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 x Lateefy, IR-8 x Jajai-77 and Bas-370 x 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 x Jajai and IR-8 x Jajai-77 recorded minimum (73-77) days to flowering, followed by D. Basmati x 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 x Jajai-77 and D. Basmati x 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 (Glasmann, 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 rice are concentrated in India and Pakistan (Basmati rice), Afghanistan, Iran, Thailand (Jasmine rices) and in Mayanmar (Sadri rices). Apart from India, major breeding programmers of aromatic rice are in Pakistan, Thailand, USA, Iran and China. In the USA, systematic breeding has resulted in the release of the scented cultivars-Della, Delta-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 rice 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
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 rives 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, Beguni, Hansraj, T-23, T-3 (Delhriad Basmati), N-108, 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 113-48, IET 10650, IET 113-41 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, Jaijai-77, D. Basmati > Lateefy, IR-8 > Jaijai-77 and Bas-370 > Jaijai-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 dehiscent 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 > Jaijai and IR-8 > Jaijai-77 exhibited minimum (73-77) days to flowering, followed by D. Basmati > Lateefy which recorded 80 days to flowering. The aromatic rice variety Jaijai-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 Jaijai-77 showed prolonged maturity days and attained taller plants and recognized as semi dwarf as compared to other rest of varieties and

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Flowering (Days)</th>
<th>Maturity (Days)</th>
<th>Plant Height (cm)</th>
<th>Tiller Plant $^{-1}$</th>
<th>Grain yield (kg ha$^{-1}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lateefy</td>
<td>75.00</td>
<td>103.00</td>
<td>106.56</td>
<td>20.00</td>
<td>2282.67</td>
</tr>
<tr>
<td>Jaijai-77</td>
<td>105.00</td>
<td>137.67</td>
<td>148.67</td>
<td>14.00</td>
<td>1781.67</td>
</tr>
<tr>
<td>D. Basmati &gt; Lateefy</td>
<td>80.00</td>
<td>111.00</td>
<td>142.67</td>
<td>16.00</td>
<td>1832.00</td>
</tr>
<tr>
<td>IR-8 &gt; Jaijai-77</td>
<td>77.00</td>
<td>107.00</td>
<td>108.00</td>
<td>16.00</td>
<td>1845.67</td>
</tr>
<tr>
<td>Bas-370 &gt; Jaijai-77</td>
<td>77.00</td>
<td>108.00</td>
<td>144.00</td>
<td>15.67</td>
<td>1706.67</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CV (%)</th>
<th>SE</th>
<th>LSD(%)</th>
<th>LSD(%)</th>
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<tbody>
<tr>
<td>1.92</td>
<td>0.906</td>
<td>3.560</td>
<td>5.900</td>
</tr>
<tr>
<td>1.57</td>
<td>0.628</td>
<td>2.46</td>
<td>4.08</td>
</tr>
<tr>
<td>0.84</td>
<td>0.756</td>
<td>2.97</td>
<td>4.92</td>
</tr>
<tr>
<td>4.72</td>
<td>51.238</td>
<td>201.20</td>
<td>333.60</td>
</tr>
</tbody>
</table>

Table 1: Plant characters of different aromatic rice varieties
Grain yield: The grain yield of Lateefy was prominently and significantly higher than rest of cultivars and crosses. The cross IR-8 x Jai-77 was at the second rank for yield production, followed by D. Basmati x Lateefy (Table 1). The earlier reports of Batti and Soorm (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 Sugadasi and other Basmati rice. It was developed from a cross between IRRI 760-A1-22-2-3 and Basmati 370. Lateefy yields almost twice than Jai-77 and Basmati 370 (Singh et al., 2000).

REFERENCES


