IMPACTOF DIFFERENTMETHODS OF SOWING ANDSEEDPRIMINGON YIELDATTRIBUTEDCHARACTERSOFRICE(*Oryza sativa* L.)

Abstract

A field experiment was conducted at Agronomy farm, Khalsa College, Amritsar (Punjab) during Kharif season of 2021, to study effect of different Sowing methods F_D (Flat dry sowing), B_D (Beds dry sowing), F_w (flat wattar sowing), B_W (beds wattar sowing) and priming methods (No priming, hydropriming and halopriming (Potassium nitrate)) on yield attributing character of rice. We concluded that maximum grain yield (72.7 q ha^{-1}) and biological yield (167.9 q ha^{-1}) was recorded at F_w which was at par with $F_{D.}$ Maximum straw yield was recorded at F_D*i.e.*, 97.1 q ha^{-1} which was at par with F_W. Maximum harvest index was recorded at F_w*i.e.*, 43.1 which was differ from other treatments. On the other hand,result showed that progressive increase in the grain yield (72 qha^{-1}) was recorded at P_N*i.e.*, Potassium nitrate which was significantly higher than others. The straw yield (95.5 qha^{-1}) and biological yield (167.9 qha^{-1}) were highest at P_N which was significantly higher over P_0 (Control) but at par with P_w (hydropriming). The maximum harvest index (42.4) was recorded at P_N but at par with P_w and control.

Keywords: *Rice; Flatbed; Wattar bed; Seed priming; Hydropriming; Potassium nitrate*

Introduction

Rice (*Oryzasativa* L.), is an important staple cereal crop and fulfills the dietary requirement for more than of half population globally. In Asia, rice is cultivated in a total area of 158 million ha annually. Rice cultivation is mainly practiced as transplanting of nursery seedlings into the puddled soil. However, in the recent years, researchers are focusing on alternative rice cultivation methods owing to a shortage of irrigation water and labor with an increasing labor cost. Direct seeded rice (DSR) has emerged as a feasible alternative establishment method to deal labour and water shortages. Because of its lower planting cost, DSR is more easily adopted by rice growers, aiming to maximize economic returns. Direct seeding helps to reduce water consumption by about 30 per cent and also avoids nursery raisings, seedling uproots, puddling and transplanting, and this reduces the labour requirement (Bhullar et al.)[1]. There are three methods of rice direct seeding: 1. dry seeding (sowing dry seeds in dry soil), 2. wet seeding (sowing pre germinated seeds on wet puddled soil) and 3. water seeding (sowing seed into standing water). On the other hand, Drought is a key abiotic factor affecting growth & productivity of rice in many continents of the globe crop loss caused by drought has been of great concern more than that of other environmental factors (Farooq et al.)[2]. Drought at initial phase of crop production causes delayed as well as non- uniform seedling establishment & emergence (kaya et al.)[3]. Water uptake decrease during the imbibition stage seed germination is the main cause of seedling emergence decline (Goswami, Banerjee &Raha) [4]). To overcome the problem of seed germination, seed priming was introduced. The principle of seed priming is based on seed imbibition behaviour, so the water uptake of seeds is an important process in the germination and growth of seeds. Seed priming treatment can lead to better germination & establishment in many crops such as maize, wheat, rice & canola. Beneficial effects of seed priming include increasing the germination rate, germination percentage & uniformity & speed of germination (Farooq et al.)[2] as well as increasing plant growth, accelerating plant flowering & increasing yield (Du &Tuong)[5]. Seed priming techniques improve the germination rate & speed of germination (Bradford, 1986) [6] are low risk technologies& are low-cost solution for poor stand establishment (Farooq et al.) [7]. There are several types of seed priming techniques based on priming solution, such as hydropriming, osmopriming, hormonal priming, nutrient priming and biopriming, which are used to improve germination and emergence in seeds of many field and horticultural crops under optimal and suboptimal conditions (Basra et al; Farooq et al.a,b,c; Farooq et al; Farooq et al.)[8,9,10,11] . Halo priming is soaking of seeds in salts (KNO_3, NaCl, $CaSO_4$ and $CaCl_2$). In salt affected and normal soils this technique improve the seed germination. Therefore, seed priming with KNO3 is considered to be a promising technique to enhance the germination of rice seed. Potassium (K), a macronutrient, is needed in protein synthesis, enzyme activation and stomatal movements, and plays a direct or indirect role in osmotic adjustment (Gattwardet al.; Adams and Shin)[12,13]. Seed priming of rice with nitrate salts (KNO_3 and Mg $(NO_3)_2$.). increased height of plant, no of leaves, leaf area, fertile tillers, grain yield and panicle quality. This may due to the fact that nitrate salts worked as crop growth regulator and translocate more photos-assimilates towards yield attributing parts and improve the final yield. WhileHydro-priming is the soaking of seeds in water before sowing and it may improve the germination and emergence under normal and saline conditions (Roy N K et al.)[14].Seed priming with water is cheap and simple method, which have potential to improve seedling emergence homogeneity, germination percentage under water stress (drought) conditions and this technique can be easily used and adopted by the farmers Hydro-priming significantly affect plant weight, root length, roots number, shoot length, vigor index and time taken to 50% percent emergence. Priming cause different physiological and biochemical changes in seeds and break dormancy. Priming increased the activity of â-mannanases and break the dormancy. Seed priming involves seed treatment with various organic and synthetic chemicals.

Materials and Methods

The experiment was conducted in Agronomy farm of Khalsa College, Amritsar during kharif 2021. PR 126 variety of rice was used in the experiment. The experiment was carried out in Factorial Randomised Block design consisting of 12 treatments with 3 replications. In main plot, there are 4 treatments of sowing of rice viz., F_D (Flat dry sowing), B_D (Bed dry sowing), F_w (Flat wattar sowing) and B_w (Beds wattar sowing). In sub plot, the treatments consisted of priming with different priming substances followed by re-drying for 12 hours. The treatment used were control (No priming), hydro-priming (soaking of seeds for 12 hours) & KNO_3 (soaking seeds for 12 hours followed by 12 hours drying). The land was given irrigation before its final preparation. It was then given 3-4 ploughing (including operation with disc plough, cultivator and rotavator). Fertilizers were applied @ 120:90:60 NPK kg ha^{-1}. All phosphorus and potash and half nitrogen were applied at the time of sowing while the nitrogen was applied in splits at 4,6 and 9 weeks after sowing. Data were collected on 1000-grain weight (g) and paddy yield (q ha^{-1}), straw yield (q ha^{-1}) and biological yield (q ha^{-1}).Observations were taken regularly for germination & counting was done regularly until final germination was recorded. All the recorded data were tested for normally homogeneity and analysed using SPSS. The mean separation was done using LSD (at 5% level of significance).

RESULTS AND DISCUSSION

Table no. 1- Effect of method of sowing and seed treatment on yield attributes.

Treatments	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	Biological yield (q ha^{-1})	Harvest Index (%)
Method of sowing				
F_D (flat dry sowing)	69.8	97.1	167.0	41.7
B_D (beds dry sowing)	64.2	90.4	154.6	41.3
F_W (flat wattar sowing)	72.7	95.0	167.9	43.1
B_W (beds wattar sowing)	67.1	89.7	158.5	42.5

CD (0.05)	**4.3**	**4.7**	**8.9**	**0.4**
Seed treatment				
P_N (potassium nitrate)	72.0	95.5	167.9	42.4
P_W (hydrorpriming)	68.1	93.5	162.4	42.06
P_0 (non-priming)	65.3	90.1	155.6	42.0
CD (0.05)	**3.7**	**4.1**	**7.7**	**0.4**
Interaction	**NS**	**NS**	**NS**	**NS**

Yield attributes

From the experimental field we concluded that maximum grain yield i.e., 72.7 q ha^{-1} was recorded at flat wattar sowing which was comparable with flatbed sowing but 7.7% and 11.6% more obtained under B_D and B_w. However, it was found at par with F_D (69.8 q ha^{-1}). Similar result was given by Javaidet al. [15] concluded that flat sowing showed higher paddy yield. It might be due to production of comparable number of seedlings, spikelets per panicle, grain weight and higher number of panicles per unit area.Further, data indicated that straw yield was higher at F_D which was at par with F_w but significantly differ from others. It recorded 97.1 q ha^{-1} straw yield which was 6.90% and 7.62% higher than B_D and B_w.The reasons were well developed plants with more tillers and leaves. Which in turn lead to more straw from the plants. The plants developed well in line sowing due to better growing conditions. Kouret al.[16]. While biological yield was highest at F_w which was significantly differ from others. It recorded 167.9 q ha^{-1} biological yield which was 5.5% and 7.9% higher than B_w and B_D. However, it was found at par with F_D (167.0 q ha^{-1}). Moving further, highest harvest index was recorded at F_w which was significantly differ from others. It recorded 43.1 harvest index which was 1.3%, 3.2% and 4.1% more obtained under B_w, F_D and B_D. It might be due to production of a smaller number of tillers per unit area, which facilitated translocation of solutes throughout the grain developmental stages and eventually activated the florets to absorb nutrients to their fullest extent and develop heavy kernels in soaked seed broadcast technique (Baloch et al.) [17]

In case of yield attributes, the data showed that P_N (Potassium nitrate) gave a maximum grain yield. It recorded 72 qha^{-1} yield which was 5.4% & 9.3% more obtained under P_w and P_0.Primed seeds grow faster with rapid & uniform emergence with better crop growth & net assimilation rate as well as proper dry matter partitioning which resulted in greater yield potential. The highest effect was derived from NO_3 when present with to developing grains for proper filling by increasing leaf nitrogen content and chlorophyll synthesis. The rice yield in halo priming (2000ppm potassium nitrate) is attributed to rapid emergence, higher establishment, better root and crop growth (Dhillonet al.)[18]. Further, data indicated that straw yield was higher at P_w which was significantly higher than other levels. It recorded 93.5 qha^{-1} straw yield which was 3.6% more than obtained under control. However, it was found at par with P_N (95.5 q ha^{-1}). Seed priming with KNO_3 increase root length which increases shoot biomass hence increasing straw yield. Similar results were seen in Daset al.[19]. While, biological yield was highest at P_w which was significantly differ from control. It recorded 162.4 qha^{-1} biological yield which was 4.18% more obtained under control. However, it was found at par with P_N (167.9 qha^{-1}). Genotype with greater yield potential recorded higher biological yield & harvest index.Harvest index didn't show any type of variation in values but highest was recorded at 42.4% which was 0.9% higher than P_w and control.

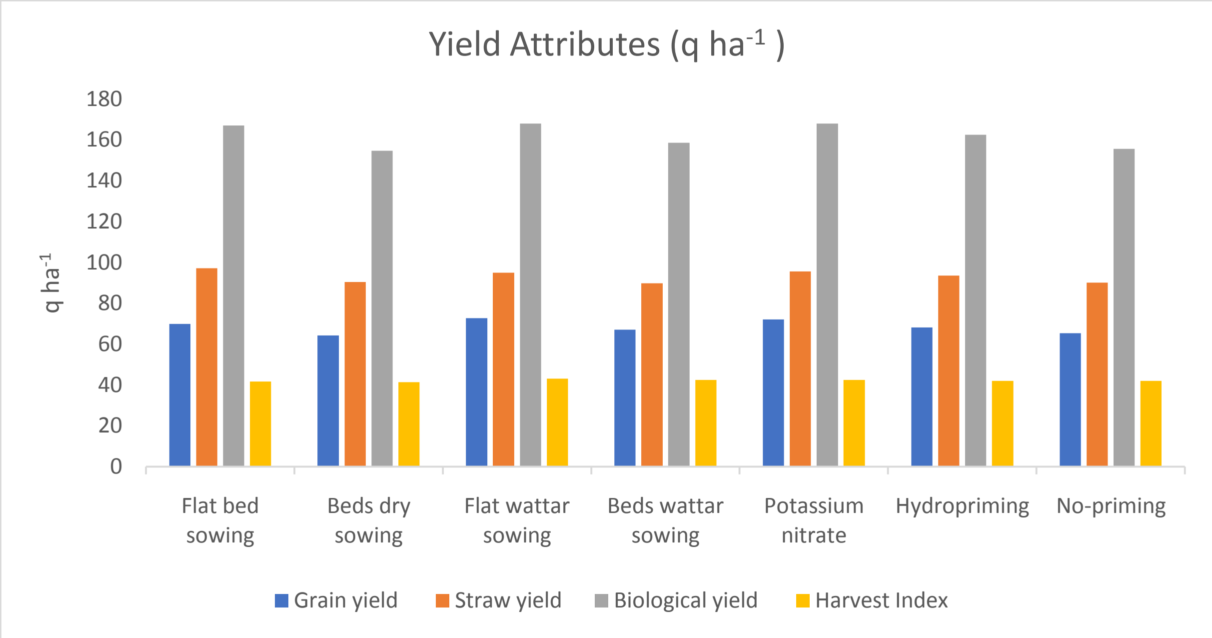

Fig. 1. Effect of method of sowing and seed treatment on yield attributes.

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