

SHORT COMMUNICATION

HUBR-16: A High Yielding Early Maturity Rice Line Coupled with Extra Long Kernel and High Kernel Elongation

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In the present study, the development of new basmati line HUBR-16 has been reported from single plant selections from an F_2 population of the cross between TBD-2 and Pusa Sugandh-2. HUBR-16 has attained uniformity in morphological and grain cooking characters. The genotype HUBR-16 recorded superiority over Taraori Basmati and Pusa 1121 with respect to earliness, and yield potential at par with Pusa 1121. Along with earliness and high yield, HUBR-16 is as good as Pusa 1121 for major grain quality traits viz., kernel length, kernel breadth and kernel length after cooking. This line may be utilized as a parent in breeding programmes for accumulation of favorable genes for kernel elongation after cooking.

Key Words: Early maturity, Grain quality, High yield, HUBR-16, Selection

The demand for superior quality basmati rice, irrespective of its price, dictates the most important feature governing basmati breeding. Since the last decade, kernel elongation after cooking and cooked rice quality have dictated the national and international markets and channelized research on this important aspect of Basmati rice breeding. Type-3 and Basmati 370 were the most popular basmati varieties exported from India in the seventies. Later on, Taraori Basmati, a collection from Karnal, India was released for commercial cultivation in 1996. Taraori Basmati had longer grains and replaced Basmati 370, fetching a premium price both in national and international markets. The research became focused on developing semi dwarf, high yielding, rice varieties possessing the typical basmati quality with higher kernel length after cooking, during the eighties. In 1989, Pusa Basmati 1 was released and it soon became popular among farmers because it had a semi-dwarf plant type coupled with the traditional basmati features of grain elongation, fragrance and cooking quality. Pusa Basmati 1 had 1.0 to 1.5 t/ha yield advantage over the traditional basmati varieties (Siddiq, 1990). Further, increased rice kernel length and linear elongation after cooking became an important objective of basmati breeding. In 2003, Pusa 1121 (Pusa Sugandh 4) was developed through selective inter mating of two advanced breeding sister lines of Pusa basmati 1 and released for cultivation in

2005. This variety is known for its extra ordinary kernel length which can be as much as 8.2 mm for single grain, the longest ever known released cultivar in the world. It also has very high kernel elongation ratio ranging from 2 to 2.5. When cooked the kernel length is more than 18 mm with minimum breadth wise expansion. This variety became popular among farmers as Pusa 1121 is photo-insensitive, requires less water, matures early and yields 48-50 q/ha compared to 23-25 q/ha for traditional tall basmati. These unparallel features of Pusa 1121 have led to revolution in domestic cultivation and demand in foreign markets. Presently, this variety is being grown over 70% of basmati growing area of India and fetches a farmer more than ₹3,000/- per quintal of paddy.

We report here the development of HUBR-16 an extra long grain genotype and its yield, maturity, grain and cooking quality characters. During *kharif* 2007 a large number of single plant selections were made from an F_2 population of a cross (TBD-2/Pusa Sugandh 2). TBD-2 is a mutant derived from Taraori Basmati and possesses dwarf plant habit along with grain quality characters of Taraori Basmati parent. The second parent, Pusa Sugandh 2 released in 2001, is a high yielding, long grain rice variety possessing basmati grain quality characteristics. Three F_3 families possessing high yield and desirable grain and cooking quality and earliness were found promising. One of these selections showed high

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kernel length, high kernel length after cooking (KLAC) apart from improved yield. In subsequent generations it showed variation in brown rice grain dimensions, kernel dimensions, alkali spreading value and bursting during cooking but remained stable for KLAC. From F₃ to F₇ generations, selection for yield *per se* and grain quality characteristics was carried out in this particular family in each generation. Of the nine selections in F₈, HUBR-16 has attained uniformity in morphological and grain cooking characters coupled with high yield and early maturity.

The agronomic features and quality characteristics of HUBR-16 are compared with Taraori Basmati (quality check), Pusa Basmati 1 (yield check) and Pusa 1121 (extra long grain check). The experiment was conducted with three replications in randomized block design for three years (2011-13) and the data were recorded on yield and quality traits. The mean values over three years are presented for genotype HUBR-16 and the three basmati checks (Tables 1 and 2). HUBR-16 is about 10 and 20 days early in maturity than Taraori Basmati and Pusa 1121, respectively. HUBR-16 gave about 10 and 20 q/ha higher yield than Pusa 1121 and Taraori Basmati, respectively. It can be concluded that the genotype

HUBR-16 is superior to Taraori Basmati and Pusa 1121 with respect to earliness, with yield at par with Pusa 1121. The Fig. 1 depicts the grain, brown rice, polished rice and cooked rice of HUBR-16 in comparison to the basmati check varieties.

Taraori Basmati, Pusa Basmati-1 and Pusa 1121 have an average milled kernel length of 7.86, 7.53 and 8.51 mm with KLAC of 13.65, 14.72 and 18.50 mm, respectively (Table 2). HUBR-16 recorded 8.62 mm kernel length, 17.86 mm KLAC along with intermediate alkali digestion value. Along with earliness and high yield potential, HUBR-16 is as good as Pusa 1121 for major grain quality traits *viz.*, kernel length, kernel breadth and KLAC. The thresh ability of HUBR-16 is very easy as husk is loosely bound to the kernel and about 2 mm space is empty in the shell of the grain which is 12.33 mm. The data on the grain characteristics of parents TBD-2 and Pusa Sugandh-2 is presented in Table 2.

Linear elongation of kernel on cooking is one of the major characters of fine rice (Sood and Siddiq, 1979). Khush *et al.* (1979) considered lengthwise expansion without increase in girth a highly desirable trait in high quality rice. Singh *et al.* (2002) stressed on the accumulation of genes for kernel elongation in the sister

Table 1. Agronomic features and quality characters of HUBR-16 rice line in comparison to basmati check varieties

Variety/Check	Pedigree	Plant height (cm)	Duration (days)	Average yield (q/ha)	Alkali digestion	Amylose content (%)	Aroma
Taraori Basmati	Pure line sel. from local basmati	146 (Tall)	132	32.79	5.0	23.51	SS
Pusa Basmati-1	Pusa 167/ Karnal local	100 (Semi dwarf)	138	42.50	7.0	24.80	SS
Pusa 1121	Pusa 614-1-2/ Pusa 614-2-4-3	118 (Semi tall)	141	44.61	7.0	22.79	MS
HUBR-16	Taraori Basmati Dwarf - 2/ Pusa Sugandh-2	114 (Semi tall)	121	53.40	5.0	24.35	MS
X	–	119.5	133	43.32	6.0	23.86	–
SE (±)	–	8.34	3.81	3.84	2.0	0.38	–
CD 5% (±)	–	19.60	8.96	9.02	4.7	0.90	–

Table 2. Grain characters of HUBR-16 rice line in comparison to basmati check varieties and parental lines

Variety/Line	Grain length (mm)	Grain breadth (mm)	L/B	Brown length (mm)	Brown breadth (mm)	L/B	Kernel length (mm)	Kernel breadth (mm)	L/B	KLAC (mm)	ER
Taraori Basmati	10.9	1.84	5.86	8.49	1.68	4.96	7.86	1.70	4.62	13.65	1.74
Pusa Basmati 1	10.19	1.87	5.34	8.40	1.59	5.16	7.53	1.58	4.76	14.72	1.95
Pusa 1121	11.94	2.10	5.60	9.5	1.81	5.15	8.51	1.65	5.16	18.5	2.17
HUBR-16	12.33	1.93	6.38	9.32	1.70	5.48	8.62	1.73	4.98	17.86	2.07
TBD-2 (Parent*)	10.76	1.96	5.48	7.95	1.78	4.46	7.06	1.68	4.18	13.13	1.86
Pusa Sugandh-2 (Parent*)	12.23	2.18	5.61	8.51	1.92	4.43	7.64	1.83	4.17	15.56	2.03
X	11.39	1.98	5.71	8.70	1.75	4.94	7.87	1.70	4.65	15.57	1.97
SE (±)	0.42	0.05	0.19	0.24	0.03	0.09	0.23	0.03	0.10	1.02	0.08
CD 5% (±)	0.99	0.12	0.45	0.57	0.09	0.22	0.53	0.07	0.24	2.40	0.19

B= breadth, ER= Elongation ratio, KLAC= Kernel length after cooking, L= length



Fig. 1. Grain, brown rice, kernel and cooked rice of HUBR-16 in comparison to basmati check varieties

lines with which Pusa 1121 was developed. In the case of HUBR-16, KLAC is 17.86 mm. The involvement of many independent loci in the genetic control of kernel elongation after cooking has been suggested by Sood *et al.* (1983). This line can be used as a parent for further accumulation of favourable genes for kernel elongation after cooking.

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