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Evaluation and selection of long slender aromatic rice (*Oryza sativa*) for higher profit in eastern India*

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Rice (*Oryza sativa* L.) is the staple food in India and occupies 44.6 million ha. Out of this, Eastern India occupies 26.8 million ha only. But the production is very low due to regular occurrence of flood, drought and cyclone. The economy of the farmers is decreasing day by day. Most of the lands remain fallow because rice cultivation is not profitable in eastern India. On the other hand, the basmati farmers of north-western Indian states are getting more profit due to export value and high price of rice in national and international market. Scented rice gives more profit compared to traditional rice. There is no increase in basmati areas and production reached the plateau but demand of Indian basmati is increasing day by day in foreign market. Till today, basmati rice is grown in north-western Indian states like Punjab, Haryana, Himachal Pradesh, Uttarakhand, part of Uttar Pradesh etc. because these states are identified as basmati growing zones. Uttarakhand is considered as hot-spot for aromatic rice diversity and the highly priced basmati rice originate in the foot hills of Himalayas (Nagaraju *et al*.2002) About two-third of basmati produced in our country are exported to foreign countries. As a result, there is shortage of aromatic rice for our own consumption. Eastern India is the rice bowl of the country. There is distress sale of normal rice which causes the economy of the people very worse day-by-day. If the suitable scented rice variety can be grown in irrigated areas, the economy of farmers will be uplifted and the scented rice can be available at lower price for our own people in the country. Keeping this in view, seven promising long slender aromatic rice varieties were evaluated for their yield, yield attributes, physico-chemical and cooking characters to find out suitable variety for eastern India.

Field experiments were conducted during rainy *(kharif*) seasons of 2005, 2006, 2007 and 2008 at Central Rice Research Institute, Cuttack to evaluate the long slender scented varieties for yield, yield-attributing and quality characters. The experiments were conducted in randomized block design with three replications and BPT 5204, the popular non-scented quality rice variety of eastern India is used as check. Seven promising long slender scented varieties, viz. Pusa Basmati 1, Basmati 370, Pusa Sugandh 2, Pusa Sugandh 3, Vasumati, Taroari Basmati, Geetanjali were transplanted. The spacing was 15 cm × 20 cm. The normal agronomic practices were followed to raise the crops. Twenty-days-old seedlings were transplanted in mid-July. The crop was harvested in middle of October. The yield characters like plant height, days to 50% flowering, EBT/mt^2, panicle length, panicle weight, sterile grains/panicle, 1 000 g weight yield, harvest index, straw yield etc. were taken in randomly selected 10 plants in each replications. The data on yield, yield-contributing characters and straw yield were recorded for all the four years and analyzed on pooled basis. The data were statistically analyzed as suggested by Gomez and Gomez (1984). The harvested produce of each varieties were evaluated for the quality characteristics as per standard procedures of rice grain quality analysis at 14% moisture content.

The economics was worked out based on prevailing prices both for inputs and outputs during the periods. The economics of processing in different scented rice varieties were studied on milling. Based on milling recovery, its cost and the prevailing prices in the market for the produce, the returns were calculated.

Usually harvesting during mid-October retains aroma for longer time and yield is good. Harvesting after 30 days of flowering yield more without any damage (Chopra *et al*. 2002).

The yield attributes are presented in Table 1. From this experiment it is observed that the plant height varied from 99.8cm (BPT 5204) to 120.4 cm (Pusa Basmati 1). All the tested genotypes are of intermediate height. So there is no lodging problem during maturity. EBT/mt^2 is highest in check variety (512.5), followed by Geetanjali (427), Basmati 370

*Short note

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Table 1 Yield-attributing, physico-chemical and cooking characters of different scented rice varieties (mean of four years)

Variety	Plant height (cm)	Ebt/mt^2	Panicles length (cm)	Paniclew height (g)	1 000-grain weight (g)	DFF (days)	Grains/ panicle	Sterile grains/ panicle	Straw weight (kg/ha)	Harvest index	Hulling (%)	Milling (%)	HRR (%)	KL (mm)	KB (mm)	L/B	Grain type	WU	KLAC	VER	ER	AC (%)	Scent
Pusa Basmati 1	120.4	373.5	28.45	2.85	22.5	101	123.5	17.9	6715	0.34	75.5	67.5	52.5	7.2	1.75	4.25	LS	273	11.7	4.0	1.7	20.5	strong
Geetanjali	104.5	427	27.9	2.95	25.75	88.5	109	21.75	7875	0.48	76.5	68.5	52.0	7.45	1.85	4.05	LS	140	12.1	4.1	1.7	21.8	mild
Pusa Sugandh 2	103.8	290	28.6	3.9	26.5	97	133.1	20.35	5495	0.42	77.25	70.25	54.5	7.15	1.75	4.05	LS	315	11.8	4.0	1.6	22.8	strong
Pusa Sugandh 3	107	328.5	27.55	3.03	26	94	114.2	22.15	7425	0.44	76.25	69.0	49.5	7.35	1.70	4.3	LS	330	12.2	3.8	1.7	23.5	strong
Taroari Basmati	104.5	333.5	21.75	1.35	21.5	112	50.8	22.9	5280	0.27	71.0	68.5	44.5	7.15	1.70	4.25	LS	145	11.6	4.2	1.6	21.3	strong
Vasumati	109.5	343	25.5	2.25	22.5	95.5	125.8	14.9	6930	0.40	68.5	66.5	53.0	7.15	1.74	4.15	LS	232	11.2	4.0	1.73	24.1	strong
Basmati 370	118.5	392.5	30.3	3.35	19.0	108	131	24.95	7380	0.41	76.0	68.5	47.5	7.05	1.65	4.25	LS	215	11.1	3.85	1.7	20.7	strong
BPT5204 (check)	99.85	512.5	25.75	3.2	17.0	111	179	12.1	10230	0.33	79.8	79.8	57.33	5.4	1.85	2.95	MS	230	8.1	4.0	1.55	23.6	no scent
Mean	108.5	375.06	27.0	2.85	21.46	100.62	120.81	19.6	7166.25	0.38	75.1	69.09	51.38	6.97	1.74	4.02		230.63	11.2	4.0	1.64	22.15	
CV%	1.47	6.52	2.37	4.87	19.38	0.53	9.63	5.36	6.5	3.21	0.87	0.74	1.87	1.4	3.75	3.78		4.0	0.66	3.27	3.29	1.64	
CD (P=0.05)	3.78	57.85	1.5	0.32	ns	1.26	27.5	2.49	1107.37	0.02	1.55	1.21	2.28	0.23	ns	0.36		21.89	0.177	ns	ns	0.85	

NB, HRR %; head rice recovery; KL, kernel length; KB, kernel breadth; WU, water uptake; KLAC, kernel length after cooking; VER, volume expansion ratio; ER, elongation ratio; AC, amylose content

(392) and lowest in Pusa Sugandh 2 (290). Panicle length is highest in Basmati 370 (30.3cm), followed by Pusa Sugandh 2 (28.6) and lowest in Taroari Basmati (21.8cm). Panicle weight is highest in Pusa Sugandh 2 (3.9) and lowest in Taroari Basmati (1.4). 1000 grain weight ranged from 17.0 g (BPT5204) to 26.5 g (Pusa Sugandh 2). Days to fifty percent flowering varied 88.5 (Geetanjali) to 112 (Taroari basmati) All the genotypes are medium duration and suitable for medium land only. These varieties should be cultivated in irrigated land/favourable uplands in both seasons. Grains/ panicle is highest in BPT5204 (179) and lowest in Taroari Basmati (51). Straw yield is highest in BPT 5204 (10230 kg/ ha) due low harvest index and lowest in Taroari Basmati (5280 kg/ha). Harvest index varied from 0.27 (Taroari Basmati) to 0.48 (Geetanjali), followed by Pusa Sugandh 2 (0.42), Pusa Sugandh 3 (0.44). Sterile grains/panicle is highest in Basmati 370 (24.95) and lowest in check (12.1). Grain yield is highest in Geetanjali (4975 kg/ha), followed by 4133 kg/ha (Basmati 370), 3906 kg/ha (Pusa Basmati 1) and at par with the check variety (4256 kg/ha). These varieties are consistently performed good over the seasons. So it is concluded that Geetanjali, Pusa Basmati 1 and Basmati 370 are better than check variety. Geetanjali yielded highest due to high EBT/mt^2 and high harvest index (Samanta 2007).

All the scented varieties were analyzed for their physico-chemical and cooking characters (Table 1). All the tested varieties are having good milling recovery and ranged from 68.5 (Vasumati) to 79.8 (BPT 5204). The milling recovery of Pusa Basmati 1, Geetanjali and Basmati 370 are at par with check. Head rice recovery is very important because more head rice recovery gain more profit. HRR (%) ranged from 44.5 (Taroari Basmati) to 57.5 (BPT5204).The varieties like Pusa Basmati 1, Geetanjali, Pusa Sugandh 2 and Vasumati are having very good head rice recovery. Grains are long slender in all the genotypes except check which is medium slender. Kernel length is highest in Geetanjali (7.45 mm), followed by Pusa Sugandh 3 (7.35 mm) Pusa Basmati 1 (7.2 mm) and lowest in check (5.4) Kernel breadth ranged from 1.65 mm (Basmati 370) to 1.85 mm (BPT5204). Kernel length after cooking is highest in Pusa Sugandh 3 (12.2), followed by Geetanjali (12.1) and lowest in BPT 5204 (8.1). Elongation ratio in all the genotypes are almost similar and varied from 1.6–1.7. Water uptake ranged from 140 (Geetanjali) to 330 (Pusa Sugandh 3). Less water uptake require less energy for cooking. There is high variability in water uptake. Volume expansion ratio is almost similar in all the tested genotypes, i e 4.0. Amylose content ranged from 20.5 (Pusa Basmati 1) to 24.5 (Vasumati) But all the tested genotypes are having intermediate amylose content, i e 20–25% which is acceptable by the Indian people. Sharma *et al*. (2008) studied the quality characters of aromatic rice for basumati improvement.

In Odisha, the cost of production is ₹ 30000/ha.The cost of production, gross income are presented in Table 2. The variety Geetanjali is having highest net returns (₹ 35 213),

Table 2 Economics of scented rice production in paddy and after processing under Odisha condition

Variety	Mean yield (kg/ha)	Gross returns (₹)	Cost of production (₹)	Net returns (₹)	B:C Ratio	Milled rice yield (kg/ha)	Total cost including milling (₹/ha)	Gross returns (₹/ha)	Net returns (₹/ha)
Pusa Basmati 1	3 906	51 573	30 000	21 573	1.72	2 637	32 344	65 925	33 581
Geetanjali	4 975	65 213	30 000	35 213	1.117	3 408	32 985	85 200	52 215
Pusa Sugandh 2	3 701	48 258	30 000	18 258	1.61	2 598	32 220	64 950	32 730
Pusa Sugandh 3	3 164	43 166	30 000	13 166	1.44	2 183	31 898	54 575	22 677
Taroari basmati	2 596	34 848	30 000	4 848	1.16	1 778	31 558	44 450	12 892
Vasumati	3 490	46 731	30 000	16 731	1.56	2 320	32 094	58 000	25 906
Basmati 370	4 133	54 762	30 000	24 762	1.83	2 831	32 480	70 775	38 295
BPT 5204 (check)	4 256	41 209	30 000	11 209	1.37	3 396	32 554	67 920	35 366

₹12 000/tonne for paddy and ₹700/tonne for straw wt. for scented rice, ₹ 8 000/tonne for BPT 5204 (Check) and ₹ 25 /1.0 kg milled rice and ₹ 60/100 kg milling and ₹20/kg for check variety

followed by Basmati 370 (₹ 24 762) having highest net returns and Pusa Basmati 1 (₹ 21573) and lowest in check variety (₹ 11 209) because it is non scented variety the selling price is lower than scented varieties. The high net returns are due to high yield in Geetanjali and benefit: cost ratio is highest in Geetanjali (1.117) also suggesting higher profit in this region. Majunath *et al*. (2008) studied the economics of aromatic rice in Goa condition.

The amount of milled rice, cost of processing with economics are presented in Table 2. The scented are sold in ₹ 25/kg in the market and accordingly the profit was calculated. The milled rice depends on high head rice recovery and yield. In this it is recorded that Geetanjali is having high-milled rice (3408 kg), followed by Basmati 370 (2 831 kg) and Pusa Basmati 1 (2 637 kg). Accordingly high net returns are recorded in Geetanjali (₹ 52 215), followed by Basmati 370 (₹ 38 295) and Pusa Basmati 1 (₹ 33 581) and lower in check (₹ 35 366). Because the rate of non-scent milled rice is lower than scented rice (₹ 20/kg).

Thus, for making more profit in rice cultivation, there is need to grow scented rice like Geetanjali in this region so that the economy of the farmers will be uplifted. It is also observed that selling milled rice will fetch more profit than selling paddy**.**

SUMMARY

Field experiments were conducted during rainy *(kharif*) season 2005, 2006, 2007 and 2008 at Central Rice Research Institute, Cuttack to evaluate the long slender aromatic rice for feasibility of better profitability. The trial consists of seven aromatic rice cultivars namely Pusa Basmati 1, Basmati 370, Geetanjali, Pusa Sugandh 2, Pusa Sugandh 3, Taroari Basmati, Vasumati and local check BPT 5204. The varieties were transplanted in randomized block design with three replications. The yield, yield attributes, physico-chemical and cooking characters were recorded and analyzed statistically on pooled basis. It was observed that Geetanjali gave significantly higher yield (4 975 kg/ha), followed by Basmati 370 (4 133 kg/ha), Pusa Basmati 1 (3 906 kg/ha). The milling recovery ranged from 66.5 (Vasumati) to 79.8 (BPT 5204). The variety Geetanjali gave highest gross and net returns ₹ 85 200/ha and ₹ 52 215/ha, respectively after processing and value-addition.

REFERENCES

Chopra N K, Sinha J P and Nisha Chopra. 2002. Effect of time of harvest on seed quality in paddy, *Seed Research* **30** (1) : 67–9.

Gomez K A and Gomez A A. 1984. *Stastitical Procedure for Agricultural Research*, pp 20–8. John Wiley and Sons, New York.

Manjunath B L, Prabhu Desai H R, Talaulikar Sunetra and Korikanthimath V S. 2008. Selection of scented rice (*Oryza sativa*) and its value-addition for higher profit. *Indian Journal of Agricultural Sciences* **78** (8) : 663–6.

Nagaraju J, Kathirvel M, Kumar R R, Siddiq E A and Hasnain S E. 2002. Genetic analysis of traditional and evolved basmati and non-basmati rice varieties using fluorescence–based ISSR-PCR and SSR markers. *Proceedings of Natural Academy of Sciences* **99**: 5836–41. USA.

Samanta S C, Biswas P and Rashid M H Badiuzzaman. 2007. Effect of cultivar and foliage prunning on grain yield, grain quality and economics of aromatic rice in Southern part of Bangladesh. *Journal of Subtropical Agricultural Research and Development* **5** (3) : 246–50.

Sharma Neerja, Singh Naveen, Singh Mandeep and Bharaj T S. 2008. Quality characteristics of aromatic fine grained rice (*Oryza sativa*) genotypes for utilization in basmati improvement. *Indian Journal of Agricultural Sciences* **78** (1) : 44–9.

Shobha Rani N, Rama Prasada S, Prasad G S V and Patil D. 2003. Relationship of hull content with milling traits in scented rices. *Journal of Food Sciences and Technology* **40**: 663–5.

Subudhi H N, Sanjukta Das and Ashok Patnaik. 2005. Studies on grain yield and some physico-chemical characteristics in aromatic rice in Eastern India. *Agriculture Science Digest* **25** (4) : 240–3.