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Performance of Aromatic Rice Strains for Growth and Yield Potentials

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Abstract: The experiment was conducted at Rice research Institute, Dorki, Larkana, Pakistan to evaluate the growth and yield performance of various aromatic strains. The various varieties and crosses were Lateefy, Jajai-77, D. Basmati×Lateefy, IR-8×Jajai-77 and Bas.-370×Jajai-77. It was observed that aromatic varieties and their crosses initiated flowering between 73 and 105 days. Among the tested strains, Lateefy, Bas.-370×Jajai and IR-8×Jajai-77 recorded minimum (73-77) days to flowering, followed by D. Basmati×Lateefy which took 80 days to flowering. The aromatic rice variety Jajai-77 recorded prolonged (105) flowering days. Maturity days and plant height of the strains also followed the similar pattern, where Jajai-77 showed prolonged maturity days and attained taller plants and recognized as taller or semi dwarf as compared to other rest of varieties and crosses. The grain yields of Lateefy followed by IR-8×Jajai-77 and D. Basmati×Lateefy were significantly higher than rest of cultivars and crosses. It was concluded that Lateefy aromatic rice had better adoptability in the region by producing satisfactory grain yield.

Key words: Rice, aromatic, basmati, yield, growth, Pakistan

INTRODUCTION

The definition of Basmati was changed to include its other fine grain qualities. Basmati rice is traditionally grown in the Himalayan foothill regions of India and Pakistan and the name is traditionally associated with this geographical origin (Bligh, 2000). Basmati rice possesses characteristics of both *indica* and *japonica* types and may be considered as an intermediate group between the two (Ahuja *et al*., 1995). It is similar to the indica type in morphological features, but differs in phenol reactions, iso-enzyme patterns (Glaszmann, 1987), kernel appearance (opaque as against translucent of indica) and in cooking as well as eating qualities (intermediate amylose content, medium gel length of 40-60 mm and medium alkali value) in contrast to indica with high amylose and hard gel. It is distributed all over the rice growing world, long grained aromatic rices are concentrated in India and Pakistan (Basmati rices), Afghanistan, Iran, Thailand (Jasmine rices) and in Mayanmar (Sadri rices). Apart from India, major breeding programmers of aromatic rices are in Pakistan, Thailand, USA, Iran and China. In the USA, systematic breeding has resulted in the release of the scented cultivars-Della, Della-X2, Jasmine 85 and Texas. However, Basmati rice from India and Pakistan are preferred by the consumers in USA, Europe and Arabian countries (Siddiq *et al*., 1997). Basmati rice is accepted as the best scented, longest and slenderest rice in the world and the Indian subcontinent continues to be its homeland. Both India and Pakistan have a monopoly over its production and marketing in the world markets. Presently, both these countries together export around five and a half lakh tonnes of good quality basmati rice (Daily Times, 2004). The farmer's and miller's concern is to get high price of produce (both paddy and rice) which is determined by market quality standards comprising of shape, size and colour of rice, percentage of milling, hulling and head rice recovery (Ahuja *et al*., 1995). Aromatic rices are preferred by the consumers all over the world due to its flavour and palatability. Although a large number of these collections are available, little systematic analysis of genetic diversity has been carried out (Choudhury *et al*., 2001). Basmati rice occupies a prime position on account of its extra long superfine slender grains, pleasant, exquisite aroma, fine cooking quality, sweet taste, soft texture, length-wise elongation with least breadth-wise swelling on cooking and tenderness of cooked rice (Paramita *et al*., 2002). Basmati rice is characterized by extra long superfine slender grains with chalky endosperm and a shape comparable with a Turkish Dagger; pleasant and exquisite aroma, sweet taste, dry, fluffy and soft texture when cooked, delicate curvature, low amylose, medium-low gelatinization temperature, 1.5 to 2-fold length-wise elongation with least breadth-wise swelling on cooking and tenderness of cooked rice (Siddiq *et al*., 1997). Basmati emits specific aroma in the field at harvesting, in storage, during milling, cooking and eating (Jefferson, 1985). Aroma is fast developed when

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Basmati is grown in areas where the temperature is cooler at maturity. When grown outside the Punjab region in Pakistan, Basmati is not aromatic. Standard cultivars grown in Sind (Pakistan) mature without aroma (Juliano, 1972). Aroma is the result of genetic factors and environment. The climate and/or soil of the Punjab of Pakistan, Haryana, Punjab and Western UP of India are most suitable for expression of aroma and other quality traits. Aroma is lower in early transplanted (1 June) crop (Ali *et al*., 1991). Basmati rice is, in average, sold at 2-3 times the price of other rice available on the world market. As such, there is a requirement for a method that would allow the detection of non basmati long-grain rice within samples of Basmati (Heather, 2000).

The varietal improvement of Basmati rice was initiated in 1920s at Kala Shah Kaku, (now in Pakistan) and Nagina in Uttar Pradesh. Earlier efforts were made to develop varieties through pure line selection from available agro-commercial group. At Kala Shah Kaku, a collection of Basmati land rices with short bold, short slender, medium slender, long bold and long slender grain types, awned or non-awned type and red or golden husked was made. Basmati 370 was selected from these land races for cultivation in Punjab in 1933. A number of other varieties like Basmati 217, Mushkan, Begumi, Hansraj, T-23, T-3 (Dehradun Basmati), N-10B, N-12 etc. were also developed in the Punjab and Uttar Pradesh. These varieties were of tall stature with weak stems, non-responsive to higher doses of fertilizer and low yields but were famous for aroma and specific cooking qualities and taste. With the introduction of the dwarfing gene in 1964, efforts were concentrated, through hybridization, to develop high yielding aromatic varieties by reducing plant height and retaining the quality traits of traditional Basmati. Sustained and systematic research efforts for over two decades has resulted in the development of Pusa Basmati 1 and Kasturi. Other dwarf Basmati rice cultures of promise that are in the advanced stages of testing are IET 10367, IET 11348, IET 10650, IET 11341 and IET 12019 (Siddiq *et al*., 1997). It is estimated that there are over 300 aromatic rice varieties that have been recognized, although the use and production of these varieties are limited (Weber *et al*., 2000). Plant breeders are concerned that many of the minor scented varieties will be lost because of low productivity and poor market support (Singh *et al*., 1997). Tall Basmati varieties are photosensitive and need short days for induction of flowering. Sensitive varieties flower when the day length is decreasing and reaches a critical stage for induction of the flowering. This effect on flowering, by shortening day length, influences the ripening period. Photosensitive index/phase is higher in sensitive varieties like traditional Basmati lines and less in insensitive varieties like improved or newly released Basmati types as Pusa Basmati 1 and Haryana Basmati 1 (Ahuja *et al*., 1995). Looking the economic importance of aromatic rices of Pakistan in the world market, the field investigations were carried to explore the strains and crosses of aromatic rices for yield and growth potentials.

MATERIALS AND METHODS

The field research was laid-down at Rice Research Institute, Dorki, Larkana, Pakistan to assess the performance of various aromatic strains for growth and yield potentials. The strains screened were: Lateefy, Jajai-77, D. Basmati×Lateefy, IR-8×Jajai-77 and Bas.-370×Jajai-77. The soil was well plowed, leveled and puddled. Twenty two days old seedlings were transplanted in the plots having randomized complete plot design. All the recommended cultural practices for weed, insect and disease control were adopted. The data was analyzed through the procedures of Steel and Torrie (1980).

RESULTS AND DISCUSSION

Growth parameters: Flowering begins with protrusions of the first dehiscing anthers in the terminal spikelets. At the time anthesis is occurring, the panicle is erect in shape (De Datta, 1981). The panicle flower beginning at the top, middle and lower thirds, occurring in the 1, 2 and 3rd day after panicle exertion (heading) in a tropical environment (Fernandez *et al*., 1979). The results of the research revealed that aromatic varieties and their crosses initiated flowering between 73 and 105 days. Among the screened varieties, Lateefy, Bas.-370×Jajai and IR-8×Jajai-77 exhibited minimum (73-77) days to flowering, followed by D. Basmati×Lateefy which recorded 80 days to flowering. The aromatic rice variety Jajai-77 took maximum (105) days to flowering and statistically was different to other tested varieties (Table 1). The similar trend for *maturity days* and *plant height* was noted, where Jajai-77 showed prolonged maturity days and attained taller plants and recognized as semi dwarf as compared to other rest of varieties and

Table 1: Plant characters of different aromatic rice varieties

Varieties	Flowering (Days)	Maturity (Days)	Plant Height (cm)	Tillers Plant^{-1}	Grain yield (kg ha^{-1})
Lateefy	73.00c	103.00c	106.33c	20.00a	2232.67a
Jajai-77	105.00a	137.67a	148.67a	14.00b	1781.67b
D. Basmati ×Lateefy	80.00b	111.00b	142.67b	16.00ab	1832.00b
IR-8 ×Jajai-77	77.00bc	107.00bc	108.00c	16.00ab	1845.67b
Bas.-370 ×Jajai-77	77.00bc	108.00bc	144.00b	15.67ab	1706.67b
CV (%)	1.92	1.57	0.84	8.02	4.72
SE	0.906	1.019	0.628	0.756	51.238
LSD(5%)	3.560	4.00	2.46	2.97	201.20
LSD(1%)	5.900	6.63	4.08	4.92	333.60

lcrosses. Itani *et al.* (1991) studied 94 local scented rice varieties of Japan and observed that, as a rule, scented rices were tall and fewer panicle number, higher stem weight, lower yield and were susceptible to lodging and awned more frequently than the leading. However, this study shows that Lateefy was a semi dwarf, also reported by Batti and Soomro (1985). For Tiller production, significant difference in tiller production was observed in the screened aromatic rice varieties. The maximum number of tillers were found in Lateefy, however, other varieties exhibited non-significant differences for tiller production. Dwivedi (1997) studied the response of some scented rice cultivars and found significant differences for tiller and grains per panicle in Kamini and Sugandha than rest of the cultivars. Khurram *et al.* (2004) reported that morphological studies showed significant variation between tested varieties of rice for days to maturity, plant height and panicle length. The maximum tiller production in Lateefy seems to be its genetically potentiality and adaptation in the rice growing tracts of Pakistan.

Grain yield : The grain yield of Lateefy was prominently and significantly higher than rest of cultivars and crosses. The cross IR-8×Jajai-77 was at the second rank for yield production, followed by D. Basmati×Lateefy (Table 1). The earlier reports of Batti and Soomro (1985) also support the findings of current studies that Lateefy, an aromatic semi dwarf rice was released in 1983 for general cultivation to replace the local tall scented Sugdasi and other Basmati rices. It was developed from a cross between IRRI 760-A1-22-2-3 and Basmati 370. Lateefy yields almost twice than Jajai-77 and Basmati 370 (Singh *et al.*, 2000).

REFERENCES

Ahuja, S.C., D.V.S. Panwar, U. Ahuja and K.R. Gupta, 1995. Basmati Rice: The Scented Pearl. Hisar, Haryana, India: Directorate of Publications, CCS Haryana Agricultural University, pp: 1-61.

Ali, A., M.A. Karim, S.S. Ali and A. Majid, 1991. Relationship of t ransplanting time to grain quality in Basmati 385. Intl. Rice Res. Newslet., 16: 1111.

Bhatti, I.M. and A.A. Soomro, 1985. Lateefy, a new aromatic semi-dwarf rice. Intl. Rice Res. Newsl. 10: 3.

Bligh, H.F.J., 2000. Detection of adulteration of Basmati rice with non-premium long grain rice. Intl. J. Food Sci. Technol., 35: 257-265.

Choudhury, P.R., S. Kohli, K. Srinivasan, T. Mohapatra and R.P. Sharma, 2001. Identification and classification of aromatic rices based on DNA fingerprinting. Eupytica, 118: 243-251.

Daily Times, Pakistan, 2004. Pakistan Basmati rice in the market, May, 26. http://basmati.com/basmati/pakistan/index.shtml.

De Datta, S.K., 1981. Morphology, Growth and Development of Rice Plant. In: Principles and Practices of Rice Production. John Wiley and Sons, pp: 158.

Dwivedi, D.K., 1997. Response of scented rice genotypes to nitrogen under mid-upland situation. Indian J. Agron., 42: 74-76.

Fernandez, F., B.S. Vergara, S. Yoshida, L.D. Haws, N. Yapit and O. Garcia, 1979. Growth and Development Stage of the Rice Plant: an Early Maturing Dwarf in the Tropics. IRRI, Los Banos, Pilippines.

Glaszmann, J.C., 1987. Isoenzymes and classification of Asian rice varieties. Theor. Applied Gene., 74: 21-30.

Heather, F.J.B., 2000. Detection of adulteration of Basmati rice with non-premium long-grain rice. Intl. J. Food Sci. Technol., 35: 257.

Itani, Tomio, Moritaki, Tosimasa, Kubo, Hidenobu and K. Ohsaki, 1991. Agronomic characteristics of ecented rice varieties in Japan. Bull. Hiroshima Agric. Coll., 6: 379-392.

Jefferson, J.N., 1985. Rice Quality in World Markets. In: Rice Grain Quality and Marketing, Philippines: IRRI, Los Banos, pp: 1-13.

Juliano, B.O., 1972. Physico-Chemical Properties of Starch and Protein and Their Relation to Grain Quality and Nutritional Value of Rice. In: Rice Breeding. Philippines: IRRI, Los Banos., pp: 389-405.

Khurram, B., T. Husnain, T. Fatima, Z. Latif, A.M. Syed and S. Riazuddin, 2004. Field evaluation and risk assessment of transgenic indica basmati rice. Mol. Breed., 13: 301-312.

Paramita, B., S. Rekha, Singhal and P.R. Kulkarni, 2002. Basmati rice: A review. Intl. J. Food Sci. Technol., 37: 1

Siddiq, F.A., K. Muralidharan and R.N. Shobha, 1997. Basmati Rice. New Delhi: Directorate of Rice Research. Ind. Council of Agric. Res., pp: 1-14.

Singh, R.K., U.S. Singh and G.S. Khush, 1997. Indigenous aromatic rices of India: Present scenario and needs. Agricultural Situation in India LIV, pp: 491-496.

Singh, R.K., G.S. Khush, U.S. Sing, A.K. Singh and S. Singh, 2000. Breeding Aromatic Rice for High Yield, Improved Aroma and Grain Quality. In: Aromatic Rices. Oxford and Ib Publishing Co. Pvt. Ltd., pp: 71-105.

Steel, R.G.D. and J.H. Torrie, 1980. Principles and Procedures of Statistics. 2nd Edn., McGraw Hill Inc. New York.

Weber, D.J., R. Roilla and U.S. Singh, 2000. Chemistry and Biochemistry of Aroma in Scented Rice. In: Aromatic Rices. Oxford and IB Publishing Co. Pvt. Ltd., pp: 29-46.