27 cm on 9th day after sowing. Among the treatments, seeds soaking with silixol plus @ 2 ppm recorded highest shoot length and root length of rice and were 4.09 cm and 7.27 cm, respectively which was on par with 1ppm and recorded the shoot length of 4.02 cm and root length of 7.24 cm. The higher values on growth characters due to silixol plus @ 2 ppm might be due to increased cell division, elongation and cell expansion caused by silicon nutrition. This result was witnessed with effect of silicon on Relative elongation rate of shoot and root of rice (Fig 2). The relative elongation rate of shoot ranged from 50.81 to 166.26 per cent and relative elongation rate of root ranged from 43.17 to 125.64 per cent respectively. Among the treatments, the highest relative elongation rate of shoot was recorded @ 2 ppm (166.26 %) followed by 1 ppm (163.04 %) and relative elongation rate of root of 125.64 % at 2 ppm followed by 125.04 % at 1ppm. The same treatment registered highest vigour index of 1098.54 which was followed by 1ppm (1050.89). The increased of vigour index could be due to improvement on germination and growth of rice seedlings characteristics of rice (Feizi *et al.*, 2013). Seeds soaking with silixol plus @ 2 ppm also caused highest fresh weight (1.78 g) among the others due to increased seedling growth. This was comparable with 1ppm (1.67 g). The lesser values on growth parameters were recorded under silixol plus @ 4 ppm due to delayed germination and poor growth of seedlings.

Table 1: Effect of Silixol plus on seed germination of rice.

Treatment	Germination (%)			
	3DAS	5DAS	7DAS	9DAS
0 ppm	58.00	73.99	78.99	86.99
1 ppm	69.99	88.33	93.33	93.33
2 ppm	74.99	93.32	94.99	96.66
3 ppm	66.65	84.99	88.32	91.66
4 ppm	52.33	68.33	73.32	76.66
SEd	2.91	2.88	2.61	2.27
CD at 5%	5.16	6.29	5.70	5.94

Table 2: Effect of Silixol plus on growth parameters of rice.

Treatment	Shoot length (cm)	Root length (cm)	Vigour Index	Fresh weight(g)
0 ppm	2.46	5.79	717.66	1.46
1 ppm	4.02	7.24	1050.89	1.67
2 ppm	4.09	7.27	1098.54	1.78
3 ppm	3.24	6.23	868.02	1.28
4 ppm	1.25	2.5	287.47	0.81
SEd	0.18	0.08	26.02	0.07
CD at 5%	0.39	0.19	56.70	0.15

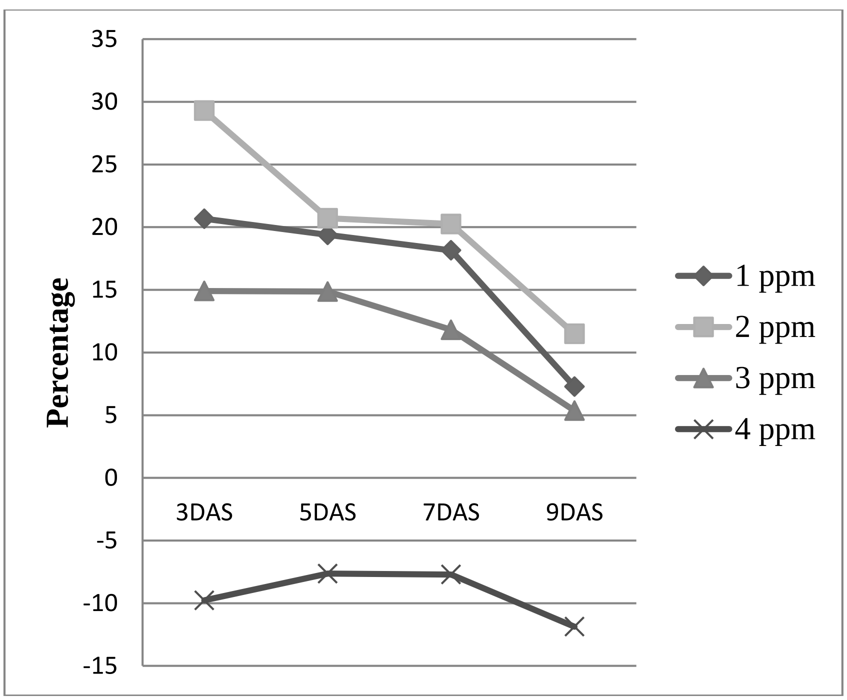

Figure 1: Effect of Silixol plus on per cent increase or decrease of germination percentage over 0 ppm

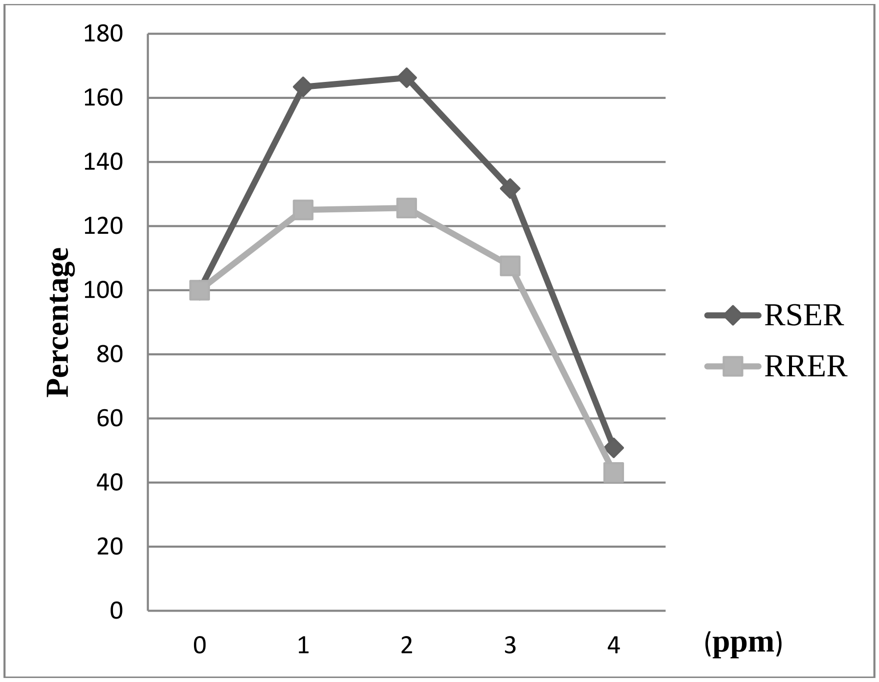

Figure 2: Effect of Silixol plus on relative elongation rate of shoot and root of rice.

IV. Conclusion

In this present research, it can be revealed that application of silicon to the seeds through silixol plus by seeds soaking had a positive role on germination and growth of rice seedlings parameters. Further, seeds soaking silixol plus @ 2 ppm and 1 ppm showed similar effect on rice germination percentage and seedling growth and the response is decreased at higher levels. Hence seeds soaking with silixol plus @ 1ppm can be recommended to enhance the germination and growth of rice.

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