

Research Article**Rice TKM 13: A high yielding medium duration fine grain variety**

S. Banumathy*, R. Saraswathi, A. Sheeba, R. Manimaran, E. Sumathi, M. Devanathan, G. Manickam, G.V. Ramasubramanian, R. Agila, T. Jayaraj and R. Rajendran

Rice Research Station, Tamil Nadu Agricultural University, Tirur, Tiruvallur – 602 025.

E-mail: banumathysiva2004@gmail.com

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Abstract

Medium duration fine grain rice culture TM 07275, a cross derivative of WGL 32100 / Swarna was released as Rice TKM 13 by State Variety Release Committee (SVRC) during 2015 as an alternate variety to BPT 5204. Rice TKM 13 is a semi-dwarf, erect, high tillering and non lodging variety and matures in 125-130 days. This variety is best suited for thaladi season (September sowing) of Cauvery delta region and samba season (August-September sowing) of other districts in Tamil Nadu. In the overall mean performance, the variety has recorded a overall mean grain yield of 5938 kg/ha in 159 locations which was 6.2 and 10.1 per cent increase over the check varieties CO (R) 49 (5592 kg/ha) and BPT 5204 (5390 kg/ha) respectively. It has medium slender fine grain with 1000 grain weight of only 13.8 g, which is lesser than all medium duration rice varieties. The rice is translucent with high milling (75.5%) and head rice yield (71.7%), which is on par with the check variety BPT 5204. Cooking quality and organoleptic characters are comparably similar to BPT 5204. It is moderately resistant to leaf folder, stem borer, GLH, blast, RTD, brown spot and sheath rot, which are its added advantages. In National trials conducted in 101 locations, TKM 13 has recorded a grain yield of 5201 kg/ha which was 11.2 per cent increase over the national check variety IR 64. Based on the superior performance, the variety was identified by Variety Identification Committee (VIC) for Central Variety Release Committee (CVRC) release in the western states viz., Gujarat and Maharashtra

Key words

Rice TKM 13, fine grain, medium duration, grain quality, CVRC release

Introduction

Rice is the predominant crop of Tamil Nadu which is grown in three different seasons viz., kar /kuruvai/sornavari (April-July), samba /thaladi /pishanam (Aug-Nov) and navarai /kodai (Dec-March). Nearly two thirds of total rice area (17.25 lakh ha; Source - Department of Economics and Statistics, 2013-14) in the state is under cultivation during samba/thaladi season. During this season, farmers cultivate medium duration varieties viz., ADT 39, ADT (R) 46, ADT 49, CO (R) 49, CO 50 and BPT 5204. In Tamil Nadu, farmers prefer medium slender fine grain rice varieties for cultivation, because of its grain quality and good market potential.

Rice grain quality is a complex character which is determined by its physical and physicochemical properties. Physical properties include kernel size, shape, milling recovery and grain appearance (Cruz and Khush, 2000). Physicochemical properties of rice are determined based on amylose content, gel consistency and gelatinization temperature. The gel consistency is responsible for softness and amylose content is responsible for texture and appearance in rice (Hossein Sabouri, 2009). In rice, eating and cooking qualities are mainly controlled by the physicochemical properties which greatly influence the consumer preference (Rohilla *et al.*, 2000). Therefore, eating and cooking quality can be considered as important quality traits that have to be focused in rice breeding programmes to meet the growing market demand. Volume expansion over cooking is

another quality parameter which influences the edible volume which is the final output after cooking (Rebeira *et al.*, 2014).

The variety BPT 5204 is widely grown for its fine grain quality and high market preference. But the variety is susceptible to major pests and diseases. This necessitates developing suitable fine grain rice variety with tolerance to major pest and diseases as an alternate for BPT 5204. In this context, efforts were made at Rice Research Station, Tirur of Tamil Nadu Agricultural University, to evolve high yielding, medium duration fine grain rice variety with desirable grain qualities and tolerance to major pest and diseases.

Materials and method

Rice TKM 13 is a derivative of the cross WGL 32100 / Swarna effected during *Thaladi* (September sowing), 2002-03 at Tamil Nadu Rice Research Institute, Aduthurai, stabilized in F₄ generation at Rice Research Station, Tirur and fixed as TM 07275 during *Samba* (August-September sowing), 2006-07. Performance of the culture was tested in different yield trials at Rice Research Station, Tirur from 2007-2010 along with medium duration checks viz., CO (R) 48, CO (R) 49 and BPT 5204. The culture TM 07275 was tested in MLT- Quality Rice medium (MLT-QR-M) for two years (2009-10 and 2010-11) in different Rice Research Stations of TNAU covering different ecosystems of Tamil Nadu. Based on the performance in MLT, the culture was tested in ART Rice 15 during 2010-11 at five

locations each in 10 districts and during 2011-12 in all districts except Ramnadapuram, Sivagangai, Viruthunagar and The Nilgris. The culture was tested in 14 locations during 2010-12 through six Krishi Vigyan Kendras (KVKs).

The performance was tested in 24 farmers' holdings in On Farm Trials (OFT) during 2010-13, along with the check variety BPT 5204 in Tiruvallur, Kancheepuram, Thiruvavur and Puducherry. Large scale demonstrations (LSD) of TM 07275 were conducted at Rice Research Station, Tirur and KVK, Thiruvavur along with the check varieties during samba/thaladi, 2013. In National trials conducted under All India Coordinated Rice Improvement Programme (AICRIP) during 2011-2013 at 101 locations, the culture TM 07275 (IET 22565) was evaluated in Irrigated Mid-Early (IME) in all the AICRIP centers of India.

Pest and disease performance was tested under artificial and field conditions at Aduthurai, Coimbatore and Tirur. Agronomical performance of the culture was tested under SRI system of cultivation during 2012-13 at Rice Research Station, Tirur. Physical, cooking and biochemical properties of rice were tested along with check BPT 5204 at Indian Institute of Cereal Processing Technology (IICPT), Thanjavur and Home Science College & Research Institute (HSC & RI), Madurai.

Result and discussion

Performance of Rice TKM 13 (TM 07275) over different trials: Rice TKM 13 has recorded an overall mean grain yield of 5938 kg/ha at 159 locations which was 6.2 and 10.1 per cent increased yield over CO (R) 49 (5592 kg/ha) and BPT 5204 (5390 kg/ha) respectively (Table 1). In the station trials, the culture TM 07275 recorded a mean grain yield of 6222 kg/ha. The yield increase was 16.8 and 24.3 per cent respectively over the checks CO (R) 49 (5329 kg/ha) and BPT 5204 (5005 kg/ha) (Table 2). In Multi Location Trials (MLT), the overall yield performance of TM 07275 (5415 kg/ha) revealed a yield increase of 7.0 and 9.3 per cent over CO (R) 49 (5061 kg/ha) and BPT 5204 (4955 kg/ha) respectively (Table 3).

In the first year of Adaptive Research Trial (ART), TM 07275 has recorded a mean grain yield of 5880 kg/ha in 38 locations which was on par with the check varieties CO (R) 49 (5747 kg/ha) and BPT 5204 (5758 kg/ha) (Table 4). In 16 and 13 locations, it performed better than the check varieties CO (R) 49 and BPT 5204 respectively. During 2011-12, the culture recorded a mean grain yield of 5948 kg/ha in 63 locations, the yield increase being 4.0 and 7.7 per cent over CO (R) 49 (5717 kg/ha) and BPT 5204 (5489 kg/ha) respectively (Table 5). It performed better than the

checks CO (R) 49 and BPT 5204 in 27 and 37 locations. The overall mean grain yield of the culture in ART from 101 locations was 5923 kg/ha. The yield performance was 3.4 per cent higher than CO (R) 49 (5728 kg/ha) and 6.0 per cent than BPT 5204 (5590 kg/ha) (Table 6).

In ART conducted through KVK's, TM 07275 has recorded a mean grain yield of 5603 kg/ha which was 9.2 and 9.6 per cent higher than CO (R) 49 (5129 kg/ha) and BPT 5204 (5113 kg/ha) respectively (Table 7).

In the OFT, the culture recorded an average grain yield of 6390 kg/ha with 27.8 per cent increase over BPT 5204 (5001 kg/ha). The culture was found to perform better (6727 kg/ha) with 8.2 and 17.0 per cent yield advantage over CO (R) 49 (6218 kg/ha) and BPT 5204 (5749 kg/ha) in LSD. In National trials conducted during 2011-2013 at 101 locations, the culture TM 07275 (IET 22565) recorded an average grain yield of 5201 kg/ha, which was 11.2 per cent yield advantage over the national check IR 64 (Table 8). Based on the yield advantage, the culture has been identified by the Variety identification Committee (VIC) for CVRC release in the western states viz., Gujarat and Maharashtra.

Reaction to pests and diseases: The culture TM 07275 is moderately resistant to leaf folder, stem borer, GLH, blast, RTD, brown spot and sheath rot (Table 9).

Grain quality: The rice is white, medium slender with 1000 grain weight of only 13.8g which is lesser than all medium duration rice varieties. The culture has high milling and head rice yield, which is on par with the check variety BPT 5204. Cooking quality and organoleptic characters are comparably similar to BPT 5204 (Table 10 a, b, c). The feedback from the farmers revealed that, this variety possesses more tillers, densely packed grains, free from pests and diseases at field condition, less duration (7-10 days earlier) than BPT 5204, acceptable milling and cooking quality characters and also fetches good market price as that of BPT 5204.

Based on the yield advantage over the check variety and comparable milling, cooking quality and organoleptic characters as that of BPT 5204, the culture TM 07275 was released by SVRC as Rice TKM 13 for cultivation in Tamil Nadu during thaladi season of Cauvery delta region and samba season of other districts. The variety was also identified by the Variety identification Committee (VIC) for CVRC release in the western states viz., Gujarat and Maharashtra.

References



- Cruz, N.D. and Khush, G.S. 2000. Rice grain quality evaluation procedures. pp15-28. **In:** Sing, R.K., Sing, U.S. and Khush, G.S. (Ed.). Aromatic rices. Oxford and IBH Publishing Co. Pvt. Ltd. New Delli, India.
- Hossein Sabouri, 2009. QTL detection of rice grain quality traits by microsatellite markers using indica rice (*Oryza sativa* L.) combination. *J. Genetics*, **88**: 81-85.
- Rebeira, S.P, Wickramasinghe, H.A.M. and Samarasinghe, W.L.G. 2014. Diversity of Grain Quality Characteristics of Traditional Rice (*Oryza sativa* L.) varieties in Sri Lanka. *Tropical Agricultural Research*, **25**(4): 470 – 478.
- Rohilla, R, Singh, V.P., Singh, U.S., Singh, R.K. and Khush, G.S. 2000. Crop husbandry and environmental factors affecting aroma and other quality traits. pp 201-216. **In:** Sing, R.K., Sing, U.S. and Khush, G.S. (Ed.). Aromatic rice. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, India.



Table 1. Overall mean yield performance of TM 07275 in different trials

Name of the Trial	Locations	Grain yield (kg/ha)			Duration (days)		
		TM 07275	CO (R) 49	BPT 5204	TM 07275	CO (R) 49	BPT 5204
On-Station trial (2006– 2009)	4	6222	5329 (2)	5005	132	135	137
Multi location trials (2009 to 2011)	14	5415	5061	4955	128	131	132
Adaptive Research Trials (2010-11)	38	5880	5747	5758	131	132	133
Adaptive Research Trials (2011-12)	63	5948	5717	5489	128	129	129
KVKs (2010-12)	14	5603	5129	5115	130	130	132
OFT (2010-13)	24	6390	-	5001	132	-	136
LSD (2013)	2	6727	6218	5749	130	130	132
National trial (Kharif, 2011)*	34	5321	4590**	-	129	-	-
National trial (Kharif, 2012)*	35	5019	4802**	-	127	-	-
National trial (Kharif, 2013)*	32	5263	4644**	-	124	-	-
Overall Mean	159	5938 (159)	5592 (132)	5390 (159)	130	130	132
% inc. over the checks			6.2	10.1			

*Not included in the mean; ** National check (IR 64)

Table 2. Performance of TM 07275 at RRS, Tirur (2007 to 2010)

S. No.	Year	Trial	Grain yield (kg/ha)			
			TM 07275	CO (R) 48	CO (R) 49	BPT 5204
1.	2007	Initial Yield Trial	6315	5255	-	5020
2.	2008	Preliminary Yield Trial	6225	5140	-	4970
3.	2009	Advanced Yield Trial	6054	5320	5246	4813
4.	2010	Advanced Yield Trial	6294	5394	5412	5215
		Mean	6222	5277	5329	5005

Table 3. Pooled Mean in Multi location Trials -Quality Rice Medium (2009-10 & 2010-11)

S. No.	Location	Grain yield (kg/ha)		
		TM 07275	CO (R) 49	BPT 5204
1.	2009-10 (6)	5789	4983	4656
2.	2010-11 (8)	5135	5120	5179
	Mean (14)	5415	5061	4955
	% increase over the checks		7.0	9.3

Table 4. District-wise Performance in ART Rice 15/ Special transplanted (2010-11)

Districts	Grain yield (kg/ha)			% increase over checks	
	TM 07275	CO (R) 49	BPT 5204	CO (R) 49	BPT 5204
Ariyalur (4)	5208	4961	5295	5.0	-
Coimbatore (5)	4900	5150	4950	-	-
Karur (5)	5297	4928	5446	7.8	-
Namakkal (4)	6690	6794	6480	-	3.2
Perambalur (2)	5665	5223	5360	7.5	4.8
Nagapattinam (3)	5257	5307	4929	0.9	6.7
Thiruvarur (2)	5545	5045	5425	9.9	2.2
Trichy (3)	5955	6075	5742		3.7
Thanjavur (5)	6115	5304	5627	15.3	8.7
Tirunelveli (5)	7666	7958	7604	-	0.8
Overall mean (38)	5880	5747	5758	2.3	1.8

Table 5. District-wise Performance in ART Rice 15/ Special transplanted (2011-12)

Districts	Grain yield (kg/ha)			% increase over checks	
	TM 07275	CO (R) 49	BPT 5204	CO (R) 49	BPT 5204
Coimbatore (5)	6501	6461	6175	0.6	5.3
Cuddalore (5)	3010	2844	2933	5.8	2.6
Erode (4)	7087	6985	6833	1.5	3.7
Karur (4)	5809	5219	4521	11.3	28.5
Kancheepuram (4)	4915	4613	4312	6.5	14.0
Namakkal (3)	6418	6373	6466	0.7	-
Madurai (4)	5656	5563	5104	1.6	8.9
Nagapattinam (3)	5725	6149	5862	-	-
Nagercoil (4)	5916	5838	5963	1.4	-
Puthukottai (3)	5545	5045	5425	9.9	2.2
Salem (4)	6203	5875	5710	5.6	8.6
Theni (5)	7358	7275	6724	1.1	9.4
Tirunelveli (4)	6176	6206	6018	-	2.6
Thanjavur (5)	5980	5701	5180	4.9	11.5
Thiruvarur (2)	4888	4700	4938	4.0	-
Thiruvannamalai (3)	5307	5240	5323	1.3	-
Tiruvallur (4)	6255	5489	5220	14.0	19.8
Vellore (3)	6417	5930	5727	8.2	11.2
Overall mean (63)	5948	5717	5489	4.0	7.7

Table 6. Pooled Mean in Adaptive Research Trials (2009-10 and 2010-11)

S.No.	Year	Grain Yield (kg/ha)		
		TM 07275	CO (R) 49	BPT 5204
1.	2010-11 (38)	5880	5747	5758
2.	2011-12 (63)	5948	5717	5489
	Overall mean (102)	5923	5728	5590
	% inc. over checks		3.4	6.0



Table 7. Adaptive Research Trials conducted through KVK's

KVKs	Grain yield (kg/ha)			% increase over checks	
	TM 07275	CO (R) 49	BPT 5204	CO (R) 49	BPT 5204
Madurai (3)	4620	4410	4302	4.8	7.4
Nagapattinam (2)	5143	4780	4774	7.6	7.7
Trichy (3)	6454	5865	6217	10.0	3.8
Tiruvallur (3)	5718	5157	4987	10.9	14.7
Thiruvarur (1)	5373	4325	4167	24.2	28.7
Vriddhachalam (2)	5307	5913	5857	-	-
Overall Mean (14)	5603	5129	5113	9.2	9.6

Table 8. Pooled Mean in National Trials (2011-2013)

S.No.	Year	Trial	Grain Yield (kg/ha)			
			TM 07275 (IET 22565)	National check (IR 64)	Regional checks	Local checks
1.	2011 (34)	IVT-IME	5321	4590	4952	4937
2.	2012 (35)	AVT 1-IME	5019	4802	4817	5044
3.	2013 (32)	AVT 2-IME	5263	4644	4977	5153
Overall mean (101)			5201	4678	4915	5109
% inc. over checks				11.2	5.8	1.8

Table 9. Reaction of TM 07275 to major insect pests and diseases under field condition

Station	Culture/ check varieties	Pests							Diseases				
		Stem borer		Leaf folder	BPH	GLH	WBPH	Blast	RTD	Brown spot	Sheath rot	Sheath blight	BLB
		Dead heart (%)	White ears (%)										
Aduthurai	TM 07275	1.88	5.30	1	-	-	-	-	5	5	5	5	7
	CO (R) 49	5.97	5.88	1	-	-	-	-	7	7	9	9	7
	BPT 5204	4.44	5.54	1	-	-	-	-	7	9	9	9	7
Coimbatore	TM 07275	-	-	-	7	5	5	5	5	5	5	7	-
	CO (R) 49	-	-	-	9	7	7	5	5	7	5	7	-
	BPT 5204	-	-	-	7	5	7	7	7	7	9	9	-
Tirur	TM 07275	8.10	9.30	1	-	3	-	5	3	3	3	-	5
	CO (R) 49	8.30	9.60	1	-	5	-	7	7	5	5	-	5
	BPT 5204	10.70	9.90	1	-	5	-	7	5	5	7	-	7

Table 10. Grain quality characters of TM 07275**a. Milling, physical and cooking quality characters**

Quality characters		TM 07275	BPT 5204
Milling characters*	Milling yield (%)	75.5	75.7
	Head rice yield (%)	71.7	71.9
Physical quality characters*	Kernel length (mm)	5.44	5.64
	Kernel breadth (mm)	1.92	1.94
	L/B ratio	2.83	2.89
Cooking quality characters**	Kernel length after cooking (mm)	9.0	8.9
	Kernel breadth after cooking (mm)	2.8	3.0
	Linear elongation ratio (LER)	1.64	1.62
	Breadthwise expansion ratio (BER)	1.27	1.50
	Volume expansion (ml)	40	40

(*Source : IICPT, Thanjavur & TNAU, Coimbatore; ** Source : HSC&RI, Madurai)

b. Biochemical characteristics of TM 07275

Parameters	TM 07275	BPT 5204
Gel consistency	Soft	Soft
Gelatinization temperature	High to intermediate	High to intermediate
Amylose content	23.8	22.6

(Source : AICRIP report & TNAU, Coimbatore)

c. Organoleptic evaluation of cooked rice

Characteristics	TM 07275	BPT 5204
Appearance	9.0	9.4
Cohesiveness	9.0	8.5
Tenderness on touching	8.6	8.6
Tenderness on chewing	9.2	9.0
Texture	9.0	8.6
Taste	9.0	9.0
Elongation	9.2	9.2
Overall acceptability	9.2	9.2

Maximum score 10 (Test conducted at RRS, Tirur)

Fig.1: Pedigree of TM 07275 (IET 22565)

