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Influence of seed priming on yield attributes of few varieties of rice (*Oryza sativa* L.) under moisture stress conditions

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ABSTRACT

The present investigation was carried out at rice research farm of College of Agriculture, Central Agricultural University, Imphal in *kharif* season of 2019 at polyhouse to study the effect of chemical priming treatments on yield attributes of rice varieties. Treatment consists of three variety of rice viz. CAU-R1, keibu-chiro and Kiophou and two priming chemicals viz. 2% KNO_3, and 50 ppm Salicylic acid with one control (no priming). Water stress were created in each pot by maintaining soil moisture level at 32% by using soil moisture meter. The results showed that highest number of effective tillers per hill (3.73), number of spikelet's per panicle (120.93), number of filled grains per panicle (92.93), grain yield (7.07 g/hill) and straw yield (11.91 g/hill) were observed in variety CAU-R1 with treatment of 2% KNO_3 (V_1C_1).

Key words: *Chemical priming, KNO_3, Rice and water stress.*

Introduction

Rice (*Oryza sativa* L.) is one of the most important food crop and a primary food source for more than one third of the world's population. Due to population increases, the demand for rice is estimated to be 2,000 million metric tons by 2030 (FAO, 2002). The most devastating abiotic stress in the plants is drought stress. Drought induces various changes in morphological, metabolic and/or physiological functions of plant. It negatively affected on crop growth, biomass accumulation and the world food security. Food security in the world is challenged by increasing food demand and threatened by declining water availability. Rapid germination and emergence are essential for successful crop establishment, for which seed priming could play an important role. Seed priming is an effective technology to enhance rapid and uniform emergence and to achieve high vigour, leading to better stand establishment and yield. It is a simple and low cost hydration technique in which seeds are partially hydrated to a point where pre-germination metabolic activities start without actual germination, and then re-dried until close to the original dry weight. Seed priming is employed for better crop stand and higher yields in a range of crops under drought stress condition.

Therefore, the present study was undertaken to evaluate the effect of chemical priming techniques on yield attributes of different rice varieties under moisture stress conditions.

Materials and Methods

The present investigation was conducted as pot experiment at the poly house of College of Agriculture, CAU, Imphal during *kharif* seasons of 2019. Soil is clayey and acidic in nature (pH 5.6), high in avail-

able organic carbon (1.3%), medium in available nitrogen (306.4 kg/ha), available phosphorus (22.97 kg/ha) and available potassium (227.3 kg/ha). The experiment was laid out in Factorial randomized block design (FRBD) with 9 treatments and 3 replications. Treatment consists of three variety of rice (V_1: CAU-R1, V_2: keibu-chiro and V_3: Kiophou) and two priming chemical with one control (no priming) (C_0: control, C_1: 2% KNO_3, and C_2: 50 ppm Salicylic acid). Before sowing, seeds of rice varieties were soaked overnight (12 hours) separately in KNO_3 (2%) and salicylic acid (50ppm) solution. Then seeds were toughly washed with distilled water and soaked in it for another 8 hours before kept to germinate. Non primed seeds were taken as untreated control. After 15 days of sowing, seedlings were thinned retaining only four seedlings per pot with spacing 10 cm × 10 cm. Required quantities of fertilizers for 10 kg of soil were calculated from the recommended dose of NPK 60:40:30 kg/ha and applied by mixing with soil using urea, single super phosphate and mutate of potash as a source of N, P, and K, respectively.

The data obtained were subjected to analysis of variance (ANOVA) for testing the significance of the treatment effects and interpretation of the result (Gomez and Gomez, 1984).

Results and Discussion

Influence on yield attributes by varieties

The data of the present study showed that different variety response significantly different with respect to yield attributes due to variation in genetic characteristics of varieties under a given environmental conditions. The variety CAU-R1 recorded maximum number of effective tillers per hill followed by Keibu-chiro and Kiophou (Table 1). The difference in number of effective tiller per hill might be due to the variation in the genetic makeup of the variety. Among different varieties, CAU-R1 recorded highest number of spikelets per panicle which was significantly superior to Keibu-chiro and Kiophou. Hussain *et al.* (2014) and Roy *et al.* (2014) also reported in rice that number of spikelets per panicle influenced by variety (Table 1). Variety exhibited significant variation on number of filled grains/panicle. The maximum number of filled grains per panicle was recorded in variety CAU-R1 and lowest in Kiophou. The variation among the varieties might be due to genetic characteristics. The results were also supported by Singh and Gangwer (1989) and Chandra and Kumar (2020) who reported that varietal differences in the number of filled grains per panicle might be due to their differences in genetic constituent (Table 1). Significantly highest grain yields were recorded in CAU-R1 variety followed by Keibu-chiro and Kiophou. The increased in grain yield is due to higher number of panicles/hill, maximum panicle length and filled grains/panicle. Similar results were observed by Kusutani *et al*. (2000) and Dutta *et al.* (2002) who reported that genotypes producing more grain yields in rice due to higher number of effective tillers. Variety showed significant effect on straw yield. The maximum straw yield was recorded in variety CAU-R1 which might be due to maximum number of tillers per hill and higher biomass production as compared to other variety. Similar results recorded by Ram (2000) in wheat and Hossain (2002) in rice.

Influence on yield attributes by the effect of chemical priming

Seed priming with chemicals had significant effect on yield attributes of different rice varieties. Significantly maximum number of effective tillers/hill was recorded with treatment 2% KNO_3 followed by 50 ppm salicylic acid treatment. Increase in the number of effective tillers per hill might be due to enhanced vigour of primed seed that improved initial growth and development of the plant. More number of productive tillers per plant which also might be due increase mobilization of nutrient and moisture supply from primed seeds and hence results in enhanced fertilization, which lower number of sterile spikelet's as reported in wheat by Amin *et al*. (2016). Significantly maximum number of spikelets per panicle was recorded with treatment of 2% KNO_3 and minimum in control. This might be due improvement in growth parameters by chemical priming. Significantly higher number of filled grains per panicle was recorded with treatment of 2% KNO_3 which was significantly superior to 50 ppm salicylic acid and control. Increased in filled grains might be due to enhancement in growth parameters like leaf area, leaf area index and leaves number due to priming treatment. The lowest number of filled grains was recorded in control. Reduction in filled grains per panicle under moisture stress might be due to restriction of translocation of assimilate to the grains due to low soil moisture levels. These results

Table 1. Number of effective tillers/hill, number of spikelet's/panicle, number of filled grains/panicle, grain yield and straw yield as influenced by chemical priming on different rice varieties

Treatment	No. of effective tillers/hill	No. of spikelet's/ panicle	No. of filled grains/panicle	Grain yield (g/hill)	Straw yield (g/hill)
Variety					
V_1	3.03	101.77	70.51	5.42	9.41
V_2	2.50	91.00	59.31	4.23	8.45
V_3	2.19	84.31	52.34	3.08	6.06
SE d (±)	0.10	1.01	1.46	0.12	0.41
CD (P=0.05)	0.21	2.13	3.11	0.25	0.86
Chemical priming					
C_0	2.01	78.88	36.34	2.50	5.49
C_1	3.02	104.07	77.72	5.46	9.53
C_2	2.70	94.13	68.10	4.77	8.90
SE d (±)	0.10	1.01	1.46	0.12	0.41
CD (P=0.05)	0.21	2.13	3.11	0.25	0.86
Interaction (VxC)					
SE d (±)	1.17	1.74	2.54	0.20	0.7
CD (P=0.05)	0.36	3.69	5.38	0.43	NS

agree with the finding of Hossain (2001) and Zain *et al*. (2014) in rice. Highest grain yield was recorded with priming of 2% KNO_3 which was significantly superior to treatment of 50 ppm salicylic acid and control. Improving of seed yield was due to increase in number of panicle per hill, panicle length, number of spikelets per panicle due to priming treatment. Similar finding was reported by Kalpana *et al*. (2015) in wheat. Significantly higher straw yield was recorded with treatment of 2% KNO_3 which was statistically at par with 50 ppm salicylic acid treatment but significantly superior than control. The increased in straw yield was due to increase in number of tillers per hill by chemical priming treatments. Similar finding was also reported by Mahajan 2011 in rice.

Conclusion

Moisture stress resulted in deleterious effect on rice crop. However, the present findings concluded that seeds priming with chemicals improved the yield attributes of rice through enhanced in metabolic activity and greater mobilization of reserved food to the growing points. Application of 2% KNO_3 recorded the maximum of effective tillers, number of spikelets, number of filled grains/panicle, grain yield and straw yield. It was observed that among variety, CAU-R1gave the better yield performance in most of these traits. These chemical priming could be effectively used in rice crop for mitigating the effect of drought stress.

Conflict of Interest- None

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