**GRDB FL 15: A New Rice (*Oryza sativa* L.) Variety Released for Commercial Cultivation in Guyana**

**Abstract**

Varieties determine the ultimate quantity and quality of produce. It acts not only as a carrier of technology but also sets upper limits of productivity, as built into its genetic architecture, the upper limit. The prime objective of the local rice breeding program is to develop varieties superior to the existing ones in terms of yield, tolerance to lodging, and excellent milling and cooking characteristics. The purpose of this trial was to evaluate the performance of a new rice genotype against one of the most dominant cultivated varieties in Guyana. As such, On-Farm trials were conducted with candidate variety FG12-49 (new rice genotype) in 27 farmers’ fields/locations across the major rice-growing regions of Guyana during the second crop 2017 and first crop 2018 on plot size of 225m2 and 0.4 – 2.02 ha (1-5 acres) respectively. This new genotype has conclusively demonstrated better: yield ability, tillering ability vigour, tolerance to lodging, stronger and thicker culms, slower leaf senescence, and more grains per panicle than the popular check rice variety GRDB FL 10. Data obtained showed that genotype FG 12-49 recorded a higher average grain yield and head rice recovery from paddy when compared to GRDB FL 10 in both cropping seasons: 2017- FL 12-49; 7299.0 kg/ha, GRDB FL 10; 6473.1 kg/ha with HRR% of 72.7% and 61.3% respectively; 2018 FL 12-49; 7249.1 kg/ha, GRDB FL 10; 6277.4 kg/ha with HRR% of 62.5% and 51.3% respectively. Genotype FG 12-49 was recommended for release countrywide for commercial cultivation as New Variety "GRDB FL 15".

Keywords: rice variety; variety testing; genotype; trials; yield; cultivation.

1. **Introduction**

Rice (*Oryza Sativa* L.) is one of the world most important food grain cultivated, ranked second to maze, feeding over half the planet population: predominantly in Asia, Africa, and South America, providing a primary source of calories and nourishment. Rice is not just grown as a food source, but also a livelihood for many, with significant economic and social impacts, including job creation opportunities and contributes to global food security. With global food security, sustainable development/agriculture, climate change and the green revolution being the leading topic of discussion in the “Grow More” campaign, researcher and plant breeders around the world has and have been seeking alternative ways and means to improve existing varieties and or developing higher yield climatized varieties (Zibaee, 2013). The ultimate objective of crop breeder is to develop varieties with higher yielding potential and desirable agronomic and morphological characteristics (Khan, 2015). In China although rice cross breeding has made rapid progress since the 1980s; rice production has increased by 59% despite the decline in arable land (Wang, 2022).

After the second world war there were a desperate need for food globally, thereby creating a shift from traditional breeding to more established modernized research, hence the creation of the International Rice Research Institute (IRRI) in the 1960s by the Rockefeller Foundation and Food Foundation (FF) (Hargrove *et al*., 2006).

For centuries, traditional breeding has accomplished elite varieties by selection genotypes with desirable traits such as; adaptability, diseases and pests’ resistance and higher yield potential. Nevertheless, through conventional breeding, rice breeders have efficaciously developed improved rice varieties with enhanced yield attributes; increase of grain numbers on panicle, number of spikelets, and length of the panicle which contributes significantly to the overall increase in yield for new varieties (Sabar, 2024).

In Guyana, rice is the leading foreign exchange earner in the Agricultural sector (Seoraj, 2021). It is grown seasonally on approx. 100,000 hectares of lands in Guyana, which keep increasing every crop with a national average yield of around 6 tones ha-1. In order to satisfied the growing demands for this staple crop, an organized breeding program was coined by the Guyana Rice Development Board (GRDB). This rigorous breeding program focuses on increasing the yield, stability, quality, and nutrition of rice while also providing a crop that can be cultivated on all the rice growing Regions in Guyana, while combating the harsh climatic conditions (flash flood and short dry spell), (Persaud *et al*., 2024). The ultimate aim of the rice breeding program is to develop varieties superior to the existing ones in yielding ability, disease resistance, tolerance to lodging, excellent milling and cooking characteristics.

The demand for rice is projected to increase faster than the rate of yield increase, and rice production needs to be doubled to meet the demand of the world's inhabitants by 2050. Despite the enormous efforts to develop high-yielding varieties, breeders are facing the challenge of breaking the yield barriers (Ata-Ul-Karim et al., 2022). The ultimate aim of the rice breeding program is to develop varieties superior to the existing ones in yield, disease resistance, tolerance to lodging, and excellent milling and cooking characteristics. Depending on the target traits, improvement of the nutritional value of rice varieties can be achieved through conventional breeding approaches or using more advanced technologies such as double haploid breeding, molecular marker-assisted selection, and genetic engineering (Sitaresmi et al., 2023; Madishetty et al., 2023).

The release of a new genotype as a variety is based on a conclusive demonstration of its superiority over the most pronounce existing variety (included as a check in the evaluation trials - GRDB FL 10) in yielding ability or some other feature of economic importance, such as disease resistance, tolerance to lodging, quality traits, etc.

The selection of a candidate lines is a rigorous and tedious process where various testing methods are used, and keen observations are made over many years before a new variety is developed. The final stage of testing before a variety is released for commercial cultivation is done in farmers' fields across the major rice-growing regions in Guyana. This is done to test their adaptability in various conditions (soil types, climatic conditions, etc.) and the acceptability by farmers. The trial also serves to provide feedback on the farmers' preferences for the creation and development of newer candidate varieties.

After two successful rounds of testing in farmers' fields during the second crop of 2017 and the first Crop of 2018, the candidate variety (FG12-49) was released for commercial cultivation as GRDB FL 15 by the farmers in Guyana.

1. **Materials and Methods**

The final evaluation of the performance of new genotypes of paddy before possible release as a variety is conducted in farmer’s fields across the major rice-growing regions of Guyana. As such, twenty-seven (27) farmers were selected to participate in this On-Farm Testing of the candidate variety (GRDB FL 15) during the autumn crop of 2017 and spring crop of 2018. The plot size for each trial in the first round was 225m2 and 0.40 - 2.02 ha (1-5 acres) for the second round. In this trial, the most popular and high-yielding rice variety (GRDB FL 10) was used as the check variety for comparison. All the standard recommended agronomic practices were followed closely i.e., seed rate at 157.2 kg/ha, Urea at 185 kg/ha, Potash 84 kg/ha, TSP at 84 kg/ha, control for weeds, pests and disease at the GRDB recommended rates and timings. Field sanitation and routine husbandry practices were followed throughout the duration of the trial.

The characterisation of candidate variety (FG 12-49) for morphological, agronomic and milling traits was done at Rice Research Station Burma, Mahaicony, East coast Burma. These traits were studied over two independent seasons during 2017. Single panicle selections taken from the pre-basic seed plots were used to establish 100 progenies of each variety in the nursery. Seedlings at twenty-one days old were uprooted and transplanted in the field. In the field each progeny was represented by two rows (25 plants / row) with a spacing of 20cm within rows and 40 cm between rows. The normal routine husbandry practice was followed according to GRDB standard recommended agronomic practices.

**2.1. Breeding Details:**

Testing Designation: FG 12 - 49

Breeding Designation: FL10915-2P-4-2P-1P-M

Parentage: FL07175-1P-1-3P-1P / FL04648-6P-9-1P-3P-M//FL04574-1P-4-3P-1P-M

Breeding Method: Introduction and Selection

Proposed Name of Variety: GRDB FL 15

Breeders: Mahendra Persaud (GRDB), Edgar Corredoer (FLAR)

**2.2. Data Collection**

In the two experimental plots, three squares of 5 m2 each were selected randomly, and several agronomical and morphological parameters were evaluated. Data on plant height, productive tiller per meter square, lodging incidence, grain yield (kg/ha), panicle length, fertility and 1000 grain weight of rice were measured, collected and recorded for the candidate and the check variety cv. GRDB FL 10. The general guideline for data collection and documentation of various characters is the Standard Evaluation System for Rice (2013. IRRI. SES Standard Evaluation System for Rice, 2018).

**2.3. Statistical Analysis**

The variance of data was analysed using analysis of variance (ANOVA) with Statistix 10 software, and grand mean values for traits were compared according to the Least Significant Difference (LSD) statistical test.

1. **Results and Discussion**

***3.1 On-Farm Trials:***

In this study, the performance of a candidate variety (FG 12 - 49) of paddy was tested against one of the most popular and high-yielding commercial varieties (GRDB FL 10) on 27 farms in Guyana’s rice cultivation. The data collected over the two seasons from the on-farm trials were analysed and discussed below.

***3.1.1 Grain Yield***

Grain yield is the single most important trait of interest for the farmers. As shown in Table 1, while testing these two genotypes in farmer fields across the country; the check variety obtained a grain yield ranging from 3607.00 kg/ha to 11016kg/ha while the candidate variety obtained yield range between 3994.5kg/ha to 9882.7kg/ha. During the two seasons (Autumn 2017 and Spring 2018), the check variety produced an average yield of 6473.1kg/ha and 6277.4kg/ha while the candidate variety produced an average yield of 7299.0kg/ha and 7249.1kg/ha respectively. As shown in Table 2, in both seasons the candidate variety yielded a significantly higher grain yield than the check variety with a difference of 826kg/ha and 971.7kg/ha respectively. These differences translate to a 12 % yield advantage for the candidate variety in both seasons. Also, in Spring 2018 both genotypes yielded less when compared to the previous season and a more pronounced decrease in yield can be seen in the check variety while the Candidate variety maintained a more constant yield. Persaud *et al.,* 2022 also reported similar results on these genotypes.

**Table 1: List of farms that participated in the On-Farm Trial with the yield obtained for the check and candidate variety.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **SN** | **Farmer** | **Region** | **Location** | **Yield (kg/ha)** | | | |
| **Autumn 2017** | | **Spring 2018** | |
| **FG12-49** | **GRDB FL 10** | **FG12-49** | **GRDB FL 10** |
| 1 | Rafeek Khan | 2 | Anna Regina | 8728.6d | 8467.0c | 6445.7jkl | 5677.0fg |
| 2 | Ramnaresh Ramnauth | 2 | Hibernia | 9883.7a | 11016.0a | 7413.6fghi | 6766.0cde |
| 3 | Davendra Singh | 2 | Suddie | 7116.8ij | 5806.0h | 7636.9defgh | 8130.0b |
| 4 | Deoram Prahalad | 2 | Hibernia | 5972.5lm | 5234.0i | 7352.4ghi | 7177.0c |
| 5 | Rajendra Singh | 2 | Cullen | 9332.8b | 5437.0i | 8404.9abc | 3736.0h |
| 6 | Y. Sahdeo | 3 | Wakenaam | 7003.9ijk | 4197.0l | 7153.0hij | 7145.0c |
| 7 | Gandhi | 3 | Leguan | 7682.2f | 6206.0g | 6962.6hijk | 5454.0g |
| 8 | Jeetlall Ramraj | 3 | West Coast Demarara | 6948.1jk | 5323.0i | 6105.4l | 6130.0defg |
| 9 | Ganga Persaud | 3 | Hague | 8799.9d | 7643.0d | 8750.2ab | 6091.0efg |
| 10 | Birdo Persaud | 3 | West Coast Demarara | 6149.7l | 4740.0jk | 8305.5bcd | 6765.0cde |
| 11 | Anthony Sebastian | 4 | Hope | 9143.3bc | 9017.0b | 7666.0cdefgh | 6879.0cd |
| 12 | Jeewan Gobin | 5 | Mahaica Creek | 3994.5q | 4596.0jk | 8072.3bcdefg | 6069.0efg |
| 13 | Lincon Samaroo | 5 | Mahaicony Creek | 8718.7d | 8497.0c | 5146.2m | 6108.0efg |
| 14 | Rafel DeGroot | 5 | Fair Field | 5275.3o | 3873.0m | 6283.4kl | 5953.0fg |
| 15 | Shamshundar Ramrup | 5 | De Hoop | 7642.3fg | 6622.0f | 6343.7kl | 6319.0def |
| 16 | Carl Singh | 5 | Burma | 7330.5ghi | 6248.0g | 5737.8lm | 5462.0g |
| 17 | Brijdat Ramnarash | 5 | Letter T Village | 6928.1jk | 7043.0e | 8584.4ab | 6094.0efg |
| 18 | A. Crawford | 5 | Onverwagt | 8153.2e | 8337.0c | 8209.3bcde | 6064.0efg |
| 19 | Mohamad Rafeeoodeen | 5 | Washington | 7647.9fg | 6321.0fg | 6892.4ijk | 5659.0fg |
| 20 | Tulla Persaud | 5 | Bush Lot Village | 7855.2ef | 7741.0d | 8140.2bcdef | 8098.0b |
| 21 | Seenarine | 5 | Bath Settlement | 5775.0mn | 4233.0l | 7556.0efghi | 5533.0g |
| 22 | RRS | 5 | Cotton Tree Village | 5633.7n | 4475.0kl | 7278.0hi | 7518.0bc |
| 23 | Basdeo Sukanand | 6 | # 11 Village | 6777.6k | 4871.0j | 4321.6n | 3607.0h |
| 24 | Leekh Rambridge | 6 | Bengal Farm | 7211.7hij | 6997.0e | 7551.3efghi | 6013.0efg |
| 25 | Kenard Basdeo | 6 | Black Bush Polder | 7530.9fgh | 7432.0d | 9074.9a | 10279.0a |
| 26 | Lakeram Rahaman | 6 | # 52 Village | 8927.0cd | 8252.0c | 6973.6hijk | 4005.0h |
| 27 | BBP, Sub Station | 6 | Black Bush Polder | 4910.9p | 6153.0g | 7363.3ghi | 6758.0cde |
| **Grand Mean** | | | | **7299** | **6473.1** | **7249.1** | **6277.4** |
| **CV** | | | | **2.74** | **3.04** | **6.24** | **7.45** |
| **P-value** | | | | **0** | **0** | **0** | **0** |
| **F-Value** | | | | **156.9** | **241.63** | **18.05** | **25.7** |

***3.1.2 Panicle length***

The panicle lengths of samples from the two entries were measured and the mean ranged from 23.33cm to 28.60cm was observed over the two cropping seasons (Table 2). It was observed that the check variety produces longer panicles than the candidate variety in both seasons. In the autumn season, GRDB FL 10 recorded significantly longer panicles than the candidate variety while no significant difference was found in the Spring season. In 1990, Idris and Matin reported that panicle length is influenced by variety.

***3.1.3 Grain Weight***

As indicated in Table 2, the candidate variety produces grain with lower weight as compared to the check variety in both seasons. The average grain weight for the candidate variety ranged between 24.5g to 26.36g while the check variety ranged between 28.52g to 28.60g. Data indicated that in the first season, there was a significant difference in grain weight in favour of the check variety while there was no significant difference in the second season. These results were in line with the findings of Howlader *et al.,* 2017, who stated that the genetic makeup of a variety may have contributed to the variation in the thousand-grain weight. Heavier grains certainly contribute to higher yields.

***3.1.4 Lodging***

It was observed that during the two seasons, the check variety showed a significantly higher tendency to lodging as compared to the candidate variety. The candidate variety showed an average lodging tendency of 0% over the two seasons while the check variety showed an average of 36.4 % and 13.58% lodging in Autumn and Spring respectively. Rice varieties that are tolerant to lodging is of significant economic benefit for farmers in Guyana as the losses are both quantitative and qualitative. The local conditions favour lodging of high-yielding varieties at maturity especially during rain and delayed harvesting. Shahidullah *et al*., 2009 state that plants sensitive to lodging are not desirable because they will lodge and ultimately reduce grain yield.

**Table 2: Yielding character of the candidate and check variety over the testing period.**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SN** | **Autumn 2017** | | | | **Spring 2018** | | | |
| **Panicle Length (cm)** | **1000 Grain Weight (g)** | **Yield (kg/ha)** | **Lodging (%)** | **Panicle Length (cm)** | **1000 Grain Weight (g)** | **Yield (kg/ha)** | **Lodging**  **(%)** |
| FG 12 - 49 | 23.33b | 24.50b | 7299.00a | 0b | 22.87a | 26.36a | 7249.1a | 0.00 b |
| GRDB 10 | 26.33a | 28.52a | 6473.10b | 36.4a | 24.48a | 28.60a | 6277.4b | 13.58a |
| **Grand Mean** | **24.83** | **26.51** | **6886.10** | **18.20** | **23.68** | **27.48** | **6763.20** | **6.79** |
| **CV** | **2.85** | **2.25** | **0.23** | **21.45** | **9.29** | **7.17** | **0.98** | **4.45** |
| ***P*-value** | **0.035** | **0.0143** | **0.0002** | **0.0076** | **0.4637** | **0.2977** | **0.0031** | **0.0003** |
| ***F*-Value** | **27.00** | **68.37** | **4041.81** | **130.43** | **0.81** | **1.95** | **319.96** | **3029.46** |

***3.1.5 Plant Height***

During the two testing seasons, the mean plant height was recorded between 98.44cm and 110.58cm. For the first season of testing, the check variety recorded a significantly taller plant height than the candidate variety while there was no significant difference during the second round. Data shows a clear indication that the plants grew slightly taller in the Autumn season compared to the Spring season. Plant height is an important growth parameter for any crop since it defines or alters yield contributing traits, which in turn gives grain production ([Reddy](https://www.sciencedirect.com/science/article/pii/S2405844021020430" \l "bib27) *[et al](https://www.sciencedirect.com/science/article/pii/S2405844021020430" \l "bib27)*[., 1997](https://www.sciencedirect.com/science/article/pii/S2405844021020430" \l "bib27)). According to Ashrafuzzaman *et al.,* 2009, plant height is determined by the genetic makeup of the cultivar, however other factors can also influence this attribute as seen in the data presented for the two seasons. Local farmers prefer plant height of 100-110 cm as this facilitates both manual and mechanical husbandry operations. Tall varieties also tend to lodge easily along the windy coast belt.

***3.1.6 Effective Tiller***

Over the testing period, the two tested rice genotypes recorded a mean effective tiller of 387.95 to 396.39 per square metre. The candidate variety produced more tillers in the first season than in the second one and the reverse can be seen in the case of the Check variety. As noted in Table 3, there is a similar trend for both testing periods where the candidate variety produces a significantly lower number of effective tillers than the check variety. Similar findings were reported by Hussain *et al.,* 2014 where they found that even though some rice variety produces more effective tillers than others the grain yield was lower.

***3.1.7 Spikelet Fertility***

The mean percentage of spikelet fertility of the two genotypes tested ranged from 81.65 to 89.64. There is a slight increase in spikelet fertility from the first round as compared to the second round where in both instances the check variety (GRDB 10) registers a higher per centage of fertile spikelets over the candidate variety (GRDB FL 15). During the first season, the check variety showed a significantly higher spikelet fertility than the test entry, while no significant difference was found in the second season. Islam *et al.*, 2013 reported that the varieties that produced a higher number of filled grains per panicle showed higher grain yield per hectare. The candidate variety showed higher levels of unfilled grains which suggests that with higher grain filling can contribute to even higher grain yield

***3.1.8 Grains Per Panicle***

The candidate variety recorded a significantly higher number of grains per panicle when compared to the check variety in both seasons. In the first round of testing, the candidate variety recorded 200.91 grains per panicle while the check variety recorded 127.26 with an average difference of 73.65 grains more in favour of the candidate variety. Also, a similar trend was observed in the second round of testing where an average difference in the number of grain panicles was 48.55 which is slightly smaller than the previous season. The number of grains per panicle is one of the important yield-attributing traits in rice production and as shown in this experiment the number of grains per panicle can directly influence the grain yield per area. Grevois *et al.,* 1992 and Samonte *et al.,* 1998 also observed positive direct effects of filled fertile grains per panicle on rice yield.

**Table 3: Yielding character of the candidate and check variety over the testing period.**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SN** | **Autumn 2017** | | | | | **Spring 2018** | | | |
| **Plant Height (cm)** | **Effective Tiller** | **Grains/Panicle** | **Spikelet Fertility (%)** | **Plant Height (cm)** | | **Effective Tiller** | **Grains/Panicle** | **Spikelet Fertility (%)** |
| FG 12 - 49 | 104.35a | 387.78b | 200.91a | 81.65b | 99.66a | | 359.96b | 135.15a | 84.64a |
| GRDB 10 | 110.58b | 405.00a | 127.26b | 88.86a | 98.44a | | 415.94a | 86.60b | 89.64a |
| **Grand Mean** | **107.47** | **396.39** | **164.09** | **85.26** | **99.06** | | **387.95** | **110.88** | **87.14** |
| **CV** | **0.31** | **0.07** | **1.67** | **0.14** | **11.68** | | **3.73** | **5.88** | **2.69** |
| ***P*-value** | **0.0019** | **0.0002** | **0.0009** | **0.0002** | **0.9088** | | **0.0419** | **0.0118** | **0.1209** |
| ***F*-Value** | **527.11** | **6498.07** | **1085.80** | **5721.23** | **0.02** | | **22.40** | **83.14** | **6.80** |

***3.1.9 Head Rice Recovery (HRR) – Paddy***

The Head Rice Recovery (HRR) is one of the top priorities for rice breeding (Zhao and Fitzgerald, 2013) meaning that varieties with a higher per centage of HRR attract higher market prices. In this experiment, HRR from Paddy indicated a significant advantage in the candidate variety over the check variety over the two testing seasons. The two genotypes produced higher HRR in the first season as compared to the second season with the candidate variety recording 72.70 and 62.53 per cent while the check variety recorded 61.33 and 51.31 per cent with an average difference of over 10% in favour of the candidate variety. These results are similar to Shi *et al.,* 2021, who studied seven rice varieties in China and found an HHR ranging from 59.82 per cent to 72 per cent. Taking into account that Guyana exports more than 70 % of its production, higher grain quality (HRR) is crucial to maximise on various market opportunities.

***3.1.10 Chalkiness of Endosperm***

Regarding the chalky endosperm, there was no significant difference noted between the two genotypes over the testing periods; however, the candidate variety noted a slightly lower level of chalky endosperm during the second season when compared to the check variety. The candidate variety showed chalky endosperm of 0.30 and 0.16% while the check variety was 0.30 and 0.26% for the two seasons. The chalky endosperm of rice grain is an indicator of the grain quality. Wassmann *et al.* (2009) state that the milling qualities of rice are associated with chalkiness, immature kernels, kernel dimensions, fissuring, amylose content and amylopectin chain length. Cheng *et al*., 2005, and Zhao *et al*., 2013 also state that chalky endosperm influences consumer acceptability, cooking ability and milling quality. The candidate variety (FG 12-49) therefore showed a good indication of good grain quality.

**Table 4: Milling character of the candidate and check variety over the testing period.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SN** | **Autumn 2017** | | **Spring 2018** | |
| **% HRR Paddy** | **Chalkiness (%)** | **% HRR Paddy** | **Chalkiness (%)** |
|
| FG 12 - 49 | 72.70a | 0.30a | 62.53a | 0.16a |
| GRDB 10 | 61.33b | 0.30a | 51.31b | 0.26a |
| **Grand Mean** | **67.02** | **0.30** | **56.92** | **0.21** |
| **CV** | **3.81** | **11.79** | **2.05** | **21.29** |
| ***P*-value** | **0.03** | **1.00** | **0.007** | **0.0558** |
| ***F*-Value** | **29.72** | **00** | **138.91** | **7.13** |

**3.2 Characterization**

Some of the important agronomic and morphological characters of genotype FG-12-29 studied over the two seasons are highlighted in Table 5. According to (2013. IRRI. SES Standard Evaluation System for Rice, 2018), the candidate variety can be characterised as an early duration (110 days) semi dwarf rice variety which possesses excellent early seedling vigour with low tillering ability and canopies very early. It has a strong and thick culm (stem) coupled with intermediate leaf senescence, which contributes positively to its ability to tolerate lodging. This genotype produces a very compact panicle with heavy secondary branching and 150-250 grains. This genotype produces a long, slender grain with very high milling yields (61.0% head rice recovery from paddy).

**Table 5: Characters evaluated of Candidate Variety (FG 12 - 49)**

|  |  |
| --- | --- |
| Characters | GRDB FL 15 |
| Agronomic and Morphological |  |
| Seedling Vegetative Vigour (Vg) | Extra vigorous |
| Tillering Ability (Ti) | Low (5 - 9) |
| Culm Strength (Cs) | Strong |
| Leaf Senescence (Sen) | Intermediate |
| Leaf Length (LL) | 59 cm |
| Leaf Width (LW) | 18 mm |
| Leaf Blade Pubescence (LBP) | Intermediate |
| Leaf Blade Colour (LBC) | Green |
| Basal Leaf Sheath Colour (BLSC) | Green |
| Leaf Angle (LA) | Erect |
| Flag Leaf Angle (FLA) | Intermediate |
| Ligule Length (LgL) | 16 mm |
| Ligule Colour (LgC) | White |
| Ligule Shape (LgS) | Cleft |
| Collar Colour (CC) | Light Green |
| Auricle Colour (AC) | Light Green |
| Culm Length (CL) | 80.6 cm |
| Culm Number (CN) per plant | 7 |
| Culm Angle (CmA) | Erect (<30°) |
| Diameter of Basal Internode (DBI) | 5.6 mm |
| Culm Internode colour (CmIC) | Green |
| Panicle Type (PnT) | Compact |
| Secondary Branching of Panicles (PnBr) | Heavy |
| Panicle Axis (PnA) | Semi Upright |
| Panicle Exertion (Exs) | Well exerted |
| Panicle Treshability (PT) | Loose |
| Phenotypic Acceptability (PAcp) | Excellent |
| Awning (An) | Short and partly awned |
| Apiculus Colour (ApC) | Straw |
| Stigma colour (SgC) | Yellow |
| Lemma and Palea colour (MPC) [Grain Colour] | Straw |
| Lemma and Pubescence (LmPb) | Short hairs |
| Sterile Lemma Colour (SLmC) | Straw |
| Sterile Lemma Length (SLmL) | 9.2mm |
| Days to Flowering | 73 days |
| Days to complete Flowering | 80 days |
| Dormancy (Days) | 21 days |
| Maturity (Mat) | 110 days |
| *Disease* | |
| Blast (*Pyriculariagrisea*) | Resistant |
| Brownspot (*Cochliobolusmiyabeanus (Bipolarisoryzae, Drechsleraoryzae*). | Moderately Resistant |
| Sheath Blight (*Thanethoporuscucumeris (Rhizoctoniasolani*) | Moderately Resistant |
| Sheath Rot (*Soracladiumoryzae*) | Moderately Resistant |
| *Grain* |  |
| Grain Length (GrL) | 9.7 (mm) |
| Grain Width (GrW) | 2.5 (mm) |
| Grain Shape (GrS) | Slender |
| Brown Rice Length (BrLn) | Long: 7.1 (mm) |
| Brown Rice Width (BrW) | 2.3 (mm) |
| Brown Rice Shape (BrS) | Slender (over 3.0) |
| White Rice Length (WrLn) | 6.5 mm |
| White Rice Width (WrW) | 2.0 mm |
| 1000 Grain Weight (GW) | 26.6 g |
| Head Rice Recovery (HRR)- Paddy | 61.30 (%) |
| Total Rice Recovery (TRR)- Paddy | 67.60 (%) |
| Total Rice Recovery (TRR)- Brown | 86.80 (%) |
| Grain Expansion- Length (GEL) | 75.21 (%) |
| Grain Expansion- Width (GEW) | 67.17 (%) |
| Cooking Time (White rice) | 15-18 mins |
| Cooking Time (Parboiled) | 18-20 mins |
| Alkali Spreading Value (ASV) | 7.0 |

1. **Conclusion**

Candidate Variety (FG12-49) has demonstrated better yield ability, tillering ability, vigour, tolerance to lodging, stronger and thicker culms, slower leaf senescence, and more grains per panicle than the popular check rice variety (GRDB FL 10) in cultivation. The high head rice recovery (from paddy) and low levels of chalky endosperm indicate good grain quality. The conclusive demonstration of the superior performance of candidate variety across the country is a recommendation to be released as a new variety, GRDB FL 15, for commercial cultivation in Guyana.

**Abbreviation:** HRR – Head Rice Recover (expressed in per cent), GRDB – Guyana Rice Development Board.

1. **Disclaimer (Artificial Intelligence)**

The author (s) desires to clarify, that NO artificial intelligence (AI) language models such as NLP, ML, Deep Learning, Generative AL and or Elicit were used in the generation of this research article. All text and data analysis were conducted exclusively by the author (s).

1. **References**
2. Zibarr. Arash. 2013. Rice: Importance and Future. University of Guilan. Journal of Rice Research. DOI: 10.4172/jrr.100e102.
3. Khan. M. Hafiz., Dar. A. Zahoor., Dar. A. Aher. 2015. Breeding Strategies for Improving Rice Yield – A Review. Agricultural Science, 467-478. <http://www.scip.org/journal/as>.
4. Wang Haixia., Xiong Ruogu., Zhan Yonzhi., Tan Xaeming., Pan Xiaohua., Zeng Yangjun., etal. 2022. Grain Yield Improvement in High-Quality Rice Varieties Released in Southern China from 2007-2017. Front-Sustain Food System. Volume 6.
5. Hargrove Tom., Caffman W. Ronnic. 2006. Breeding History. Internation Rice Research Institute.
6. Sabar. M., Mustafa. E. S., Ijaz. M., Khan. R. A. R. etal. 2024. Rice Breeding for Yield Improvement Through Traditional and Modern Genetic Tools. Rice research Institute, Kala Shab Kaku, Pakistan. DOI: 10.59324/ejeba.2024. (1).02 CC.BY4.0.
7. Seoraj, N. (2021, January 5). Rice earnings top $51B. Guyana Chronicle the nation’s paper. <https://guyanachronicle.com/2021/01/05/rice-earnings-top-51b/>
8. Mahendra Persaud1, Danata Mc Gowan1\*, Nandram Gobind1, Miranda Henry1  Viviane Baharally1, Gansham Payman1, Rajendra Persaud1, Edgar Corredor2 2024.On-Farm Evaluation of New Rice (*O. sativa*) Genotype (FG12-259) for Commercial Cultivation in Guyana. Journal of plant Science and Agricultural Research. Vol. 8 No.1:128.
9. *2013. IRRI. SES Standard evaluation system for Rice*. (2018). Blogspot.com. https://ricepedia.blogspot.com/2018/04/2013-irri-ses-standard-evaluation.html.
10. Persaud, M., Mc Gowan, D., Gobind, N., Persaud, R. and Corredor, E. (2022). Evaluation of Yield and Yield Attributing Traits in Advanced Breeding Lines of Rice (Oryza sativa L.) over Two Rice Growing Seasons in Guyana. *Greener Journal of Plant Breeding and Crop Science*, 10(1): 1-7
11. Idris, M., and Matin, M. A. (1990). Response of four exotic genotypes of aman rice to urea. *Bangladesh J. Agril. Sci*, *17*(2), 271-275.
12. Howlader, M. H. K., Rasel, M., Ahmed, M. S., Hasan, M. M. and Banu, L. A. (2017). Growth and yield performance of local T Aman genotypes in southern region of Bangladesh. *Progressive Agriculture,* 28. 109. 10.3329/pa. v28i2.33471.
13. Shahidullah, S. M., Hanafi, M. M., M. Ashrafuzzaman, Uddin, M. K., & Sariah Meon. (2009). Analysis of lodging parameters in aromatic rice. *Archives of Agronomy and Soil Science*, *55*(5), 525–533. <https://doi.org/10.1080/03650340902737896>.
14. Reddy, T. Y., and Reddy, G. H. (1997). *Principle of agronomy*. Kalyani publishers, p. 515
15. Ashrafuzzaman, M., Islam, M.R., Ismail, M.R., Shahidullah, S.M. and Hanafi, M.M. (2009). Evaluation of six aromatic rice varieties for yield and yield contributing characters. Int. J. Agric. Biol., 11: 616–620.
16. Hussain, S., Fujii, T., McGoey, S., Yamada, M., Ramzan, M. and Akmal, M. (2014). Evaluation of different rice varieties for growth and yield characteristics. *The Journal & Animal and Plant Sciences,* 24(5): 1504-1510
17. Islam N., Kabir M. Y., Adhikary S.K. and Jahan M. S. (2013). Yield performance of six local aromatic rice cultivars. *J. Agric. Vet. Sci.,* 6(3): 58–62.
18. Gravois, K. A. and Helms, R. S. (1992). Path analysis of rice yield and yield components as affected by seeding rate. *Agronomy Journal*, 84: 1-4.
19. Samonte, S.O.P.B., Wilson, L.T. and McClung, A.M. (1998). Path analyses of yield and yield-related traits of fifteen diverse rice genotypes. *Crop Sci*., 38: 1130-1136
20. Zhao, X., & Fitzgerald, M. (2013). Climate Change: Implications for the Yield of Edible Rice. *PLoS ONE*, *8*(6), e66218. <https://doi.org/10.1371/journal.pone.006621>
21. Shi, S., Wang, E., Li, C., Zhou, H., Cai, M., Cao, C. and Jiang, Y. (2021). Comprehensive Evaluation of 17 Qualities of 84 Types of Rice Based on Principal Component Analysis. *Foods (Basel, Switzerland)*, 10(11), 2883. <https://doi.org/10.3390/foods10112883>
22. Wassmann, R., Jagadish, S.V.K., Heuer, S., Ismail, A., Redona, E. (2009) Climate change affecting rice production: the physiological and agronomic basis for possible adaptation strategies. Adv Agron 101: 59–122.
23. Cheng, F. M., Zhong, L. J., Wang, F. and Zhang, G. P. (2005). Differences in cooking and eating properties between chalky and translucent parts in rice grains. *Food Chemistry*, 90: 39-46.
24. Ata-Ul-Karim, S. T., Begum, H., Lopena, V., Borromeo, T., Virk, P., Hernandez, J. E., ... & Kato, Y. (2022). Genotypic variation of yield-related traits in an irrigated rice breeding program for tropical Asia. *Crop and Environment*, *1*(3), 173-181.
25. Sitaresmi, T., Hairmansis, A., Widyastuti, Y., Susanto, U., Wibowo, B. P., Widiastuti, M. L., ... & Nugraha, Y. (2023). Advances in the development of rice varieties with better nutritional quality in Indonesia. *Journal of Agriculture and Food Research*, *12*, 100602.
26. Madishetty, A. R., Lal, G. M., & Adarsh K. (2023). Genetic Variability and Correlation Studies for Yield and Yield Related Traits in Rice (Oryza sativa L.). *International Journal of Plant & Soil Science*, *35*(20), 1165–1176.