Tropical Agricultural Research & Extension 26 (4): 2023

RESEARCH ARTICLE

SELECTION OF TRADITIONAL RICE VARIETIES FOR GALLE DISTRICT BASED ON AGRONOMIC CHARACTERISTICS AND FARMER-CONSUMER PREFERENCES

WickramasingheWGM[1]*, Abeywickrama LM[2] and Millawithanachchi MC[3]

[1]Office of the Assistant Director of Agriculture (Galle /Eastern Zone), Labuduwa, Akmeemana, Sri Lanka
[2]Faculty of Agriculture, University of Ruhuna, Sri Lanka
[3]Rice Research Station, Labuduwa, Akmeemana, Sri Lanka

Received: 6 June 2023, Accepted: 10 October 2023, Published: 31 December 2023

ABSTRACT

In response to the growing trend of cultivating traditional rice varieties in the Galle District this study aimed to select suitable varieties that align with the preference of farmers and consumers. A survey of traditional rice varieties cultivated in the Galle district led to the collection of thirty traditional rice accessions from the Germplasm collection of the Plant Genetic Resource Center (PGRC) for preliminary evaluation with 4 traditional varieties from the Rice Research Station Labuduwa (RRSLd). Preliminary evaluations were conducted during the 2017 *Yala* season at the RRSLd. Subsequently, five accessions/varieties from the preliminary evaluations, six varieties from Regional Rice Research and Development Center-Bombuwala (RRRDCBw/RRSBw), and two improved rice varieties; (Ld 368 and Bw 372) were further evaluated during the 2017/18 *Maha* season using a Randomized Complete Block Design with two replicates in RRSLd. The evaluations involved the active participation of farmers, researchers, consumers, and traders. Varieties were assessed on eight morphological characteristics. using the pair-wise ranking method of the Participatory Rural Appraisal (PRA) approach. Data analysis was performed using the Kruskal Wallis One Way ANOVA model. Bw 372 and Ld 368 received above-average rankings, with *Suwandal* (RRSLd) achieving the highest score for cooked rice quality. In the overall evaluation Ld 368, *Kahawanu* (4250), *Kuruluthuda* (RRSBw), and *Suwandal* (RRSLd) emerged as preferred choices. These selections were tested in farmer fields during the 2018 *Yala* season with Ld 368, *Kuruluthuda* (RRSBw), and *Kahawanu* recording higher yields. In the 2018/19 *Maha* season, all the varieties tested in the 2018 *Yala* season were tested in farmer fields except *Kahawanu* (4250). Ld 368 and Bw 372 outperformed others in farmer fields. Based on farmer preference and yield performance, *Gonabaru* (farmer selected) and *Kuruluthuda* (RRSBw) were the most preferred traditional rice varieties, followed by *Suwandal* (RRSLd) and *Rathdal* (RRSLd).

Keywords: Agronomic characters, Farmer preferences, Traditional rice varieties

INTRODUCTION

Sri Lanka boasts a rich diversity of rice germplasm, encompassing more than 2000 traditional varieties, each characterized by distinct traits. The Plant Genetic Resource Center (PGRC) conserves over 4000 rice accessions (Priyangani *et al.* 2008). Traditional rice accessions, known for their wide genetic diversity, represent a valuable genetic resource, particularly for enhancing rice resilience to biotic and abiotic stress and nutritional enhancement (Tennakoon *et al*. 2020) Recent studies, as noted by Ranawake *et al.* 2013, have identified salinity and stress tolerance in Sri Lanka's traditional rice varieties. These traditional varieties were selected, conserved, developed, and cultivated due to their tolerance to adverse environmental and soil conditions, resistance to pests and diseases, and alignment with cultural and religious preferences (Dharmase 2010).

*Corresponding author: mayawick1@gmail.com

However, the advent of the Green Revolution in the 1960s and 1970s brought about a dramatic shift, with modern, high-yielding varieties replacing traditional, low input and environmentally friendly ones, resulting in a heavy dependence on external inputs and modern technology. In the 21st century, over 95% of the total cultivated area is dominated by these newly improved varieties, leading to the near-extinction of many traditional rice varieties that were once widely cultivated. Traditional rice varieties are instrumental in promoting the health and nutrition of the population (B4FN 2016). Presently, there is a rising trend in the demand for low-input traditional varieties, driven by an increasing awareness of their health benefits and concerns over food produced with agrochemicals. Growers can achieve economic viability through the cultivation of traditional varieties, as their higher market prices compensate for their lower yields when compared to newly improved varieties.

Before the widespread adoption of newly improved varieties, Sri Lanka boasted a landscape where over a thousand diverse different traditional rice varieties were cultivated, each distinguished by unique nutrient profiles and characteristics. However, today only a handful of traditional rice strains are commonly grown – with almost all cultivation leading towards newly improved varieties (Withanawasam 2017). Recently government authorities, non-government organizations, and other stakeholders have introduced several traditional varieties to farmers in the low-line areas of the Galle district. Unfortunately, most of these traditional varieties exhibit subpar yield qualities and plant structures ill-suited to the Galle district's climate.

Furthermore, farmers have faced economic losses, challenges in seed production programs, and issues related to self-seed production due to the poor performance of traditional varieties. As a result, there is an imperative need to identify suitable traditional rice varieties for cultivation, grounded in desirable agronomic characteristics and aligned with farmer and consumer preferences. Consequently, this study was conducted to assess the current state of traditional rice cultivation in the Galle district, evaluate traditional rice varieties in low-line areas, and select superior varieties based on overall performances, as well as the perspectives of farmers and consumers.

MATERIALS AND METHODS

A comprehensive data collection approach was employed to identify traditional rice varieties cultivated by farmers in Galle District, drawing from surveys conducted in all Divisional Secretariat divisions, data obtained from the Department of Agriculture Southern Province, and relevant literature sources. As a result, 30 traditional rice varieties were selected for evaluation, with details as follows: *Bala Maa Wee* (3598), *Batapola* (2105), *Dahanala* (2049), *Demas Wee* (2054), *Dewaraddiri* (4610), *Dik Wee* (2109), *Duru Wee* (2990), *Goda Heenati* (4049), *Goda Manel* (4045), *Gonabaru* (3633), *Handiran* (2057), *Hatada Wee* (3470), *Hatapanduru* (4236), *Hathi Al* (4057), *Herath Banda* (2064), *Hondarawalu* (3521), *Kaharamana Wee* (3440), *Kahawanu* (4250), *Kalu Heenati* (2087), *Koththamalli* (3727), *Maa Wee* (8551), *Murungakayan* (3257), *Muthu Samba* (3564), *Periyakarupan* (3947), *Pokkali* (3573), *Rathdal* (4174) *Sudu Heenati* (2088), *Suwandal* (4595), *Weda Heenati* (2340) and *Yakadamaran* (4208) and 4 varieties from Labuduwa Rice Research Station *Al Wee* (RRSLd), *Rathdal* (RRSLd), *Suwandal* (RRSLd) and *Dahanala* (RRSLd) were included in the evaluation.

Preliminary evaluations of these 34 traditional varieties were conducted at the RRSLd with assessments based on the descriptors outlined by the International Rice Research Institute (IRRI) in 1980, as well as visual observations. This preliminary evaluation took place during the 2017 *Yala* season. Subsequently, 5 varieties, *Dahanala* (RRSLd), *Rathdal* (RRSLd), *Suwandal* (RRSLd), *Kahawanu* (4250), and *Herath Banda* (2064) were chosen for further evaluations. These 5 selections were paired with 6 varieties from the RRSBw. Altogether, 11 traditional varieties were subjected to in depth evaluations at the RRSLd during the 2017/18 *Maha season.* For the sake of comparison, two commonly cultivated improved varieties in the area, Ld 368 and Bw 372, were included.

The 13 varieties were cultivated in plots measuring 6 x 3 m each with two replicates using a Randomized Complete Block Design during the 2017/18 *Maha* season. The field trial underwent simultaneous evaluations through two approaches; a participatory approach and the collection of quantitative data via focus group discussions.

The Participatory Rural Appraisal Approach was utilized to select criteria for the evaluation of morphological characteristics. Through focus group discussions with farmers, numerous characteristics were narrowed down to eight key morphological traits characters such as (1) plant height, (2) size of the panicle, (3) number of seeds per panicle, (4) size of the seed, (5) number of tillers per plant (6) age category of the variety, (7) ability to control weeds, and (8) susceptibility to lodging at maturity. Given that some criteria were qualitative, all criteria were converted into a qualitative rank scale to enable uniform statistical testing. Thus these selected traits were classified on to a five-point scale (1) very bad, (2) bad, (3) moderate, (4) good, and (5) very good based on a Likert scale. The quality of cooked rice also a significant criterion, and it was assessed based on five aspects; (1) colour, (2) fragrance (3) taste, (4) stickiness, and (5) overall appearance, as proposed by Azabagaoglu and Gaytancioglu (2009).

At the crop's maturity stage in the fields, fields were ranked visually by invitees attending the field day. Participants included farmers who grew traditional rice, those who did not, officers from the Department of Agriculture, students and the staff from the Faculty of Agriculture, University of Ruhuna. For the participatory evaluation, the voting method was employed to gauge overall variety preference, with cards indicating "√" for preferred and "x" for non- preferred. Additionally, the ranking of varieties for morphological characteristics was performed through scorecards, which were distributed among participants, who were asked to independently rank the properties on a scale ranging from (1) very bad to (5) very good. Cooked rice samples for each variety were also ranked according to taste.

Data on plant height, size of the panicle, number of seeds per panicle, size of the seed, and number of tillers per plant were collected by evaluating 5 plants of each variety during the assessment. The age category of the variety, ability to control weeds, and lodging at maturity were also assessed. From the data analysis of morphological characters and the participatory preference analysis, four varieties - *Suwandal*-RRSLd*, Rathdal*-RRSLd*, Kuruluthda*-RRSBw*, and Kahawanu*-4250 were selected.

In the 2018 *Yala* season, 200g of each selected 4 traditional varieties; *Suwandal*-RRSLd*, Rathdal*-RRSLd*, Kuruluthda*-RRSBw*, Kahawanu*-4250 *and* one farmer-grown traditional variety, *Gonabaru* which differed from the PGRC collected *Gonubaru* (3633) in preliminary evaluations and was suggested by the participants of the field day, along with two improved varieties, Ld 368 and Bw 372 were distributed among 30 farmers representing all the divisional secretariats of Galle District. The purpose was to assess the farmer preferences qualitatively. Yield data were collected separately for each trial after harvesting, and the farmer preferences were recorded. Notably, as described by Paris *et al.*(2016), close collaboration between scientists and farmers facilitated access to germplasm adapted to farmers' circumstances and requirements, and this research emphasized sharing of experiences of the farming community with scientists and other stakeholders in the selection of suitable varieties with preferred characteristics.

During the 2018/19 *Maha* season, the same varieties were evaluated at ten farmer fields in the Galle district, with two replicates in 6x3 m plots. *Kahawanu* (4250) was excluded from the yield evaluation trial due to its extended age and non-alignment with the cropping season. Based on the performance in yield, morphological characteristics, and farmer-consumer preferences, the most suitable varieties were selected.

Statistical analyses included the use of the Kruskal Wallis One Way ANOVA method for separate characteristics analyses, as well as pair-wise comparisons for each character

among all varieties as outlined by Seigal and Castelan (1988) For the evaluation of the quality of cooked rice among different varieties, the analysis of voting data from the participatory evaluation was performed using the Friedman Test.

Analysis of Variance was conducted for yield and other quantitative research data, followed by mean separation using the Duncan Multiple Range Test (DMRT). The final selections of the most suitable varieties were done based on the combined evaluation of yield performance, morphological characteristics, and farmer-consumer preferences.

RESULTS AND DISCUSSION

In the preliminary evaluation, out of the 34 evaluated 34 accessions/ varieties *Ma Wee* (PGRC-8551), *Hathi Al* (4057), *Dewaraddiri* (4610), *Kottamalli* (3727), *Hondarawalu* (3521), *Bala Ma Wee* (3598) and *Heta Panduru* (4236) did not flowered due to their photoperiodic sensitivity. Most of the varieties displayed leaf lengths exceeding 50cm.

Considering the visual observations and other desirable characters, 11 traditional rice varieties were selected for further evaluation; *Kahawanu* (4250), *Herath Banda* (2064), *Beheth Heenati* (RRSBw), *Raththambili Al* (RRSBw), *Kahata Wee* (RRSBw), *Madathawalu* (RRSBw), *Pachchaperumal* (RRSBw), *Suwandal* (RRSLd), *Dahanala* (RRSLd), *Kuruluthuda* (RRSBw), and *Rathdal* (RRSLd).

Yield and Agronomic Characters of selected 11 Accessions and Farmer Preference Analysis

Significant differences were observed in the plant height, panicle length, flag leaf length, and flag leaf width among the tested varieties while the number of tillers, and the number of panicles did not show significant differences (Table 1). Ld368, *Rathdal* (RRSLd), and *Kuruluthuda* (RRSBw) were shorter varieties and were not significantly different from each other. However, due to the tall nature of other tested varieties except Ld 368, *Rathdal* (RRSLd), and *Kuruluthuda* (RRSBw), others experience lodging during the maturity stage.

According to Moldenhauer and Nathan (2004), Sakamoto and Matsuoka (2008), and Huang *et al*. (2013), rice yield is determined by indirect traits such as plant height, growth period, tillering ability, panicle length, seed length, seed setting rate, and grains per panicle as well as direct traits like panicle number per unit area or per plant, filled grains per panicle and 1000-grain-weight.

Kahata Wee (RRSBw) recorded the highest panicle length and flag leaf length while *Rathdal* (RRSLd) recorded the lowest values for both characteristics. *Kahata Wee* (RRSBw) reported highest value for flag leaf width, Ld 368 and Bw 372 reported higher values for flag leaf width and were not significantly different from *Kahata Wee* (RRSBw). *Beheth Heenati* (RRSBw) recorded the lowest value for flag leaf with, and *Dahanala* (RRSLd) recorded a lower value for flag leaf blade width than the other varieties.

In rice improvements, narrow and lengthy leaves are not preferred due to their droopy nature, which is an inefficient architecture for photosynthesis. Meicheng *et al.* (2020), also described that.

Among the tested varieties, Ld368 scored the highest value of seeds per panicle, while the others did not significantly differ in terms of for seeds per panicle. *Pachchaperumal* (RRSBw) achieved the highest 1000 grain weight, and there was significant difference among tested varieties. *Raththambili Al* (RRSBw) scored the highest ten-seed length, while *Kuruluthuda* (RRSBw) had the lowest. *Kuruluthuda (RRSBw*) recorded the highest ten-seed width, and the lowest was observed in *Rathdal* (RRSLd) the lowest panicle weight was achieved by Bw372, and the highest was scorer by Ld368. The lowest shattering percentage was recorded by the improved variety Ld 368. Bw 372, and *Herath Banda* (2064) were not significantly different from that, while *Beheth Heenati* (RRSBw) and *Kahata Wee* (RRSBw) recorded higher shattering percentages, indicating the inferior agronomy of traditional varieties (Table 2).

Table 1: Mean performance of the plant height, number of tillers per plant, number of panicles per plant, panicle length, flag leaf length, flag leaf width of tested rice varieties

Variety	Plant Height (cm)	No. of tillers	No. of panicles per plant	Panicle length (cm)	Flag leaf length (cm)	Flag leaf Width (cm)
Herath Banda (2064)	147.6^{ab}	7.3^{a}	6.1^{a}	21.37^{cd}	29.16^{dc}	1.08^{bc}
Beheth Heenati (RRSBw)	145.6^{ab}	9.9^{a}	9.7^{a}	24.52^{bcd}	32.53^{dc}	1.02^{c}
Raththambili Al (RRSBw)	139.3^{b}	9.2^{a}	9.4^{a}	22.31^{bcd}	30.51^{dc}	1.15^{bc}
Rathdal (RRSLd)	111.7^{ed}	9.6^{a}	9^{a}	19.99^{d}	24.46^{d}	1.19^{bc}
Kahata Wee (RRSBw)	161.3^{a}	10^{a}	9.1^{a}	29.99^{a}	45.9^{a}	1.57^{a}
Madathawalu (RRSBw)	133^{bc}	6.15^{a}	6.15^{a}	20.645^{cd}	29.07^{dc}	1.185^{bc}
Suwandal (RRSLd)	133.7^{bc}	6.5^{a}	6.5^{a}	26.73^{ba}	43.75^{ba}	1.24^{bc}
Pachchaperumal (RRSBw)	147^{ba}	9.1^{a}	8.7^{a}	23.95^{bcd}	37.42^{bc}	1.17^{bc}
Dahanala (RRSLd)	133.9^{bc}	7.3^{a}	7.4^{a}	22.94^{bcd}	30.74^{dc}	1.04^{c}
Kuruluthuda (RRSBw)	114.2^{ed}	10.3^{a}	10.3^{a}	24.94^{bcd}	31.36^{dc}	1.23^{bc}
Kahawanu (4250)	129.7^{bcd}	9.7^{a}	8.9^{a}	24.95^{bcd}	34.97^{c}	1.25^{bc}
Bw372	116.5^{ecd}	7.1^{a}	6.7^{a}	24.3^{bcd}	31.07^{dc}	1.39^{ba}
Ld 368	109.8^{e}	11.4^{a}	11.4^{a}	25.08^{bc}	30.94^{dc}	1.38^{ba}
Cv%	5.9	25.4	26.4	8.5	10.4	10.7

(DMRT group of each value are indicated in superscript. Means with the same letter are not significantly different p< (0.05)

The number of filled seeds perplant, unfilled seeds perplant and yield were significantly different among the tested varieties (Table 3). *Pachchaperumal* (RRSBw) recorded the highest number of filled seeds per plant, while Bw 372, Ld 368, *Kahawanu* (4250), and *Kuruluthuda* (RRSBw), *Suwandal* (RRSLd), *Rathdal* (RRSLd) achieved higher yields.

The evaluations were conducted without the application of fertilizer, yet the top yield performer was Ld 368. *Kahawanu* (4250), and *Kuruluthuda* (RRSBw) did not significantly differ from that. However, other varieties exhibited lodging during early maturity, and yields recorded were low during the trial conducted at RRSLd. The trial experienced heavy rains during the grain filling stages. As a result of the prevailing weather conditions during the evaluation period, yield recordings were also lower than expected.

The average rank scores on a scale of one to five given by the farmers based on their preference for each selected agronomic character for different varieties are presented in Table 4.

The analysis reveals that the rank scores for all plant characteristics were above the average score of 2.5 for the improved varieties Bw 372 and Ld 368, which were used as a basis

Table 2: Mean performance of the of seeds per panicle, thousand grain weight, seed length, seed width, panicle weight and shattering percentage of tested rice varieties

Varieties	Seeds/ panicle	Thou-sand-grain weight (g)	Ten Seeds Length (cm)	Ten Seeds width (cm)	Panicle Weight (g)	Shatter-ing (%)
Herath Banda(2064)	71.8^{b}	25^{cb}	7.95^{bc}	3.3^{cb}	11.015^{bac}	4.31^{c}
Beheth Heenati (RRSBw)	121.9^{ba}	15.75^{e}	5.95^{e}	2.7^{e}	15.545^{bac}	19.53^{a}
Raththambili Al (RRSBw)	102.7^{b}	24.2^{cbd}	8.5^{a}	2.75^{ed}	20.4^{bac}	5.16^{bc}
Rathdal (RRSLd)	96.1^{b}	12.9^{f}	6.02^{e}	2.105^{f}	12.495^{bac}	11.52^{b}
Kahata Wee (RRSBw)	75.1^{b}	22.45^{cd}	8.2^{ba}	2.65^{e}	13.59^{bac}	19.94^{a}
Madathawalu (RRSBw)	105.6^{b}	27^{b}	7.7^{dc}	3.25^{cb}	12.925^{bac}	7.345^{bc}
Suwandal (RRSLd)	136.2^{ba}	11.5^{f}	5.55^{f}	2.45^{e}	8.55^{c}	10.09^{bac}
Pachchaperumal (RRSBw)	83.5^{b}	30^{a}	7.95^{bc}	3.5^{b}	23.65^{ba}	7.53^{bc}
Dahanala (RRSLd)	81.4^{b}	17.9^{e}	7.95^{bc}	2.65^{e}	12.48^{bac}	15.795^{ba}
Kuruluthuda (RRSBw)	130.4^{ba}	16.65^{e}	2.7^{g}	6.7^{a}	17.29^{bac}	9.875^{bac}
Kahawanu (4250)	122.3^{ba}	16.65^{e}	6.1^{e}	3.05^{cd}	20.065^{bac}	5.93^{bc}
Bw 372	89.6^{b}	21.45^{d}	7.55^{d}	2.65^{e}	10.06^{bc}	3.625^{c}
Ld 368	189.7^{a}	16.35^{e}	6.2^{e}	2.55^{e}	24.755^{a}	2.595^{c}
Cv%	30.2	6.2	2.4	4.5	35.8	39.0

(DMRT group of each value are indicated in superscript. Means with the same letter are not significantly different $p<(0.05)$

for comparison. Among the traditional varieties considered only *Kuruluthuda* (RRSBw) showed qualities slightly below the average, with scores did not significantly different from those of the improved varieties Ld 368 and Bw 372. *Suwandal* (RRSLd) recorded the highest score of 3.41 for the qualities of cooked rice. Other varieties with higher average rank scores for the quality of cooked rice included Bw 372 and Ld 368 (improved varieties), as well as two traditional varieties, *Kuruluthuda* (RRSBw) and *Kahawanu* (4250).

Based on the participatory evaluation results, where varieties were ranked through visual observation and analyzed using , the Friedman test (Table 4), significant differences were observed between the tested rice varieties in terms of farmer preference. . *Kahawanu* (4250) (11.8) has the highest mean rank (11.8), followed by Ld 368 (11.5), *Kuruluthuda* (RRSBw) (11.3), and *Suwandal* (RRSLd) (11) recorded by *Dahanala* (RRSLd) (1.0) and *Herath Banda* (2064) (2.0). According to participatory evaluation ranks, Ld 368, *Kahawanu* (4250), *Kuruluthuda* (RRSBw), and *Suwandal* (RRSLd) were the preferred choices among the participants.

Table 3: Mean performance of the of filled seeds per plant, unfilled seeds per plant and yield (t/ha) of tested rice varieties

Varieties	Filled seeds / plant	Unfilled seeds/plant	Yield (t/ha)
Herath Banda (2064)	70.1^{fe}	11.9^{dc}	1.17^{b}
Beheth Heenati (RRSBw)	84.9^{de}	21.3^{bac}	0.77^{b}
Raththambil Al (RRSBw)	96.2^{bdec}	13.4^{bdc}	0.88^{b}
Rathdal (RRSLd)	104.3^{bdac}	10.4^{dc}	0.86^{b}
Kahata Wee (RRSBw)	54.2^{f}	29.2^{a}	1.0^{b}
Madathawalu (RRSBw)	81.93^{de}	7.675^{d}	0.42^{b}
Suwandal (RRSLd)	124.9^{ba}	23.7^{ba}	1.11^{b}
Pachchaperumal (RRSBw)	129.9^{a}	7.85^{d}	0.88^{b}
Dahanala (RRSLd)	94.7^{dec}	15.2^{bdc}	0.86^{b}
Kuruluthuda (RRSBw)	120^{bac}	11.2^{dc}	2.32^{a}
Kahawanu (4250)	102.6^{bdac}	15^{bdc}	2.36^{a}
Bw 372	116.2^{bac}	16.2^{bdc}	1.16^{b}
Ld 368	106^{badc}	7^{d}	2.8^{a}
CV%	12.3	32.3	27.4

(DMRT group of each value are indicated in superscript. Means with the same letter are not significantly different $p< (0.05)$

Considering both the yield and agronomic characters as well as the results of the participatory evaluations *Kahawanu* (4250)*, Kuruluthuda* (RRSBw), *Suwandal* (RRSLd)*,* Ld 368, and Bw 372 were selected for further evaluations in farmes'r fields. According to Paris *et al.* 2016, Participatory Variety Selection (PVS) has improved the selection of suitable varieties for complex rainfed environments in eastern India.

Performance of selected accessions in farmer fields for adaptability level

Out of 30 farmers, data were received from 19 for observational yield trials during the 2018 *Yala* season. When considering yield, *Suwandal* (RRSLd) recorded yields ranging from 0.5 to 2.6kg, *Rathdal* (RRSLd) received yields between 0.5 to 3.5kg of yield. *Gonabaru* (farmer field cultivated) *yielded from* 0.2 to 3.5kg, *Kuruluthuda* (RRSBw) produced yield from 0.6 to 3kg, *Kahawanu* (4250) yielded between 0.65 to 4kg and the two improved varieties Bw 372 and Ld 368 delivered yield ranging from 0.4 to 4 kg and 0.2 to 4.2 kgs respectively. Per 200g seed sample distributed.

Regarding the preference of farmers for traditional rice varieties and the two improved varieties, Bw372 received the highest preference for yield and other characteristics (90.5%), Ld 368 recorded a preference rate of 85% as good, followed by *Kuruluthuda* (RRSBw) *at* 86.4%, *Gonabaru* (Farmer field cultivated) *at* 84.2%, *Kahawanu* (4250) at 73.7 %, *Suwandal* (RRSLd) at 59.09% and

Table 4: Average rank scores for the selected characteristics and mean comparison results of the Kruskal Wallis One Way ANOVA and mean, stranded deviations of participatory evaluations of rice varieties at maturity stage

Variety	Average rank scores for selected properties								Average rank score for quality of cooked rice	Overall ranking		
	Size of the panicle	Number of seeds per panicle	Size of the seed	Number of tillers	Plant height	Age category	Controlling weeds	Lodging		Mean	Std	Mean rank
Dahanala (RRSLd)	1.65	1.65	1.96	1.79	1.57	2	2	1.56	2.18	-34	5.7	1
Herathbanda (0642)	1.96	2	2.09	1.78	1.64	1.95	1.71	1.52	2.54	-29	1.4	2
Pachchaperumal (RRSBw)	2.07	1.85	2.25	1.89	1.41	2.42	1.76	1.38	2.74	-24	7.1	3
Raththembili Al (RRSBw)	1.96	2.08	2.26	1.93	1.68	2.45	2	1.35	2.77	25	5.7	8.5
Beheth Heeneti (RRSBw)	2	2	2.22	2	2.04	2.36	2.13	1.67	2.67	-6.5	6.4	5.3
Madathawalu (RRSBw)	1.96	2.05	2.14	1.91	1.75	2.37	2.14	1.76	2.85	-16	7.1	4.3

Table 4 Contd….

Kahata Wee (RRSBw)	2.5	2.44(a)	2.42	2.48	1.62	1.73	2.29	2.11		-7.5	3.5	5.5
Rathdal (RRSLd)	2.13	2	2.3	2.08	2.54	2.73(a)	1.83	2.36	2.77	10	12.7	7
Kaha-wanu (4250PG RC)	2.42 (a)	2.26	2.73 (a)	2.24	2.3	2.69 (a)	1.93	1.98	3.20 *	36.5	2.1	11.8
Suwandal (RRSLd)	2.47 (a)	2.29	2.66 (a)	2.34	2.34	2.78 (a)	1.83	2.03	3.41 *	32.5	14.8	11
Kurulu-thuda (RRSBw)	2.86 (a)	2.97 (a)	2.89 (a)	2.81 (a)	3.17 (a)	3.09 (a)	2.32 (a)	2.71 (a)	3.02 *	33.5	2.1	11.3
Ld 368	3.34 (a)	3.19 (a)	3.14 (a)	3.25 (a)	3.55 (a)	3.33 (a)	2.79 (a)	3.15 (a)	2.98 *	36	4.2	11.5
Bw 372	3.2 (a)	3.26 (a)	3.05 (a)	3.3 (a)	3.43 (a)	3.3 (a)	2.95 (a)	3.3 (a)	3.03 *	24	1.4	9
Critical Differ-ence for compari-son (α=0.05)	0.91	0.83	0.64	0.87	0.95	0.71	0.65	0.79				ChiSquare 22.8 Asymp. Sig. 0.029

Rathdal (RRSLd) was the least preferred variety (Table 5).

Athough *Kahawanu* (4250PGRC) variety is favoured by farmers for its yield, theyare reluctant to grow it due to its longer growth period of more than four-months. Consequently, during the 2018/2019 Maha season the same varieties were distributed among ten farmers scattered in the Galle District further evaluation excluding *Kahawanu*.

Significant differences in the mean yield performance were observed among the tested varieties in all locations during the yield evaluations in the 2018/19 *Maha season*. In most of the locations, improved varieties Ld 368 and Bw 372 demonstrated better performance with higher yields (Table 6). *Gonabaru* (Farmer field cultivated), *Kuruluthuda* (RRSBw), *Rathdal* (RRSLd) and *Suwandal* (RRSLd) all recorded yields exceeding 3t/ha in three locations. Based on both farmer preference and yield performance *Gonabaru* (Farmer field cultivated) and *Kuruluthuda* (RRSBw) were the most preferred, followed by *Suwandal* (RRSLd) and *Rathdal* (RRSLd).

CONCLUSION

The improved variety Ld 368 exhibited higher seed per panicle, panicle weight, and number of filled grains per plant while showing lower shattering. Bw372, *Kuruluthuda* (RRSBw), *Herath Banda*(0642) *and Raththembil Al* (RRSBw) also recorded lower shattering percentages. Yet *Beheth Heenati* (RRSBw), *Kahata Wee* (RRSBw), *Suwandal* (RRSLd) and *Dahanala* (RRSLd) recorded higher shattering percentages. Ld368 was the highest yield recorder. *Kuruluthuda* (RRSBw) and *Kahawanu* (4250) also obtained slightly lower yields. Improved varieties Bw372 and Ld368 were rated above average, followed by *Kuruluthuda* (RRSBw) in terms of morphological characters.

Table 5: Farmer preference of varieties in the preliminary farmer field evaluation during 2018 *Yala* season (Percentage of farmers)

Variety	Percentage of the farmers who said Good	Percentage of the farmers who said Moderate	Percentage of the farmers who said Bad
Suwandal (RRSLd)	59.09	18.18	22.72
Rathdal (RRSLd)	52.38	19.04	28.57
Gonabaru (Farmer field cultivated)	84.21	5.26	10.52
Kuruluthuda (RRSBw)	86.36	13.63	
Kahawanu (4250)	73.68	10.52	15.78
Bw372	90.47	9.52	
Ld 368	85	10	5

Table 6: Yield evaluation (t/ha) of selected rice varieties at famer fields during 2018/2019 *Maha* season

Variety	Ahangama (t/ha)	Akmeema (t/ha)	Yakkalamula (t/ha)	Kerandewa (t/ha)	Kodagoa (t/ha)
Ld 368	3.44 a	3.95b	4.44a	6.11a	4.00a
Bw 372	3.41 a	3.69 c	4.44a	4.94c	3.52b
Kuruluthuda (RRSBw)	1.78bc	2.8 d	3.33d	5.56b	3.05c
Gonabaru (Farmer field cultivated)	1.89 b	4.5a	4.17b	2.83f	3.41bc
Rathdal (RRSLd)	1.28 c	3.6 c	3.33d	4.00d	1.55d
Suwandal (RRSLd)	1.56 bc	4.41a	3.61c	3.28e	1.39d
CV	8.9	2.4	1.5	2	6.28

Suwandal (RRSLd) scored the highest score for the quality of cooked rice followed by Bw372 & Ld 368 and two traditional varieties, *Kuruluthuda* (RRSBw) and *Kahawanu* (4250) which also received good ratings.

In farmer field testing; improved varieties Ld 368 and Bw 372 performed better with higher yields. Among traditional varieties *Gonabaru* (Farmer field cultivated), *Kuruluthuda* (RRSBw), *Rathdal* (RRSLd), and *Suwandal* (RRSLd) achieved yields of more than 3t/ha in three locations. Based on farmer preferences and yield performance *Gonabaru* (Farmer field cultivated) and *Kuruluthuda* (RRSBw) were the most preferred traditional rice varieties, followed by *Suwandal* (RRSLd) and *Rathdal* (RRSLd).

ACKNOWLEDGMENT

The authors wish to express gratitude to Mr. Sumith Alahakoon, (Former Secretary, Ministry of Southern Province of Agriculture) and Mr. M. Subasinghe, Former Provincial Director of Agriculture, Southern Province, and Mrs. A. Palihawadana Deputy Director of Agriculture (extension), Galle District for giving the support to do the research, and staff of agriculture, Southern Province for giving support to do field trials.

And authors would like to thank the professional support given by the staff of the Rice Research and Development Center, Labuduwa.

AUTHOR CONTRIBUTION

WGMW, LMA and MCM design the study, WGMW Perform the experiments, WGMW, LMA and MCM analyzed the data, and wrote the manuscript.

REFERENCES

Azabagaoglu MO, Gaytancioglu O 2009 Analyzing consumer preference to different rice varieties in Turkey. Agricultural Tropica et Subtropica. 42 (3) 118-125

Biodiversity for Food and Nutrition (B4FN) 2016 Harnessing agricultural biodiversity to reduce hunger and malnutrition. <http://www.b4fn.org/fileadmin/ templates/b4fn.org/upload/documents / Flyers/BFN_flyer_new.pf. >

Dharmasena PB 2010 Traditional Rice Farming in Sri Lanka. Lanka Economic Review. 36, 48-53.

Huang R, Jiang L, Zheng J, Wang T, Wang H, Huang Y 2013 Genetic bases of rice grain shape: so many genes, so little known. Trends Plant Science. 18, 218–226. <doi: 10.1016/j.tplants.2012.11.001>

IRRI 1980. International Rice Research Institute and International Board for Plant Genetic Resources. Descriptors for rice Oryza sativa L. The international Rice Research Institute, Manila, Philippines. 1-21

Kaur, S. Bhagirath Singh Chauhan. 2022. Current status of herbicide-resistant weeds and their management in the rice-wheat cropping system of South Asia. In Advances in Agronomy, Academic Press, USA

Meicheng Z, Sha Tang, Haoshan Z, and Xianmin D.2020 DROOPY LEAF1 controls leaf architecture by orchestrating early brassinosteroid signaling. Biological Sciences. In Z Cyril (eds), University of Zurich, Zurich, Switzerland. 17(35): 21766–21774

Moldenhauer K, and Nathan, S 2004 Rice growth and development. In N Slaton (eds), Rice Production Handbook. Arkansas: University of Arkansas.

Paris TR, Singh RK, Atlin G, Sarkarung S, Mclaren G, Courtois B, Mc Allister K, Piggin C, Pandey S, Singh A, Singh HN, Singh N, Singh S, Singh RK, Mandal NP, Prasad K, Sahu RK, Sahu VN, Sharma M, Singh, RKP, Thakur R, Singh NK, Chaudhary D and Ram S 2016 Farmer participatory breeding and participatory varietal selection in eastern India: Lessons learned. RLPSR Conf. proceedings 12.

Priyangani EGD, Kottearachchi NS, Attanayake DPSTG, and Pathinayake BD 2008 Characterization of Suwandal and Heeneti rice varieties for the fragrance gene using PCR based molecular markers. Symposium Proceedings. Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka

Ranawake AL, Amarasinghe UGS and Dahanayeke N 2013 Agronomic Characters of some traditional rice cultivars in Sri

Lanka, Jn. of Uni. of Ruhuna 1(1): 3-9

Sakamoto T and Matsuoka M 2008. Identifying and exploiting grain yield genes in rice. Curr. Opin. Plant Biol. 11, 209–214. doi: 10.1016/j.pbi.2008.01.009

Siegel, S. and Castellan Jr., N.J. (1988) Nonparametric Statistics for the Behavioral Sciences. 2nd Edition, McGrawHill, New York. http://dx.doi.org/10.1177/014662168901300212

Thennakoon et.al., Management adaptation to flood in Guangdong Province in China: World Development 127 (2020): 104767

Withanawasam DM 2017 Traditional rice of Sri Lanka, 02 February, Wikipedia, https//en.wikipedia.org/wiki/Traditional rice of Sri Lanka.