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Research Article

A high yielding Seeragasamba variety : VGD 1

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Abstract
An experiment was carried out at Agricultural Research Station, Vaigaidam, Theni district of Tamil Nadu from 2007 to 2019 with an objective of developing a variety by deriving the grain quality characters from the traditional rice variety Seeragasamba and yield and yield attributing characters from ADT 43. The promising culture VG 09006, a cross derivative of ADT43/ traditional Seeragasamba was released as VGD 1 during 2019 by the State Variety Release Committee, Tamil Nadu. It is a medium duration variety (129 days) with erect, high tillering and non lodging plant habit. This variety is recommended for samba/late samba seasons of Dindigul, Theni, Trichy, Perambalur, Karur, Coimbatore, Erode, Dharmapuri, Vellore and Virudhunagar districts of Tamil Nadu. It recorded an overall mean grain yield of 5859 kg/ha in 101 locations, which was 32.56 and 13.80 per cent increased grain yield over traditional Seeragasamba (4420 kg/ha) and TKM 13 (5149 kg/ha), respectively. It is moderately resistant to leaf folder, blast and brown spot under field conditions. The rice is white, fine (short slender) with a 1000 grain weight of 8.9 g which is less than traditional Seeragasamba (11.6 g) and all other popularly grown rice varieties *viz*., TKM13 (13.8 g), CO 51 (16.0 g) and ADT 43 (15.5 g).

Key words
Briyani rice, Quality rice, Seeragasamba, aromatic rice, VGD 1

INTRODUCTION

Rice, *Oryza sativa* (2n=24) is an integral part of Indian culture and its richness in diversity is accountable for all the reasons and seasons. 'Rice is Life' since it caters the food requirement for more than half of the global population. Rice is an indispensable item in Indian culture and finds its place from birth to death. India had produced 118.5 million tonnes of rice during 2019 after China which ranks the first in rice production with 139.8 of million tonnes (FAOSTAT, 2020). In Tamil Nadu, rice is the predominant crop during samba season. Most of the photosensitive land races were cultivated during samba season. Among the land races of Tamil Nadu, Seeragasamba is versatile because of its aroma, grain size and yield superiority over others.

As climate change has made frequent floods and prolonged droughts, the modern high yielding rice varieties suffer most due to the erosion of its biodiversity. The significant characteristics of some of the traditional varieties are medicinal, nutritional traits and its consumer preferences. Farmers of Tamil Nadu prefer fine grain rice varieties with good market potential for cultivation. Rice quality is of greater importance for all the people involved in producing, processing and consuming rice, because it affects the nutritional and commercial value of grains (Bharat *et al*., 2018). Seeragasamba is a popular traditional variety of rice because of its mild aroma and also for making briyani. It is raised mostly in the Uppiliyapuram of Thuraiyur taluk in Trichi district, some pockets of Kolli hills in Namakkal district, Kumbakonam in Thanjavur district and Keelvellur and Vellapallam of Nagapattinam district of Tamil Nadu. It fetches premium price for its high quality rice and aroma, since it is regularly used for making

briyani (Madhan Mohan *et al*., 2013). However, yield and production of Seeragasamba gets affected due to its lodging tendency and photo- sensitivity nature. Hence, a non-lodging, photo-insensitive, semi - dwarf, high yielding aromatic rice variety is the demand of the farmers for the past few decades.

MATERIALS AND METHODS

The crossing was effected between ADT 43 and Seeragasamba at Agricultural Research Station, Vaigai dam during *Kharif,* 2007. The female parent ADT 43 is a cross derivative of IR 50/White ponni, which is preferred for cultivation during kuruvai season having medium slender grain with 110 days duration with a potential yield of 5.75 t/ha. The other parent Seeragasamba is a traditional cultivar which is preferred for samba season (September sowing) with 140 days duration having short slender scented grain with an average yield of 3.0 t/ha. The pedigree method of plant breeding was adopted. Individual plant selection was continued till the progenies become virtually homozygous without any segregation and the pedigree details are furnished in **Fig.1** as pedigree chart.

The culture VG 09006 performance was tested in different yield trials at Agricultural Research Station, Vaigai dam from 2010 to 2014 along with check varieties Seeragasamba and BPT 5204. The culture was tested for three years in MLT III and MLT -Quality Rice-Medium duration category at different research stations of TNAU from 2013 to 2016 along with check varieties Seeragasamba and TKM 13.

Based on the superior performance of the culture VG 09006 in MLTs, the culture was tested in ART Rice 18 (Aromatic slender grain, medium transplanted) during 2016-17 and 2017-18 at five locations each in 10 districts *viz*., Vellore, Dharmapuri, Salem, Erode, Coimbatore, Dindigul, Theni, Karur, Trichy and Perambalur. The performance of VG 09006 was tested in two farmers' holdings during 2015-16, along with the check Seeragasamba in Jeyamangalam (Theni District) and in Kariapatti (Virudhunagar District).

In National trials conducted under All India Coordinated Rice Improvement Programme (AICRIP), the culture VG 09006 was allotted with IET No. 24606 and was evaluated along with the national check Badshabhog in IVT-ASG *kharif*, 2014 and AVT 1- ASG *kharif* 2015.

The reaction to major pests and diseases was tested under artificial and field conditions at Aduthurai, Coimbatore, Madurai and Vaigai dam. Physical, cooking and biochemical properties of rice were tested along with check Seeragasamba at Community Science College and Research Institute, Madurai.

RESULTS AND DISCUSSION

In the overall mean performance, VG 09006 has manifested yield advantage over the checks *viz.,* Seeragasamba and TKM 13 in different yield trials. It recorded an overall mean grain yield of 5859 kg/ha in 101 locations, which was 32.56 and 13.80 per cent increased grain yield over Seeragasamba (4420 kg/ha) and TKM 13 (5149 kg/ha), respectively (**Table 1 and Plate 1**).

In the yield trials conducted at ARS, Vaigai dam from 2010 to 2014, the culture VG 09006 recorded a mean grain yield

Table 1. Overall mean yield performance of VG 09006 in different trials

Name of the Trial	Locations	Grain yield (kg/ha)			Duration (days)		
		VG 09006	Seeraga Samba	TKM 13	VG 09006	Seeraga samba	TKM 13
On-Station trial (2010-14)	4	6044	3066	-	130	144	-
Multi location trials (2013 to 2016)	23	5028	3473	3908	130	128	130
Adaptive Research Trials (2016-17)	32	5223	4510	5211	130	130	129
Adaptive Research Trials (2017-18)	27	6370	6310	6328	129	131	129
OFT (2015-16)	2	6813	3388	-	127	135	-
National trial (*Kharif*,2014)*	9	3656	-	-	134	-	-
National trial (*Kharif*,2015)*	4	3280	-	-	132	-	-
Overall Mean	**101**	**5859**	**4420**	**5149**	**129**	**134**	**129**
% inc. over the checks			**+32.56**	**+13.8**			

*Not included in the mean

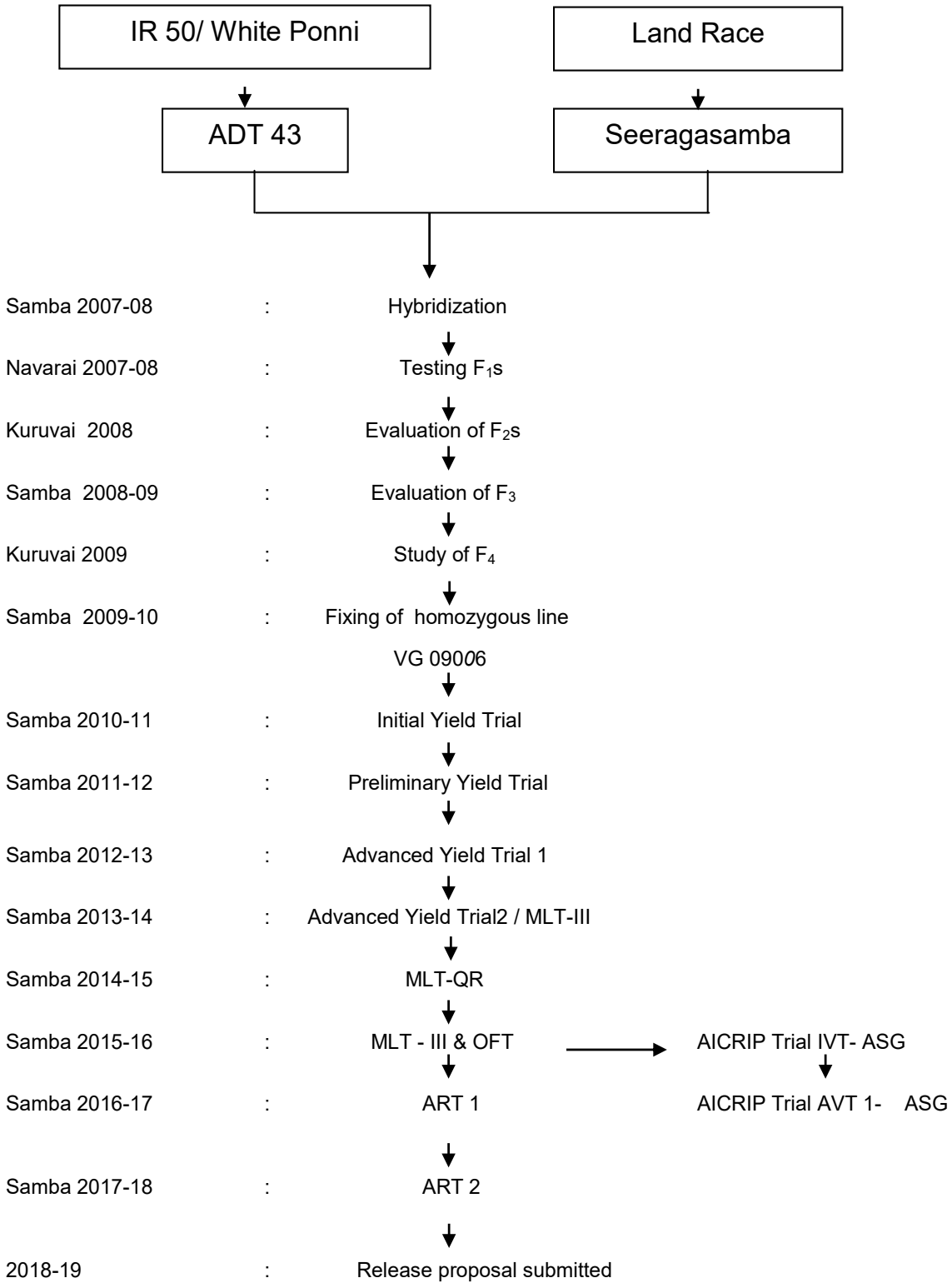

Fig. 1. Pedigree of Rice VGD 1 (Culture No.VG 09006 & IET No. 24606)

of 6044 kg/ha. The yield increase was 97.13 and 41.50 per cent, respectively over the checks, Seeragasamba (3066 kg/ha) and BPT 5204 (4270 kg/ha). The culture was tested in MLT III and MLT -Quality Rice-Medium duration category at different research stations of TNAU from 2013 to 2016. The overall yield performance of VG 09006 (5028 kg/ha) over three years has revealed a yield increase of 44.8 per cent over Seeragasamba and 28.7 per cent over TKM 13. The descriptor for this culture is given in the **Table 2**.

The culture VG 09006 was tested in ART Rice 18 (Aromatic slender grain, medium transplanted) during 2016-17 and 2017-18 at five locations each in 10 districts *viz*., Vellore, Dharmapuri, Salem, Erode, Coimbatore, Dindigul, Theni, Karur, Trichy and Perambalur. During the first year, it recorded a mean grain yield of 5223 kg/ha in 32 locations which was 16 per cent higher than the check variety Seeragasamba and 1.0 per cent higher than TKM 13. Out of 32 locations tested, the culture VG 09006 has out yielded the check Seeragasamba in 27

Table 2. The descriptor for the rice culture VG 09006 (VGD 1)

Plant height	:	94.0 cm (87-97 cm)
Early plant vigour	:	Good
Coleoptile	:	Green
Basal leaf sheath colour	:	Green
Leaf blade colour	:	Green
Leaf pubescence	:	Glabrous
Auricle	:	Present, light green
Anthocyanin pigment	:	Absent
Collar	:	Light green
Ligule	:	White
Septum	:	Cream
Flag leaf angle	:	Erect
Days to 50% flowering	:	100 (96-100 days)
Panicle exsertion	:	Well exserted
Stigma color	:	White
Apiculus color	:	Straw
Panicle length	:	24.8 cm (23.5-26.0 cm)
Filled grains/panicle	:	~260 nos. (in primary tiller)
Average single plant yield	:	35.0 g
Panicle type	:	Compact
Awns	:	Absent
Hull colour	:	Straw
Seed coat (kernel) colour	:	Light brown
Threshability	:	Easy
Aroma	:	Mild
Grain / Paddy		
L x B x T (mm)	:	5.8 x 2.2 x 1.35
1000 grain weight (g)	:	8.9 g
Brown rice		
L x B x T (mm)	:	3.7 x 1.8 x 1.25
L/B ratio	:	2.1
Rice grade	:	Short bold
Milled Rice colour	:	White
Abdominal white	:	Absent
Translucency	:	Translucent
Maturity (range in number of days) seeding/ transplanting to flowering, seed to seed)	:	Seed to seed : 129 days Range : 127 - 132 days

locations and TKM 13 in 19 locations. During 2017-18, the culture has recorded a mean grain yield of 6370 kg/ha in 27 locations, the yield increase was 1.0 and 0.7 per cent over Seeragasamba (6310 kg/ha) and TKM 13 (6328 kg/ha), respectively. It performed better than the checks Seeragasamba in 20 locations and TKM 13 in 14 locations. The overall mean grain yield of the culture in ART from 59 locations was 5747 kg/ha. The yield performance was 8.15 per cent higher than Seeragasamba (5314 kg/ha) and 0.4 per cent than TKM 13 (5722 kg/ha).

The performance of VG 09006 was tested in two farmers' holdings during 2015-16, along with the check Seeragasamba in Jeyamangalam (Theni District) and in Kariapatti (Virudhunagar District). The culture recorded an average grain yield of 6813 kg/ha, while the check registered 3388 kg/ha.

In national trials conducted during 2014 and 2015 at 13 locations, the culture VG 09006 (IET 24606) recorded an average grain yield of 3468 kg/ha, which was 40.40 per cent yield advantage over the national check Badshabhog.

The culture VG 09006 is moderately resistant to leaf folder, blast and brown spot under field conditions. The reaction to major pests and diseases are furnished in **Tables 3 to 5.** The feedback from the farmers revealed that, this variety possess more tillers, non lodging, densely packed grains, moderately resistant to major pests and diseases at field conditions, earlier than Seeragasamba. The rice is white, fine (short bold) with a 1000 grain weight of 8.9 g which is lesser than Seeragasamba (11.6 g) and all other medium duration rice varieties. The culture has high milling and head rice recovery over Seeragasamba. Cooking quality and organoleptic characters are comparable to Seeragasamba. Cooked rice is soft, mildly scented, non sticky with good taste which is preferable

Table 3. Reaction to major diseases (Field screening)

S. No.	Diseases	Year	Centre	VG 09006	Seeragasamba	TKM 13
1.	Blast	2013-14	VGD	3	5	-
		2015-16	CBE	5	3	7
		2017-18	CBE	1	9	9
2.	Sheath rot	2013-14	VGD	5	7	-
		2015-16	MDU	5	7	7
			ADT	9	9	9
		2017-18	ADT	5	0	7
			MDU	5	5	7
3.	Sheath blight	2013-14	VGD	5	5	-
		2015-16	MDU	5	5	7
			ADT	9	9	9
		2017-18	ADT	9	3	7
4.	Bacterial leaf blight	2013-14	VGD	5	7	-
		2015-16	ADT	9	9	9
		2017-18	ADT	7	3	7
5.	Brown spot	2013-14	VGD	3	5	-
		2015-16	ADT	3	5	3
		2017-18	ADT	5	3	3
			CBE	5	-	-
6.	RTD	2017-18	CBE	1	5	5

1-Highly resistant, 3-Resistant, 5-Moderately resistant / Moderately susceptible, 7-Susceptible, 9-Highly susceptible

Table 4. Reaction to major pests (Field screening)

S.No.	Pests	Year	Centre	VG 09006	Seeragasamba	TKM 13
1.	Stem borer	2015-16	Aduthurai Dead heart	0	3	1
			white ears	7	3	3
		2017-18	Aduthurai Dead heart	1	1	1
			white ears	1	1	0
2.	Leaf folder	2015-16	Aduthurai	3	1	1
			Madurai	1	3	5
		2017-18	Aduthurai	1	1	0
			Madurai	5	5	3
3.	Gall midge	2015-16	Aduthurai	3	3	5
			Madurai	7	9	7
		2017-18	Aduthurai	1	3	1
			Madurai	1	1	1

Table 5. Reaction to major pests (Artificial screening)

S.No.	Pests	Year	Centre	VG 09006	Seeragasamba	TKM 13
1.	BPH	2015-16	Coimbatore	7	9	5
			Madurai	7	7	5
		2017-18	Aduthurai	9	9	7
			Coimbatore	9	7	9
2.	WBPH	2015-16	Coimbatore	5	3	5
		2017-18	Coimbatore	7	9	7
3.	GLH	2015-16	Coimbatore	7	7	7
		2017-18	Coimbatore	7	9	9

1-Resistant, 3-Moderately Resistant, 5-Moderately susceptible, 7-Susceptible, 9-Highly susceptible

Table 6. Physical quality characteristics

Variety	Hulling (%)	Milling Yield (%)	Head rice yield (%)	1000 grain wt (g)	Kernel length (mm)	Kernel breadth (mm)	L/B ratio	*Grain Type
VG 09006	80.0	66.0	62.1	8.9	3.7	1.8	2.10	SB
Seeragasamba	70.5	60.3	58.2	11.6	4.0	1.8	2.22	SB
TKM 13	77.5	74.0	66.8	13.8	5.0	1.8	2.78	MS

* SM- Short Bold MS - Medium slender

for briyani and khuska making. It has acceptable milling and cooking quality characters and also fetches good market price as that of Seeragasamba. The details of physical characters, cooking qualities and organoleptic evaluation of the cooked rice are furnished from **Tables 6 to 9.** The rice samples were distributed to hotels of Theni, Madurai and Villupuram districts of Tamil Nadu. The feedbacks obtained from consumers at hotels are furnished in

Plate 1. Field view of VGD1

Table 7. Cooking quality characteristics

Parameters	VG 09006	Seeragasamba
Kernel length after cooking (mm)	7.8	7.0
Kernel breadth after cooking (mm)	3.0	2.0
Linear elongation ratio	2.1	1.7
Breadth wise expansion ratio	1.7	1.2
Volume expansion ratio	4.3	4.1

Table 8. Biochemical characteristics

Parameters	VG 09006	Seeragasamba
Gel consistency	Soft	Soft
Alkali Spreading Value	5	4
Amylose content	21.94	16.10

Table 9. Organoleptic evaluation of cooked rice maximum score 10

Characteristics	VG 09006	Seeragasamba
Colour and appearance	7.50	7.83
Texture	7.34	7.60
Taste	7.47	7.56
Flavour	7.31	7.41
Overall acceptability	**7.75**	**7.81**

Table 10. Consumers feed back

S. No.	Name of the Hotel and Location	Remarks
1.	M/s. ANJAPPAR, Madurai	Extermely good. Overall acceptance is on par with Seeragasamba.
2.	M/s. ANJAPPAR , Villupuram	Similar to Seeragasamba except flavour difference. Quantity of cooked briyani per unit of rice is more compared to Seeragasamba
3.	M/s. SRI GOWMARIAMMAN FOODS PRIVATE LIMITED, Theni	Similar to Seeragasamba. VG 09006 can be branded as Briyani rice
4.	M/s. MARUTI , Theni	Similar to Seeragasamba
5.	M/s. KARUNA, Theni	Similar to Seeragasamba
6.	M/s. SRI REGUPATHY VILAS, Periyakulam	Similar to Seeragasamba
7.	M/s. VASAVI ROYAL COUPLES. Periyakulam	Similar to Seeragasamba

Table 10.

The culture VG 09006 was released as VGD 1 during 2019 by the State Variety Release Committee. The variety VGD 1 got notifications vide "The Gazette of India, No.2948, dt. September 6th, 2019, New Delhi. The rice variety VGD 1 was differentiated from the other popularly grown varieties *viz.,* ADT 47 and TRY 3 which are having the same parentage of ADT 43 and Seeragasamba using SSR markers *viz*., RM214 on Chromosome #7, RM528 on Chromosome #6 and RM589 on Chromosome #6. Presence of aromatic compound 1,6,10,14-Hexa-decatetraen-3-ol (Geranyl linallol) was identified in rice grain through GC-MS analysis.

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