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RESEARCH ARTICLE

Effect of Different Varieties of Basmati Rice on their Phenological and Yield Contributing Characters

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Abstract

The experiment was conducted at Private farm Abohar (Punjab) during the year 2014. The study was carried out to compare the two varieties of basmati rice (Pusa Basmati-1121 and Pusa Punjab Basmati-1509) with regards to their phenological and yield contributing characters. The two varieties were grown in two different plots in same locality. The experiment was conducted to determine which variety is more suitable to the particular locality under a commercial point of view. Pusa Punjab Basmati-1509 is found more suitable to the particular area as its yield is more and it also takes less time to complete its crop tenure. The findings indicated that Pusa Basmati-1121 produce profuse tillers, higher plant height and more dry weight accumulation as compared to Pusa Punjab Basmati-1509.

Keywords: Basmati rice, Pusa Basmati-1121, Pusa Punjab Basmati-1509, dry matter accumulation, plant height.

Introduction

Rice (*Oryza sativa)* is monocotyledonous angiosperms belongs to grass family Gramineae and is self-pollinated crop. Rice is the most important staple food in Asia. Above 90% of the world's rice grown and consumed in Asia, where 60% of the world's population live. After corn, it is the grain with the second highest worldwide production, according to data for 2010 "Prod STAT" by FAOSTAT (2006). Basmati rice is one of the most important and popular cereal grain crop of India. Basmati rice means the "Queen of fragrance or the perfumed one" (APEDA). Basmati rice attracted the highest premium because it is very long grained rice with an aroma of its own which enhances the flavor it's mixed with. Basmati rice characterized as extra long slender grains that elongate at least twice of their original size with a characteristic soft and fluffy texture upon cooking delicious taste, superior aroma and distinct flavor. Basmati rice is unique among other aromatic rice varieties. Its average grain length is about 7.00 mm.

Basmati rice is traditionally from North India and Pakistan. India is a world leader in basmati rice production with 5 million tones and Pakistan being the second with 2.47 million ton. The areas of basmati rice production in India are Punjab, Haryana, Rajasthan and UP. The largest area under basmati rice is Haryana 60% followed by UP (17.1%) and Punjab (16.1%). Earlier mention of Basmati has been made in the epic Heer and Ranjha composed by the Punjabi poet Varis Shah in 1766. The word basmati drives from two Sanskrit roots ('Vas'; Aroma and 'May up'; Present from the beginning) while combining the two roots 'May up' changes to 'Mati' making "Vasmati". Generally pronounce it as Basmati.

Basmati was first demonstrated in area covering foothills of Eastern Himalayas stretching through Thailand, Laos, Vietnam, Burma etc. (en.m.wikipedia.org). The population of the world is increasing day-by-day; hence the production of food should be maintained in balance with maintenance of environmental aspects. We need to plant the best suited varieties to the area to maximize the production. The main varieties of Basmati rice as notified under the seeds Act, 1966 are Basmati 386, Basmati 370, Basmati 217, Pusa Basmati-1, Pusa Basmati-1121, Punjab Basmati-1, Haryana Basmati-1, Ranbir Basmati and Type-3 (Dehradooni Basmati). The ultimate yield of rice crop is controlled by a number of genetic and external factors. An optimum level of single factor will not cause any appreciable increase in yield itself, but a combination of factors contributes to the ultimate yield of rice. It is well recognized that by keeping proper phenological traits, yield contributing traits and inputs like varieties, fertilizers, and seed rate etc. have an effective role in increasing the yield of crops. Khalifa Ali and Abou (2009a) studied evaluation of some hybrid rice varieties under different sowing times and observed that grains per panicle as well as grain yield is more in case of H1 variety as compared to other varieties i.e. H2, GZ 6522 and GZ 6903. Khalifa Ali and Abou (2012) studied the effect of two rice varieties at different growth stages on various characters and concluded that H1 hybrid rice variety is higher yielder as compared to Giza 177 inbred rice variety. Akram *et al.* (2007) observed that the plant height of Basmati 385 has maximum plant height as compared to Super basmati variety of basmati rice.

Mannan *et al.* (2009) found that the Basmati 375 gave significantly taller plant followed by Basmati 370 and Basmati-D, while Basmati PNR showed the shortest plant at different growth stages irrespective of planting dates. Yield per acre is dependent on number of factors although maintaining these factors at particular point we can obtain better yield such variability of fertility within a field. Based on the above propositions, the present study was undertaken to find out which variety of basmati rice is best suited to particular area by considering the effect of two different varieties of basmati rice on their phenological and yield contributing characters. Basmati rice requires prolonged sunshine, high humidity and assured water supply. It produces good quality grains if crop matures in cooler temperature and grows well on soils with low permeability and over a wide range of soil pH; however, loamy soils are best for its cultivation.

Materials and methods

Study area and experimental design: The experiment was carried out at Private farm Abohar, Dist., Fazilka (Punjab) during the year 2014. The site lies at 30.13° N latitude and 74.20° E longitude. It is located at elevation of 180 m above sea level. The area has an annual precipitation of 284 mm, and mean temperature 24.7°C. The soil of the area is clayey loam. The water holding capacity of soil is good. The varieties sown in the area were Pusa Punjab Basmati-1509 and Pusa Basmati-1121. The trial was conducted on two acre, one acre for Pusa Punjab Basmati-1509 and one acre for Pusa Basmati-1121. The time of nursery sowing for both the varieties was 17th May 2014 and time of seedlings transplanting for both the varieties was 19th June 2014. On a well pulverized soil that is of fine tilth sow, the nursery by broadcasting the seed @ 2 kg/25 sq m area of land. Well rotten farm yard manure was also broadcasted to cover the seed. The seeds used for broadcasting were pre-soaked in water for 24 hours. Sprouted seeds were soaked in solution of Emisan 6 @ 1 g/Kg of seed. Nurseries were flood irrigated immediately after sowing. Nurseries were irrigated daily at evening time for first 3 days. Afterwards, irrigations were given as per requirement. Seeds germinate on the fourth day and could be seen. About 10 kg of urea was broadcasted in two shifts, one after 10 days of sowing and other after 25 days of sowing along with 2 Kg Phorate in each nursery plot. Nominee Gold was sprayed in both the plots after 28 days of sowing to kill all the weeds having less than 6 leaves. To transplant an acre of basmati rice, 60 sq m area of nursery is required. Nurseries were lightly irrigated before uprooting for ease of operation. Before transplanting, the main field was well leveled using laser land leveler and after that land was ploughed twice by cultivator followed by planking. Then the field was puddled in standing water. The transplanting was done manually and plant-to-plant spacing of 12-14 cm was kept in both the varieties Irrigations were given regularly for first 11 days after transplanting to stand water in a field to prevent germination of weeds after that irrigate the field at regular interval of time to keep the soil moist**.** Irrigation was withheld 15 days prior to harvesting of both the varieties. Pretilachlor 50 EC @ 500 mL/acre was applied in transplanted basmati rice after 4 days of transplanting in both the varieties as a premergence control of weeds. Weeds were also controlled by hand weeding. Weeding was done on 20th July 2014 in both varieties. Fertilizer application for both the varieties was 25 kg DAP along with 5 kg Zinc (33%) and 3 kg Sulphur (80%) per acre which was applied 8 days after transplanting, 50 kg of urea was applied after 25 days of transplanting, 25 kg after 35 days. About 8 kg Padan (Cartap hydrochloride 4% Gr) was also applied with 2nd split of urea application. However, Pusa Punjab Basmati-1509 requires one extra split of 25 kg urea/acre which was applied after 45 days of transplanting. Plant height was measured by using measuring tape from ground surface to top most leaf of the plant. It was done at an interval of 15 days after 30 days of transplanting. Plant height of 5 plants has been measured for average calculation. Dry matter has been observed from two plants by drying in oven at the interval of 15 days starting after 45 days of transplanting. Number of tiller per plant has been observed at the time of harvesting. Pusa Punjab Basmati-1509 was harvested on 24th September 2014 and Pusa Basmati-1121 was harvested on 23rd October 2014, when panicles were fully ripe.

Results and discussion

Study conducted in this project was about phenological and yield contributing characters of basmati rice. The parameters to be used were plant height, dry matter, number of tillers per plant and yield per acre. After conducting the experiments, it was found that plant height of Pusa Basmati-1121 was more than of Pusa Punjab Basmati-1509, which was due to genetic and climatic factors (Table 1). It may also take place due to input variability like less requirement of N fertilizer by Pusa Basmati-1121. Similarly plant height of different varieties i.e. Haryana basmati-1 and Basmati-370, was studied by Hussain *et al.* (2014) and found that Basmati-370 had maximum plant height. Mannan *et al.* (2009) found that the Basmati-375 gave significantly taller plant followed by Basmati-370 and Basmati-D, while Basmati PNR showed the shortest plant at different growth stages irrespective of planting dates.

Table 1. Plant height of studied Basmati rice varieties.

Days after transplanting (DAT)	Pusa Basmati-1121 (cm)	Pusa Punjab Basmati-1509 (cm)
45 DAT	76.6	69.7
60 DAT	89.0	73.1
75 DAT	95.3	82.0
90 DAT	108.2	87.0
105 DAT	116.0	-
120 DAT	125.1	-

Table 2. Dry matter accumulation of studied Basmati rice varieties.

Days after transplanting (DAT)	Pusa Basmati-1121 (cm)	Pusa Punjab Basmati-1509 (cm)
45 DAT	81.1	114.6
60 DAT	120.3	148.6
75 DAT	180.0	192.5
90 DAT	220.0	250.0
105 DAT	245.8	-
120 DAT	295.6	-

Table 3. Number of tillers per plant of studied Basmati rice varieties.

Plant No.	Pusa Basmati-1121	Pusa Punjab Basmati-1509
45 DAT	81.1	114.6
60 DAT	120.3	148.6
75 DAT	180.0	192.5
90 DAT	220.0	250.0
105 DAT	245.8	-
120 DAT	295.6	-

Dry matter accumulation varies from plant to plant and variety to variety. So the dry matter accumulation varies in different varieties may largely due to climatic and input factors such as rice grows in abundant supply of water and fertilizers produces more dry matter as compared to stressed conditions. It has been concluded from the study that dry matter accumulation of Pusa Punjab Basmati-1509 was more than that Pusa Basmati-1121 variety of basmati rice, when compared at different growth stages (Table 2). The findings of Angrish *et al.* (1997) had similarities with these results. These results was also similar as study conducted by Mannan *et al.* (2009) who found dry matter variability in Basmati-375, Basmati-370, Basmati PNR and Basmati-D and concluded that Basmati-D had maximum dry matter as compared to short stature Basmati PNR.

It has been resulted that number of tiller were more in case of Pusa Basmati-1121 as compared to Pusa Punjab Basmati-1509 (Table 3). These results were similar as the findings of Khalifa Ali and Abou (2009a) who studied that early transplanted rice variety H1 had more tillers than H2, GZ 6522 and GZ 6903. The same results were also proposed by Khalifa Ali and Abou (2009b) and observed that early transplanted rice varieties JR 5, H1 had more tillers than GZ 6522 and GZ 6903. The study indicated that yield of Pusa Punjab Basmati-1509 (22.3 q/acre) is more as compared to Pusa Basmati-1121 (19.6 q/acre). The results were also similar as the results of Mannan *et al.* (2009) findings who studied the yield comparison between Basmati PNR, Basmati-375 and Basmati-D**,** resulting in Basmati-D being the best yielder. The same results were also concluded by Lazono and Abruns (1978) by conducting an experiment of yield of 8 short grain varieties of rice under irrigation showed that Basmati-D being the best yielder.

Conclusion

The yield of Pusa Punjab Basmati-1509 was more than Pusa Basmati-1121 and it also takes 25 to 30 days less to mature. It was concluded from the study that Pusa Basmati-1121 produce profuse tillers as compared to Pusa Punjab Basmati-1509. It was also observed that Pusa Punjab Basmati-1509 have shorter plant height and produces more dry matter as compared to Pusa Basmati-1121. Keeping all the aspects in mind, we could still say Pusa Punjab Basmati-1509 is more suited to the particular area as farmers get the chance to sow next crop in the time. It also shows resistance against lodging and hardy as compared to Pusa Basmati-1121.

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