

**Ld 253: A SHORT DURATION (85 DAYS) VARIETY WITH WHITE  
LONG GRAIN AND HIGH QUALITY RICE**

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**ABSTRACT**

Development of short duration rice varieties with good quality attributes is important to cater the demand of rice growers and consumers, especially during adverse climatic conditions. Therefore, an ultra short duration variety improvement program on 2½ months rice varieties was carried out at the Rice Research Station, Labuduwa. Including Ld 8-15-30, three lines selected from the out crossing population of At 04 (a farmer field selection from Ambalantota) were nominated for the National Coordinated Rice Variety Trial (NCRVT) based on the yield, other agronomic characters, grain quality and pest and diseases tolerance. Ld-8-15-30 performed better in the NCRVT and promoted to Variety Adaptability Trial (VAT) for testing with Bg 250. The line Ld 8-15 - 30 exhibited equal or better performance compared to recommended variety Bg 250 in NCVT and VAT evaluations with better adaptability in both Wet and Dry zone locations. The line Ld 8-15 -30 recorded the highest yield of 10.11 t/ha at Murunkan in the Dry zone during 2013 *Yala* season and recorded average yields of 4.78 t/ha and 5 t/ha during 2013 *Yala* and 2013/14 *Maha* seasons, respectively across all VAT locations. This line has recorded an average yield of 3.53 t/ha in Wet zone and the highest yield was 4.73 t/ha at Ukuwela in Matale district. The line Ld -8-15-30 was released as Ld 253 variety for island wide cultivation. The Ld 253 is a short duration (85 days) variety, with white long slender grains and good quality characteristics. Better appearances of both milled and cooked rice, good palatability with soft cooked nature are the most attracting quality attributes of this variety. The variety is resistant to grain discoloration, moderately resistant to rice gall midge, brown plant hopper and blast and well adapted to Low Country Wet and Dry zones.

**Keywords:** Climate change, Ld 253, Quality grain rice, Short duration

## INTRODUCTION

Climatic change has created a direct influence on the cropping pattern and the regular cropping seasons. Rice (*Oryza sativa* L.) cultivation is more sensitive to water issues, crop losses are more frequent with the water scarcity leading to drought or floods due to excess water. Use of short duration rice varieties is one of the options to complete the cropping cycle with less water usage or for late sowing in Wet zone after the heavy rainy conditions. Though the country has achieved self sufficiency in rice, climatic aberrations such as drought and flood has interrupted the steady production of average rice leading to a scarcity at some instances. Hence, development of short duration rice varieties would favour the continuous production of rice even with adverse weather conditions. According to Rajapakse *et al.*, (1999), short duration varieties are extremely important, to escape drought particularly in lands with limited water supply under rainfed conditions. Furthermore, the short duration rice varieties with high yield potential are needed for irrigated paddy lands to expand the area cultivated and to improve cropping intensity by increased water use efficiency.

The varieties Bg 750, Bg 250 and Bg 251 are short duration rice varieties recommended by the Department of Agriculture. The variety Bg 251 was released in 2015 is an introduction, especially as a drought tolerant variety. The variety Bg 750 is not popular among the farmers due to undesirable plant characteristics such as excessive lodging. Though Bg 250 is popular in Dry and Intermediate zones, the variety are not spread in the Wet zone due to seed discoloration and the less preference for intermediate bold white seed type. There is a need to develop short duration varieties adaptable for Wet zone's conditions with better seed quality characteristics acceptable by the farmers and consumers. Therefore, a short duration variety improvement program was conducted to develop adaptable high yielding

varieties for Wet zone paddy fields with less seed discoloration and high farmer and consumer preferred grain qualities.

## MATERIALS AND METHODS

Targeting the short duration variety development, selections were carried out at the Rice Research Station (RRS), Labuduwa from the out crossing populations of At 04, a farmer field collected line with high yield and short duration. From the preliminary evaluation trial six lines, Ld 8-14-10, Ld 14-27 and Ld 8-14-42 from the cross between Ld 2-3-13/Sulai and Ld 8-15-6, Ld 8-15-15 and Ld 8-15-30 lines developed from At 04 selection were selected for the major yield trials and Bg 250 used as standard check variety. Yield evaluations were carried out in Randomized Complete Block with three replicates during 2009/10 *Maha*, 2010 *Yala*, 2010/11 *Maha* seasons. Based on the yield performance and grain quality assessments, 3 lines (Ld 8-15-6, Ld 8-15-15 and Ld 8-15-30) were selected for National Coordinated Rice Variety Test (NCRVT) at multi locations.

The nominated lines were tested in NCRVT with Bg 250 and Bg 300 as standard checks during 2011 *Yala*, 2011/12 *Maha*, 2012 *Yala* and 2013 *Yala* and at different research stations representing the three major climatic zones. Ld 8-15-30 was tested at different farmer fields during 2013 *Yala* and 2013/14 *Maha* along with the Bg 250 in Variety Adaptability Trials (VAT) for testing of adaptability under farmer manage conditions. Large Scale Variety Adaptability (LSVAT) was conducted for Ld 8-15-30 at farmer fields during 2014/15 *Maha* and 2015 *Yala* to have further conformation on the response of farmers regarding the new variety.

Nitrogen response was evaluated with four different Nitrogen levels (0, 20, 40, 60 N kg/ha) using two varieties Ld 8-15-30 and Bg 250, during 2014 *Yala* and 2015/16 *Maha* at RRS, Labuduwa.

### **Grain quality assessment and pest and disease screening**

Grain quality and pest and disease reaction assessments were done at the Rice Research and Development Institute (RRDI) at Bathalagoda along with the NCRVT with the standard procedures of rice grain quality assessments and pest and diseases screening by Grain Quality, Entomology and Pathology divisions, respectively.

Visual assessments were conducted using samples of two rice varieties Ld 8-15-30 and Bg 250 with the participation of panel of evaluators at RRS Labuduwa, for the colour, shape, size and appearance, of paddy, milled rice and parboiled rice. Cooked rice was evaluated for colour, appearance, aroma and taste. Ranks (1= very good, 2= good, 3= moderate and 4 = not acceptable) were given to the each assessed character by the individual evaluator.

Iron, Zinc, content of seed samples of Ld 8-15-30 and the other recommended varieties (Ld 371, Ld 368, Ld 365 and Ld 408) grown at RRS Labuduwa were analyzed using wet digestion method (Jackson, 1958) and protein content was analyzed using Kjeldahl digestion method at Regional Rice Research Centre at Bombuwela.

### **Data analysis**

Analysis of variance was carried out for yield trials evaluations using SAS. Adaptability of the varieties were analyzed using variance component method (Abeyesiriwardena *et al.*, 1991) and ranking method (Das, 1982). Visual assessment data of tasting panel presented as percentage analysis using Excel.

## RESULTS AND DISCUSSION

Performances at the research station yield trials are presented in the Table 1. Short duration varieties are very important for the intermittent short cropping seasons occurred due to the adverse change of the weather. Ld 8-15-30 is a short duration white long rice variety which flowered within 55-56 days and matured with 83-85 days and the duration of crop is quite comparable with the short duration variety Bg 250 (Table1). Overall varietal performances which included the Ld 8-15-30 of short duration at Research Station yield trials were found in ASDA 2013 by Rasanthi *et al.*,

**Table 1. Performance of short duration rice varieties at yield trials at RRS Labuduwa during 2010 Yala and 2010/11 Maha**

Note: Values followed by the same letter within a column are not significantly different at

Variety	Days to 50% flowering	Days to maturity	Grain yield (t/ha)
2010 Yala			
Ld 8-15-6	48	76	3.19 ab
Ld 8-15-15	47	75	3.6 a
Ld 8-15-30	55	83	2.68 bc
Bg 250	53	80	2.8 abc
2010/11 Maha			
Ld 8-15-6	51	79	1.81 a
Ld 8-15-15	50	78	1.5 ab
Ld 8-15-30	56	83	1.79 a
Bg 250	54	82	1.35 b

p=0.05 level. Source: Rasanthi *et al.* (2013)

Varietal performances during NCVT are stated in Table 2. All the tested varieties for 2.5 months category ranged from 75 days to 83 days for the maturity. According to Annual Report of DOA, 2012; Rice Research and Development Institute, Batholagoda, has given special attention on the

changes of annual rainfall pattern and the occurrence of frequent dry spells. As a result of changes of rain fall pattern, number of crop failures experienced. The ultra-short age varieties which mature around 80 days are becoming very important as these varieties can fit in to the rainfed ecosystems well, especially in season where 3 months varieties difficult to be grown due to water shortage (Annual Report of DOA 2012). In the scene Bg 10-9028 (ZX788 (CNI 28)) an introduction from China released as Bg 251 GSR for the requirement of short age varieties for the country (Bentota, 2014). Yet the varietal pool of the ultra short duration varieties should be expanded to ensure the seed requirement in an adverse condition of drought or flood to avoid drastic shortages of rice in the country.

**Table 2. Maturity durations grain yield and adaptability ranks of NCRVT tested rice varieties during 2011 *Yala* and 2011/12 *Maha*.**

Season	Variety	Maturity duration (d)		Grain yield (t/ha)		Adaptability ranks			
		DZ	WZ	DZ & IZ	WZ	Ranking Method		Variance Component method	
						DZ	WZ	DZ	WZ
2011 <i>Yala</i>	Ld 8-15-30	87	81	3.67	3.77	4	4	3	4
	Bg 10-2907	84	83	3.33	3.65	6	4	6	4
	Bg 10-9028	82	82	3.19	3.39	8	8	8	8
	Bg 10-9024	87	84	3.21	3.51	7	4	6	4
	Bg 250	84	83	3.79	4.26	2	1	1	1
	Bg 300	91	89	3.8	4.01	3	2	3	2
2011/12 <i>Maha</i>	Ld 8-15-30	85	86	5.10	3.67	3	2	3	1
	Bg 10-2907	87	85	4.66	2.83	8	7	7	7
	Bg 10-9028	83	85	4.48	3.58	7	2	7	1
	Bg 10-9024	89	88	5.08	3.3	5	6	5	6
	Bg 250	84	85	5.12	3.85	2	1	1	1
2012 <i>Yala</i>	Bg 300	93	90	5.27	3.45	1	2	1	4
	Ld 8-15-30	84	90	4.73	4.4	3	2	3	-
	Bg 10-2907	83	90	4.57	4.19	6	1	5	-

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Season	Variety	Maturity duration (d)		Grain yield (t/ha)		Adaptability ranks			
		DZ	WZ	DZ & IZ	WZ	Ranking Method		Variance Component method	
						DZ	WZ	DZ	WZ
	Bg 10-9028	82	83	4.5	4.55	4	2	5	-
	Bg 10-9024	87	90	4.91	4.3	2	2	4	-
	Bg 250	84	83	4.67	4.43	8	2	4	-
	Bg 300	94	91	5.56	4.09	1	2	1	-
2013	Ld 8-15-30	85	83	3.6	3.75	6	4	6	4
<i>Yala</i>	Bg 10-2907	88	85	3.98	4.27	2	1	2	1
	Bg 10-9028	88	86	3.64	3.41	5	6	4	6
	Bg 10-9024	84	84	3.4	3.57	7	5	7	4
	Bg 250	91	86	3.6	3.71	3	3	4	3
	Bg 300	86	83	3.85	3.81	4	2	3	2

Notes: \*DZ=Dry zone, WZ= Wet Zone , IZ= Intermediate Zone \*\* Lower the rank higher the adaptability; Sources: RRD (2012a); RRD (2012b); RRD (2013); RRD (2014a).

During 2011/12 *Maha*, 2012 *Yala* and 2013 *Yala* NCRT trials Ld 8-15-30 recorded equal or better performances compared to the standard check variety Bg 250. When consider the adaptability ranks compared to other varieties Ld 8-15-30 has shown better adaptability ranks in the wet zone. Ld 8-15-6 and Ld 8-15-15 red pericap varieties with better yield performances were not promoted for VAT due to lodging severity. Ld 8-15-30 performed well in the farmer fields of wet zone and dry and Intermediate zones which receiving adaptability rank 01 during 2013/14 *Maha* for wet zone and rank 01 during 2013 *Yala* and rank 02 during 2013/14 *Maha* showed superiority over Bg 250 (Table 3).

Highest yields of each VAT tested variety mentioned in Table 3. Ld 8-15-30 recorded the highest yield for both Dry zone and for Wet zone. Ld 8-

15-30 recorded highest yield (10.11 t/ha) out of tested varieties, during 2013/14 *Maha* VAT evaluations at Murumkan of Dry and 4.73 t/ha at Ukuwela belongs to Wet zone. In large scale VAT the candidate variety performed even or better with the Bg 250 and farmer grown variety. There was no significant difference ( $\alpha > 0.05$ ) between Ld 8-15-30 and Bg 250 varieties for seed yield when tested at different Nitrogen levels (Table 5).

**Table 3. Varietal performances in varietal adaptability test at the farmer fields during 2013 *Yala* and 2013/14 *Maha*.**

Season	Variety	Agro-ecological zone					
		Dry & Intermediate zones			Wet zone		
		Average Yield t/ha	Potential yield t/ha	Adaptability Rank	Yield t/ha	Potential Yield t/ha	Adaptability Rank
2013	Bg 10-2907	4.48	7.6 (A)	1	-	-	-
<i>Yala</i>	Ld 8-15-30	4.78	7.65 (A)	1	-	-	-
	Bg 9024	4.46	9.65(W)	1	-	-	-
	Bg250	3.71	7.2(A)	4	-	-	-
2013/14	Bg 10-2907	4.95	9.95 (M)	2	3.21	4.35 (U)	2
<i>Maha</i>	Ld 8-15-30	5.07	10.11(M)	2	3.53	4.73(U)	1
	Bg 9024	5.79	9.22(M)	1	2.99	3.75 (H)	4
	Bg250	4.56	7.2(M)	2	3.16	3.38(G)	3

Notes: AT= Ambalantota, W=Wanathawillua M= Murumkan U= Ukuwela H = Homagama G= Galahitiyawa; Sources: RRD1 2014a RRD1 2014b.

### Assessment of grain quality and pest and disease response

Reaction to pest and diseases and assessment of grain quality results are shown in Table 4. Ld 8-15-30 variety is moderately resistant to Rice Gall Midge, Brown Plant Hopper and Blast disease. The variety exhibited moderate susceptibility for bacterial leaf blight. Bg 250 similar in reactions to pest and



diseases with Ld 8-15-30. Apart from that, discoloration of seeds of Ld 8-15-30 was less compared to the other tested lines in NCRVT in the Wet zone.

Ld 8-15-30 is a quality rice variety with good appearance in raw rice and cooked rice. Preference for paddy, raw rice and cooked rice of Ld 8-15-30 and Bg 250 presented in Table 06. According to laboratory grain quality assessments the Ld 8-15-30 is categorized as long medium to long slender grain type. Ld 8-15-30 possesses intermediate level Amylose content and intermediate gelatinization temperature. Due to these characteristic the cooked rice was soft in nature and the palatability is very good. The raw rice sample was 100 percent accepted as good quality rice by the evaluators of the tasting panel. Due to long slender nature and higher length wise elongation of cooked rice, appearance was attractive for the consumers. In the tasting panel assessments cooked rice sample ranked as good in percentage of 100%, 92%, 92% and 83% preference for appearance, colour, aroma and the taste respectively. Overall acceptance of cooked rice samples of Ld 8-15-30, as good one was 92% and with regard to Bg 250, overall acceptance as good was 58%. Ld 8-15-30 was superior in grain quality than Bg 250 and Ld 8-15-30 will be more demanded by the consumers with respect to the quality of rice, leading to higher price benefiting the farmer.

With respect to nutrient analysis Ld 8-15-30 contained comparable iron, zinc and proteins with respect to recommended rice varieties grown at RRS, Labuduwa Table 7. Since the variety is 2½ months, comparable nutrient content with 3½ months varieties is a good sign for the nutritional quality of the variety.

**Table 4. Reaction to pest and diseases and grain quality assessment of 21/2 months rice varieties during 2011 *Yala*, 2011/12 *Maha*, 2012 *Yala* and 2013 *Yala* at RRDl Bathalagoda.**

Season	Variety	Reaction to pest and diseases				Grain Quality								
		RGM	BPH	BLB	BL	BR%	TMR %	HG % (raw)	HG % (par)	S/S	GT	AC	WB/WC	TL
2011 <i>Yala</i>	Bg 10-2907	MR	MR	MR/MS	MR	78.3	72.0	71.1	71.3	S/R	H	I-H	WC-2	I
	Ld 8-15-30	MR	MR	MR/MS	MR/MS	78.8	72.4	69.2	71.7	L/M	I	I	WB-2	I
	Bg 10-9024	MR	MR	MR/MS	R/MR	80.0	72.1	66.3	72.2	L/S	L	L	WB-2	I
	Bg 10-9028	-	-	-	-	78.8	73.4	67.1	69.8	L/M	I	H	WB-2/3	I
	Bg 250	MR	MR	MS/S	R/MR	80.5	74.4	69.3	71.3	L/M	I	H	WB-3	I
2011/12 <i>Maha</i>	Bg 10-2907	MR	MR	MR/MS	R	78.2	72.2	71.1	70.7	S/R	I/H	I	WC-2	I
	Ld 8-15-30	MR	MR	S	MR	79.5	73.6	71.1	73.7	L/M	I	I	WB-2	I
	Bg 10-9024	MR	MR	MS	R	80.9	73.2	66.5	73.8	L/S	L	L	WB-1/2	I
	Bg 10-9028	R/MR	MR	S	R/MR	79.0	73.5	68.2	74.0	L/M	I	H	WB-2/3	I
	Bg 250	R/MR	MR	S	R/MR	81.1	74.9	69.7	75	L/M	I	H	WB-3	I
2012 <i>Yala</i>	Bg 10-2907	R/MR	MR	S	MR	77.5	71.4	70.7	72.6	S/R	I/H	I	WC-2	I
	Ld 8-15-30	R/MR	R/MR	S	MR	78.7	72.8	66.9	73.7	L/M	I	I	WB-2	I
	Bg10- 9024	R/MR	R/MR	MR/MS	R	79.8	71.8	60.8	74	L/S	L	L	WB-1/2	I
	Bg 10-9028	R/MR	MR/MS	MS	R/MR	78.1	72.3	58.3	73.6	L/M	I	H	WB-2/3	I
	Bg 250	R/MR	MR/MS	S	R/MR	80.2	74.3	65.6	74.9	L/M	I	H	WB-3	I

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Season	Variety	Reaction to pest and diseases				Grain Quality								
		RGM	BPH	BLB	BL	BR%	TMR %	HG % (raw)	HG % (par)	S/S	GT	AC	WB/WC	TL
2013	Bg 10-2907	MR/MS	MR	MS/S	R	77.8	72	71.1	71.7	S/R	I	I	WC-2	I
	<i>Yala</i>													
	Ld 8-15-30	R/MR	R/MR	MS	MR/MS	78.6	73.6	66	73.7	L/S	I	H	WB-2	I
	Bg10- 9024	MS	R/MR	MS	R	79.1	72.8	60.2	74.8	L/S	L	L	WB1/2	I
	Bg 10-9028	MS	MR	MS/S	R	77.9	73.6	68.5	74.6	L/M	I	H	WB-2/3	I
	Bg 250	R/MR	MR/MR	S	R	80.2	75	70.5	75.3	L/M	I	H	WB-3	I

Notes: RGM=Rice Gall Midge BPH = Brown Plant Hopper BLB= Bacterial leaf Blight, BL= Blast, R= resistant, MR= Moderately resistant, MS = Moderately Susceptible, S= Susceptible, BR= Brown Rice, TMR= Total Milled Rice, HG= Head Grain, S/S= Size/shape, GT= Gelatinization temperature(L=55-69<sup>0</sup> c, I=70-74<sup>0</sup> c and H=> 75<sup>0</sup> c) AC= Amylose content (L=8-20%, I =21-25%, and H= > 25%) TL= translucency WB/WC =white center or white belly , S/R= Short round, I/B intermediate bold, L/M= Long medium, L/S = Long slender

Sources : RRD1 2012a, RRD1 2012b,RRDI 2013, RRD1 2014

**Table 5. Response of Ld 8-15-30 to added Nitrogen compared to standard variety Bg 250 at RRS Labuduwa.**

Nitrogen Level Kg/ha	Grain Yield (t/ha)			
	2014 <i>Yala</i>		2015/16 <i>Maha</i>	
	Ld 8-15-30	Bg 250	Ld 8-15-30	Bg 250
0	3.125	3.17	3.6	4.03
20	2.34	3.16	4.33	4.5
40	3.665	2.764	4.75	4.25
60	2.54	2.90	4.93	4.33
LSD	1.32		1.132	
CV	21		17.3	

**Table 6. Preference of paddy, milled rice and cooked rice samples of Ld 8-15-30 and Bg 250 by the evaluating panel.**

Variety		Colour	Shape	Size	Appearance	Overall rank
<b>Paddy</b>						
Par boiled Ld 8-15-30	V. Good / good	66.6	75	66.6	50	75
	Moderate	33.4	25	33.4	50	25
Bg 250	V. Good / good	41.6	58.4	50	33	50
	Moderate	41.6	41.6	50	58	50
Ld 8-15-30	V. Good / good	100	91.6	91.6	100	100
	Moderate	0	8.4	8.4	0	0
<b>Milled rice</b>						
Par boiled Ld 8-15-30	V. Good / good	16.7	50	66.6	42	33.4
	Moderate	50	50	33.4	50	66.6
Bg 250	V. Good / good	66.6	50	66.4	41.7	33.4
	Moderate	33.4	40	33.4	50	66.6
Ld 8-15-30	V. Good / good	100	100	100	100	100
	Moderate	0	0	0	0	0

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<b>Cooked rice</b>		<b>Appearance</b>	<b>Colour</b>	<b>Aroma</b>	<b>Taste</b>	<b>Overall rank</b>
Par boiled Ld 8-15-30	V. Good / good	25	16.7	41.7	66.6	58.3
	Moderate	41.7	66.7	41.7	16.7	25
Bg 250	V. Good / good	50	66.7	41.7	58.3	58.4
	Moderate	41.6	25	50	41.7	41.7
Ld 8-15-30	V. Good / good	100	91.6	91.6	83.4	91.7
	Moderate	0	8.4	16.7	16.6	8.3

**Table 7. Iron, Zinc and protein content of grains of L 8-15-30 and the other recommended varieties grown at RRS, Labuduwa.**

<b>Variety</b>	<b>Iron ppm</b>	<b>Zinc ppm</b>	<b>Protein %</b>
Ld 368	45.2	26.8	6.78
Ld 365	64.1	25.3	6.48
Ld 371	26.3	25.75	6.96
Ld 408	37.8	23.4	6.17
Ld 8-15-30	38.75	26.1	6.02

## CONCLUSION

The line Ld 8-15-30 was released as Ld 253 by the Department of Agriculture in 2016 by the Varietal Releasing Committee of the DoA as a better quality, short duration (85 days), white-long grain rice variety suitable for general cultivation. The variety would perform well in the Dry zone and Wet zone conditions and would be one of the alternatives to escape droughts by adopting short cropping cycles with appropriate varieties and especially, after a flood disaster that has become a frequent climatic feature in the Wet zone in a changing and variable climate.

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