The Pharma Innovation Journal 2022; 11(10): 1934-1936

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(10): 1934-1936

www.thepharmajournal.com
Received: 13-07-2022
Accepted: 17-08-2022

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Nitrogen and silicon effects on phenology and quality of transplanted rice under temperate conditions

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Abstract
The field experiment entitled "Nitrogen and Silicon effects on phenology and quality of transplanted rice under temperate conditions" was conducted at Agronomy Research Farm of Sher-e- Kashmir University of Agricultural Sciences and Technology of Kashmir during Kharif season 2014 and 2015. The results revealed that days taken to different phonological stages were curtailed with 120 kg ha-^{1} and prolonged with 180 kgNha^{-1}. All silicon applications showed non-significant effect on various phonological stages *viz*. mid tillering, panicle initiation, anthesis and maturity. Significantly higher quality parameters *viz*. alkali spread value, Gel consistency, Amylose content and Protein content were recorded with 120 kgNha^{-1}. 15% silicon improved quality parameters *viz*. alkali spread value, Gel consistency, Amylose content and Protein content as compared to other treatments. Thus, it can be concluded that the optimal nitrogen application (120 kg N/ha) and 15% silicon improved grain quality in rice.

Keywords: Phenology, nitrogen, rice, silicon and quality

Introduction
Rice is a staple food for more than half of the worlds population. Globally it is grown on an acreage of 164.19mha with total production of 509.87 million tonnes and productivity 3.10 ton per hectare (Statista Research Department, 2022) [11]. In Jammu and Kashmir rice is grown on an area of 0.3million ha with a production of 0.6 million tonnes and productivity of 2 tonnes per hectare (DES, 2020) [5]. Among the major nutrient elements, Nitrogen (N) is the most limiting nutrient in rice production, most exported at harvest and responsible for most of the production cost (Yoneyama *et al*., 2016) [12]. In this context, several efforts are being made to improve the use of this element, especially in conjunction with the application of silicon (Si), aiming to improve productivity, abiotic stresses and rice quality (Ávila *et al*., 2010; Marxen *et al*., 2016) [2, 7].
Silicon (Si) is the second most abundant element in the soil (preceded only by oxygen) and is considered a mineral element beneficial to the growth and development of many grass species, such as wheat, barley and rice (Ning *et al*., 2017) [8]. Silicon is involved in several major roles in rice: carbohydrate synthesis, phenolic synthesis and plant cell wall protection. These vectors interact with each other to eliminate statistical association of silica and lignin with straw digestibility when varieties are compared. In rice, absorbed silicon is accumulated in the tissues and contributes to increase the photosynthetic rate and the efficiency of water use and reduce the transpiration rate and toxicity to heavy metals (Seebold *et al*., 2004; Marxen *et al*., 2016) [10, 7]. In the light of above discussion, the present study was designed to investigate the performance of nitrogen and silicon on phenology and quality of transplanted rice under temperate conditions.

Material and Methods
The field experiment was carried out at Research Farm of Sher-e- Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar during Kharif -2014 and Kharif-2015. It is evident from the mean maximum and mean minimum temperatures for the entire cropping season were 27.50 °C and 12.60 °C and 27.30 °C and 13.20 °C, respectively whereas mean maximum and minimum relative humidities were 82.50 and 55.30 per cent and 82.80 and 56.20 per cent during 2014-2015 respectively. The total rainfall received during the experimentation period was 33.3 mm and 29.5 mm during 2014-2015 The experiment comprised two factors (four silicon and three nitrogen levels) was laid out in a randomised completely block design with four replications.

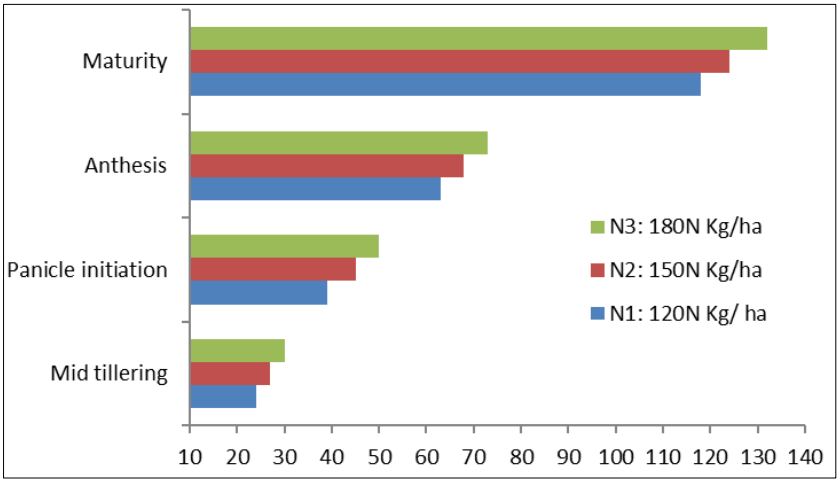
The factors included three nitrogen levels: N_1: 120kg/ha, N_2:150kg/ha and N_3:180kg/ha and four silicon levels: Si_0: Control, Si_1:5%, Si_2:10% and Si_3:15%. Following observations were recorded are:

Number of days taken to reach phenological stages Number of days taken to reach different phenophases were recorded from each treatment. This was determined when more than 50% of the plants in the plot attained the stage *viz*. mid tillering, panicle initiation, anthesis and maturity.

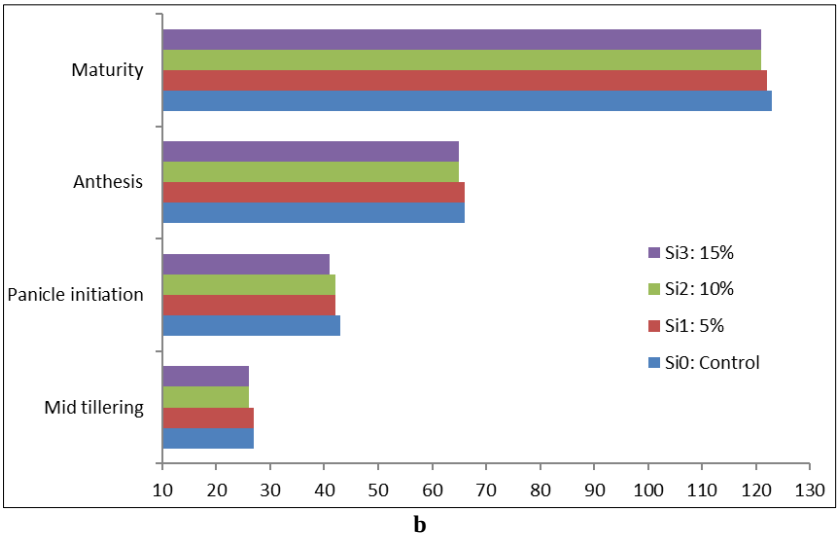
Quality parameters: Alkali spread value was done by the method of Bhattacharya and Sowbhagya (1972) [3]. Gel consistency test was performed by the method followed by Cagampang *et al* (1973) [4]. Total amylose of the milled rice grain was determined by method adopted by Sadasivam S and Manickam A (1992) [9]. The protein content of rice is usually calculated from Kjeldahl method measures the total nitrogen content of a food, which is then used to estimate the crude protein content by applying a conversion factor to the result.

Result and Discussion

Phenology: Phenology is a descriptive study of organisms in relation to their environment. Knowledge of crop phenology is important because for optimal yield in an environment, it is necessary to match the life cycle of the crop to the length of growing season. The various phenological stages *viz*. mid tillering, panicle initiation, anthesis and maturity were affected due to different nitrogen levels, Fig.1 (a and b) revealed that 180kg N ha^{-1} took more number of days to reach different phenological stages than 150 kg N ha^{-1} and 120kgN ha^{-1}. It may be due to higher doses of nitrogen increase the crop growth period. These results are supported by the findings of Hoque *et al*. (2006) [6]. Abou-Khalifa *et al*. (2007) [1] found that maximum tillering, panicle initiation and heading date increased with increased levels of nitrogen up to 165 kg N ha^{-1}. So far as silicon application is concerned, there was no significant difference with respect to all growth stages.



a



b

Fig 1 (a and b): Impact of silicon and nitrogen on phenological stages of transplanted rice under temperate conditions. (Pooled data of two years)

Quality parameters: Quality characteristics are major determinants of market price and include milling, physical appearance, cooking, sensory, palatability and nutritional value. Among nitrogen levels, 120 kgN ha^{-1} recorded higher alkali spread value (3.45), Gel consistency (68), Amylose content (18) and Protein content (8.82) followed by alkali spread value (3.23), Gel consistency (62), Amylose content (15) and Protein content (6.32). Significantly lower alkali spread value (2.76), Gel consistency (58), Amylose content (12%) and Protein content (4.02%) were recorded with 180 kg

N ha^{-1}. With regard to silicon application, 15% silicon recorded higher higher alkali spread value (3.47), Gel consistency (69), Amylose content (17%) and Protein content (8.66%) followed by alkali spread value (3.21), Gel consistency (64), Amylose content (14%) and Protein content (6.73%) which was statistically at par with alkali spread value (3.08), Gel consistency (63), Amylose content (12%) and Protein content (6.55%) and significantly lower alkali spread value (2.75), Gel consistency (51), Amylose content (9%) and Protein content (5.95%) were observed with control as shown in table below:

Table 1: Impact of silicon and nitrogen on quality parameters of transplanted rice under temperate conditions. (Pooled data of two years)

Treatments	Alkali spread value	Gel consistency	Amylose content (%)	Protein content (%)
Nitrogen levels (kg/ha)				
N: 120	3.45	68	18	8.82
N: 150	3.23	62	15	6.32
N: 180	2.76	58	12	4.02
S.Em±	0.08	0.34	0.70	0.13
CD (p≤0.05)	0.24	1.02	2.1	0.39
Silicon applications (%)				
Control	2.75	51	9	5.95
Si: 5	3.08	63	12	6.55
Si: 10	3.21	64	14	6.73
Si: 15	3.47	69	17	8.66
S.Em	0.06	0.41	0.75	0.18
CD (p≤0.05)	0.18	1.23	2.25	0.54

Conclusion

The two year study revealed nitrogen application level significantly affected the grain quality of rice. In this study we found that the quality parameters falls faster when the nitrogen application rate exceeds 120 kg N ha^{-1} and this also suggested that the optimal nitrogen application (120 kg N/ha) and 15% silicon improved grain quality in rice.

References

1. Abou-Khalifa AAA. Response of rice varieties to nitrogen fertilization under varied agro-ecological conditions. Egypt. J Plant Breed. 2007;11(2):681-691.
2. Ávila FW, Baliza DP, Faquin V, Araújo JL, Ramos SJ. Silicon-nitrogen interaction in rice cultivated under nutrient solution. Revista Ciência Agronômica. 2010;41:184-190.
3. Bhattacharya KR, Sowbhagya CM. An improved alkali reaction test for rice quality. International journal of food science and technology. 1972;7:323-331.
4. Cagampang GB, Perez CM, Juliano BO. A gel consistency test for eating quality of rice. Journal of the science of food and agriculture. 1973;24:1589-1594.
5. DES, Economic Survey, Directorate of Economics and Statistics. Government of Jammu and Kashmir; c2020.
6. Haque KMS, Khaliq KA, Aktar J, Shamsuddula AM. Yielding ability of aromatic rice under stacking and non-stacking conditions with different nitrogen fertilization. Int. J Sustain. Crop Prod. 2006;1(1):01-05.
7. Marxen A, Klotzbücher T, Jahn R, Kaiser K, Nguyen VS, Schmidt A, *et al*. Interaction between silicon cycling and straw decomposition in a silicon deficient rice production system. Plant and Soil. 2016;398(1-2):153-163.
8. Ning C, Qu J, He L, Yang R, Chen Q, Luo S, *et al*. Improvement of yield, pest control and Si nutrition of rice by rice-water spinach intercropping. Field Crops Research. 2017;208:34-43.
9. Sadasivam S, Manickam A. Biochemical methods for agricultural sciences. Wiley eastern Ltd., New Delhi; c1992. p. 73.
10. Seebold KW, Datnoff LE, Correa-Victoria FJ, Kucharek TA, Snyder GH. Effects of silicon and fungicides on the control of leaf and neck blast in upland rice. Plant Disease. 2004;88:253-258.
11. Statista Research Department. Production volume of rice India; c2022. p. 2010-202.
12. Yoneyama T, Tanno F, Tatsumi J, Mae T. Whole-plant dynamic system of nitrogen use for vegetative growth and grain filling in rice plants (*Oryza sativa* L.) as revealed through the production of 350 grains from a germinated seed over 150 days: a review and synthesis. Frontiers in Plant Science. 2016;7:1151-1177.
13.