A high yielding Seeragasamba variety : VGD 1

M. Madhan Mohan*, S. Juliet Hepziba, S. Utharasu, C. R. Anandakumar and K. Ganesamurthy

Department of Crop Improvement, Agricultural College and Research Institute, Kudumiyanmalai, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India
*E-Mail : madhanmohan.m@tnau.ac.in

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 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
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 locations. The descriptor for the rice culture VG 09006 (VGD 1) is given in the Table 2.

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

| Characteristic                      | Description          |
|------------------------------------|----------------------|
| 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) | Seed to seed: 129 days |
| (seeding/transplanting to flowering, seed to seed) 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    | 0        | 3             | 1      |
|       |            |        |              |          |               |        |
|       |            |        | VG 09006     | 0        | 3             | 1      |
|       |            |        | Seeragasamba | 7        | 3             | 3      |
|       |            | 2017-18| Aduthurai    | 1        | 1             | 1      |
|       |            |        |              |          |               |        |
|       |            |        | VG 09006     | 1        | 1             | 1      |
|       |            |        | Seeragasamba | 1        | 1             | 0      |
|       |            |        | TKM 13       | 0        | 1             | 0      |
| 2.    | Leaf folder | 2015-16 | Aduthurai    | 3        | 1             | 1      |
|       |            |        |              |          |               |        |
|       |            |        | VG 09006     | 1        | 1             | 0      |
|       |            |        | Seeragasamba | 5        | 5             | 3      |
|       |            | 2017-18| Aduthurai    | 1        | 3             | 5      |
|       |            |        |              |          |               |        |
|       |            |        | VG 09006     | 5        | 5             | 3      |
|       |            |        | Seeragasamba | 7        | 9             | 7      |
|       |            |        | TKM 13       | 1        | 3             | 1      |
| 3.    | Gall midge | 2015-16 | Aduthurai    | 3        | 3             | 5      |
|       |            |        |              |          |               |        |
|       |            |        | VG 09006     | 7        | 7             | 7      |
|       |            |        | Seeragasamba | 7        | 9             | 7      |
|       |            | 2017-18| Aduthurai    | 7        | 9             | 7      |
|       |            |        |              |          |               |        |
|       |            |        | VG 09006     | 1        | 3             | 1      |
|       |            |        | Seeragasamba | 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      |
|       |       |        |             |          |               |        |
|       |       | 2017-18| Coimbatore | 9        | 9             | 7      |
|       |       |        |             |          |               |        |
|       |       |        | Coimbatore  | 9        | 7             | 9      |
|       |       |        | Madurai     | 7        | 7             | 5      |
|       |       | 2015-16| Madurai     | 7        | 7             | 5      |
|       |       |        | Aduthurai   | 9        | 9             | 7      |
|       |       |        | Coimbatore  | 5        | 3             | 5      |
|       |       | 2015-16| Coimbatore  | 5        | 3             | 5      |
| 2.    | WBPH  | 2017-18| Coimbatore  | 7        | 9             | 7      |
|       |       |        |             |          |               |        |
|       |       | 2015-16| Coimbatore  | 7        | 7             | 7      |
|       |       |        |             |          |               |        |
|       |       |        | Coimbatore  | 7        | 7             | 7      |
|       |       |        | Madurai     | 7        | 9             | 7      |
| 3.    | GLH   | 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 (%) | Thousand 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         | Extremely good. Overall acceptance is on par with Seeragasamba.        |
| 2.     | M/s. ANJAPPAR, Villupurum      | 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  |

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-Hexadecatetraen-3-ol (Geranyl linallol) was identified in rice grain through GC-MS analysis.

REFERENCES

Bharath, M.S., Madhan Mohan M., Vanniarajan, C., Veranan Arun Gridhari, V. and Senthil, N. 2018. Genetic variability studies in ADT 43/Seeraga samba cross derivatives of rice (Oryza sativa L.). Electronic Journal of Plant Breeding, 9(4): 1450-1460.
[Cross Ref]

FAOSTAT. 2020. Statistical databases.

Madhan Mohan, M., Balakrishnan, A. and Renganayaki, P. R. 2013. Research Note A high yielding seeragasamba rice culture VG 09006 and its medicinal properties. *Electronic Journal of Plant Breeding, 4*(2): 1148–1154.

Tamil Nadu Agricultural University, Crop Scientist Meet (Rice) Reports. 2018.