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Evaluation of traditional rice cultivars of Sri Lanka for some yield components and grain yield in *Yala* and *Maha* seasons

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ABSTRACT

One hundred Sri Lankan traditional rice cultivars were evaluated in two consecutive seasons of 2011/2012 'Maha' and 2012 'Yala' seasons for yield and yield components. Analysis of data through ANOVA and mean separation using SAS statistical software reveals that in 'Maha' season, 73 cultivars recorded higher plant height, eight cultivars showed more, number of tillers plant^{-1}, 43 cultivars had more number of fertile tillersplant^{-1} fertility percentage was more in twenty nine cultivars and yield per plant^{-1} was high for thirty five cultivars. Number of productive tillers per plant and fertility percentage remained unchanged for 36 and 60 cultivars respectively in two seasons. Forty four cultivars showed higher yield per plant^{-1} in Yala season than at Maha season while thirty two cultivars remained more or less same in their regards. According to DMRT groupings, all the parameters of cultivar Hondarawala, Karayal I, Dewaredderi, Kotathavalu II, Kokuvellai, Karayal III, Karabewa, Muthumanikam, Induru Karayal, Dik wee 328, Maha Murunga Badulla, Kaharamana and Jamis wee I changed significantly at two seasons. Among them cultivar Hondarawala, Kotathavalu II, Kokuvellai, Karayal III, Karabewa, Muthumanikam, Dik wee 328 and Jamis wee I increased all the parameters in 'Maha' season compared to those of in 'Yala' season. Interestingly, the days to maturity of these cultivars were around four months. The best rice cultivars can be selected based on the performances of them in 'Yala' and 'Maha' seasons.

Keywords: Maha,traditional rice cultivars, yala, yield, yield components

Asia is the leader in rice production which accounts for about 90% of the world's total production. In Sri Lanka, 1.5 million families engage in rice cultivation, which means 6.75 million people directly or indirectly depend on rice cultivation (Jayawardana, 2000). The country's total rice production and average yield of *Maha* is higher than *Yala* (De Silva and Yamao, 2009). On average 646,000 hectares are cultivated during *Maha* season and 419,000 hectares during *Yala* season making the average annual extent sown with rice to about 106,500 hectares (Anon., 2010). During 2009/2010 *Maha* season, Sri Lanka produced about 2,629,566 metric tons of paddy and during 2010 *Yala* season it produced 1,671,054 metric tons making national average yield of 4,189,059 metric tons for the year 2010 (Department of Census and Statistics, 2010).

Yala and *Maha* are the main rice growing seasons of Sri Lanka and total rice production and average yield of *Maha* is higher than that of at *Yala* season (De Silva and Yamao, 2009). The principal cultivation season in Sri Lanka is known as *Maha* (wet season) and is from October to March and the subsidiary cultivation season, known as *Yala* (dry season) is from April to September (Zubair, 2002). In Mapalana, where the experiment was carried out, there were only two wet months in *Yala* (May and June) while *Maha* season has three consecutive wet months during September to November (Weerasinghe, 1989). Solar radiation is not a limiting factor for rice growth in almost all rice growing regions of Sri Lanka. However, when all other conditions such as water, nutrients and temperature are non-limiting, the intensity of sunlight may determine the yield level depending on the location and season. In the Wet zone, where experiment was carried out solar radiation may limit the rice yield during *Yala* season due to high cloud cover arising from the southwest monsoonal circulation whereas a similar situation could expect in the Dry zone during *Maha* season due to overcast conditions that may result due to weather systems formed in the Bay of Bengal and northeast monsoonal circulation. Generally, in Sri Lanka *Yala* is referred as dry season while *Maha* is referred as wet season (Weerasinghe, 1989) Further it has been reported that plant height and crop duration of rice are higher in dry seasons than that of in wet seasons (Hach and Nam, 2006).These differences may affect on the yield and yield components in rice since grain yield is a complex polygenic quantitative trait, greatly affected by environment. Hence, selection of best quality genotypes based on the yield solely is not effective in the countries where different cropping seasons are available (Salam *et al.*, 2009, Kumbhar *et al.*, 2013).

The main effect for genotypes reflects breeding advances and the main effect for environments characterizes the site (Zobel *et al.*, 1988). Plant height has been the main target for improvement of lodging resistance in rice. Rice cultivars with "New Plant Type" were developed with plant height about 100 cm

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(Kumar *et al.,* 1999). Different morphological traits play very important role for more rice production with new plant type characteristics associated with the plant yield (Yang *et al.,* 2007; Yang & Hwa, 2008). However plant height greatly varied with the environmental factors.

Yield with yield components should be considered to determine the selection criteria of germplasm on the basis of available genetic variation (Habib *et al.,* 2005). Among yield components, productive tillers are very important because the final yield is mainly a function of the number of panicle bearing tillers per unit area (Baloch *et al.,* 2006). Kovi *et al.* (2011) also found that temperature across the three seasons played a vital role in determining the plant height, panicle length and spikelets per panicle in rice.

The present study aims to understand the behaviour of traditional rice cultivars during *Yala* and *Maha* seasons where the climatic factors change with the season while the soil factors remained constant at the field conditions. There is no information available on the changes of agronomic characteristics in traditional rice cultivars of Sri Lanka in *Yala* and *Maha* seasons.

MATERIALS AND METHODS

One hundred traditional rice cultivars (Table 1) collected from PGRC Gannoruwa, Sri Lanka were used in the experiment during 2011/2012 *Maha* season and repeated in 2012 *Yala* season at the Faculty of Agriculture, Mapalana, Sri Lanka. Two week old seedlings were transplanted in the paddy field according to the randomized complete block design with four replications and 20 plants per plot at 15x20 cm spacing. Weed management and pest management was done properly. The field was covered by the birds' nest to prevent bird attack on panicles. The recommended fertilizer dosage for improved rice cultivars has been introduced by Faculty of Agriculture, University of Ruhuna, Sri Lanka was applied for the field: Basal dressing: Urea 50 Kg/ha, TSP 62.5 Kg/ha, MOP 50 Kg/ha and top dressing: Urea 37.5 Kg/ha – 2 weeks after planting and 8 weeks after planting. Forty plants were selected for the data recording. Data on plant height (cm), number of tillers per plant, number of productive tillers per plant, percent grain fertility and yield/plant (g) were collected at maturity. According to plant height in *Maha* season rice cultivars can be grouped as Table1 and according to days to maturity these cultivars can be grouped according to table 2.Data were analyzed using ANOVA and mean comparison was done by DMRT using SAS (SAS Institute Inc., 2000).

RESULTS AND DISCUSSIONS

All the parameters of cultivar *Hondarawala, Karayal I, Dewaredderi, Kotathavalu II, Kokuvellai, Karayal III, Karabewa, Muthumanikam, Induru Karayal, Dik wee 328, Maha Murunga Badulla, Kaharamana* and *Jamis wee I* changed significantly in *Yala* and *Maha* seasons. Among them cultivar *Hondarawala, Kotathavalu II, Kokuvellai, Karayal III, Karabewa, Muthumanikam, Dik wee 328* and *Jamis wee I* increased all the parameters at *Maha* season than that of at *Yala* season. The age of these cultivars were around four months (Table 2). Cultivar *Podi sudu wee* didn't significantly change in any parameter at *Yala* and *Maha* seasons (Table 3).

Among the evaluated cultivars, according to DMRT groupings, 73 cultivars increased plant height significantly in *Maha* season while 10 cultivars remained constant in both *Yala* and *Maha* seasons. The remaining 17 rice cultivars increased the plant height in *Yala* season. Rice plant height is a quantitative trait governed by genetic factors and environmental factors (Huang *et al.,* 1996; Atchley and Zhu, 1997; Fang and Wu, 2001). Further it has been reported that plant height is negatively correlated with the yield in rice (Senapathy *et al.* 2009). The plant height of 90 tested rice cultivars changed with the season in the present experiment (Table 2).

Among yield components, productive tillers are very important because the final yield is mainly a function of the number of panicles bearing tillers per unit area (Baloch *et al.,* 2006).

In the tested one hundred rice cultivars twenty nine cultivars recorded significantly higher number of fertile tillers. plant^{-1} in *Maha* season than in *Yala* season. However 35 cultivars increased number of fertile tillers in *Yala* season compared to the value in *Maha* season. When consider the number of total tillers. plant^{-1}, 38 cultivars recorded significantly higher number of total tillers in *Maha* season than that of in *Yala* season and 34 cultivars didn't significantly change the number of tillers in *Yala* and *Maha* seasons.

According to the Yang *et al*. (2008) rice grain yield highly varies on cropping season under the tropical irrigated conditions. Among tested cultivars in the present study forty four traditional rice cultivars recorded more yield plant^{-1} in *Maha* season while 31 cultivars showed more or less similar yield plant^{-1} in *Yala* and *Maha* seasons (Table 3). Percent fertility of 60 cultivars didn't show significant seasonal changes while 5 cultivars increased percent fertility significantly at *Yala* season compared to *Maha* season.

Forty four cultivars increased their yield/plant in *Maha* season while 31 cultivars didn't show significant

Table 1: Grouping of traditional rice cultivars according to IRRI standard evaluation system for plant height (IRRI 2002).

Tall cultivars	(more than 130 cm)	Intermediate cultivars	(110 cm-130 cm)	Semi-dwarf cultivars	(less than 110 cm)
Sudu wee Ratnapura	130.15	*Bala Ma wee II*	110.73	*Palasithari 601*	79.40
Chinnapodiyan	130.73	*Murungakayan 3*	111.03	*Polayal I*	86.45
Mudukiriel	130.98	*Rata wee*	112.88	*Akuramboda*	90.93
EAT Samba	131.00	*Madoluwa*	113.00	*Sinnanayan 398*	91.35
Suduru Samba III	131.48	*Lumbini I*	114.75	*Polayal II*	92.10
Kotathavalu I	131.55	*Kirikara*	115.75	*BG 34-8*	95.00
Dena wee	131.88	*Kaharamana I*	116.13	*Puwakmalata Samba*	97.45
Jamis wee II	132.28	*Murungakayan 101*	116.63	*Kottakaram*	101.28
Kiri Murunga wee	132.65	*Naudu wee*	117.20	*Podisayam*	101.88
Geeraga Samba	132.80	*Gangala*	119.00	*Kaharamana II*	103.95
Seevalee Ratnapura	133.08	*Periamorungan*	120.23	*Murunga wee*	104.75
Ingrisi wee	133.18	*Halabewa*	123.13	*Suduru Samba I*	105.03
Madael	134.43	*Sudu Karayal*	123.15	*BG 35-7*	105.78
Heendik wee	134.78	*Kotathavalu II*	123.38	*BG 35-2*	105.88
Buruma Thavalu	134.93	*Herath Banda*	123.58	*Matara wee*	106.10
Dik wee 328	134.95	*Maha Murunga Badulla*	123.68	*Wanni Heenati*	106.43
Madabaru	135.40	*Ranruwan*	123.83	*MI 329*	107.70
Kokuvellai	135.78	*Rajes*	123.83	*Yakada wee I*	107.95
Kalu gires	135.95	*Madael Kalutara*	124.40		
H 10	135.95	*Kaluhandiran*	124.63		
Pokuru Samba	136.08	*Heenpodi wee*	124.85		
Miti Riyan	136.10	*Suduru*	125.03		
Lumbini II	136.35	*Karayal III*	125.13		
Thunmar Hamara	136.35	*Kiri Naran*	125.90		
Tissa wee	136.88	*Giress*	127.33		
Kalukanda	137.13	*Bala Ma wee I*	129.00		
Karayal II	137.63	*Madael Galle*	129.23		
Kahata Samba	137.83	*Suwanda Samba*	129.48		
Handiran	138.43				
Gunaratna	138.43				
Sudu wee	138.83				
Suduru Samba II	140.70				
Kalu Karayal	141.20				
Induru Karayal	141.78				
A 6-10-37	142.83				
Sirappu Paleusithri	142.90				
Muthu Samba	143.48				
Muthumanikam	143.78				
Karayal I	144.58				
Podi sudu wee	147.03				
Seeraga Samba Batticaloa	150.10				
Heendikki	150.38				
Dewaredderi	150.50				
Yakada wee II	150.78				
Sinnanayam	150.93				
Sudu Goda wee	151.50				
Dingiri Menika	152.38				
Jamis wee I	152.58				
Balakara	152.60				
Dandumara	153.69				
Bathkiri el	155.30				
Karabewa	162.73				
Manchel Perunel	166.88				
Hondarawala	178.14				

Table 2: Days to maturity of rice cultivars

Acc.	Name	Maturity		Acc.	Name	Maturity	
3673	*Kaluhandiran*	126	Late	3645	*Muthumanikam*	128	Late
3674	*Kirikara*	119	Medium	3646	*Induru Karayal*	118	Medium
3675	*Kotathavalu I*	118	Medium	3647	*Kalu gires*	127	Late
3676	*Dena wee*	117	Medium	3650	*Madabaru*	123	Late
3677	*Herath Banda*	117	Medium	3651	*Balakara*	119	Medium
3678	*Hondarawala*	125	Late	3652	*Buruma Thavalu*	124	Late
3679	*Kottakaram*	126	Late	3517	*Seeraga Samba Batticaloa*	124	Late
3681	*Dandumara*	127	Late	3518	*H 10*	109	Medium
3686	*Karayal I*	124	Late	3519	*Manchel Perunel*	108	Medium
3687	*Deweredderi*	125	Late	3562	*Thunmar Hamara*	110	Medium
3469	*Sudu wee*	121	Late	3567	*Dingiri Menika*	119	Medium
3477	*Sudu Goda wee*	110	Medium	3570	*Madael*	120	Medium
3479	*Kiri Naran*	134	Late	3571	*Miti Riyan*	122	Late
3480	*Karayal II*	122	Late	3572	*Suduru Samba II*	123	Late
3482	*Akuramboda*	128	Late	3589	*Gangala*	136	Very late
3486	*Puwakmalata Samba*	163	Very late	3588	*Heenpodi wee*	122	Late
3487	*Palasithari 601*	123	Late	3497	*Sinnanayan 398*	124	Late
3489	*Murungakayan 3*	125	Late	3498	*Geeraga Samba*	120	Medium
3490	*Murungakayan 101*	128	Late	3504	*Dik wee 328*	124	Medium
3496	*Bala Ma wee I*	122	Late	3506	*MI 329*	111	Medium
3654	*Pokuru Samba*	125	Late	3507	*Suwanda Samba*	121	Medium
3655	*Rata wee*	118	Medium	3508	*Madael Galle*	123	Medium
3660	*Suduru*	119	Medium	3510	*Sudu wee Ratnapura*	122	Medium
3658	*Ingrisi wee*	124	Late	3511	*Maha Murunga Badulla*	123	Medium
3659	*Kotathavalu II*	119	Medium	3514	*Madael Kalutara*	123	Medium
3653	*Kalu Karayal*	125	Late	3516	*Seevalee Ratnapura*	143	Late
3668	*Ranruwan*	113	Medium	3383	*EAT Samba*	135	Late
3669	*Rajes*	119	Medium	3389	*Sirappu Paleusithri*	124	Medium
3670	*Madoluwa*	127	Late	3394	*Muthu Samba*	129	Medium
3671	*Suduru Samba I*	125	Late	3395	*Podi sudu wee*	114	Medium
3688	*Handiran*	118	Medium	3401	*Wanni Heenati*	120	Medium
3691	*Gunaratna*	155	Very late	3409	*BG 35-2*	117	Medium
3661	*Polayal I*	124	Late	3410	*BG 35-7*	127	Medium
3664	*Tissa wee*	124	Late	3415	*BG 34-8*	116	Medium
3665	*Sudu Karayal*	124	Late	3416	*A 6-10-37*	111	Medium
3666	*Podisayam*	125	Late	3417	*Periamorungan*	127	Late
3423	*Giress*	122	Late	3591	*Mudukiriel*	124	Late
3427	*Naudu wee*	127	Late	3594	*Suduru Samba III*	124	Late
3434	*Kokuvellai*	125	Late	3595	*Kaharamana II*	124	Late
3463	*Karayal III*	115	Medium	3598	*Bala Ma wee II*	124	Late
3438	*Murunga wee*	117	Medium	3606	*Chinnapodiyan*	124	Late
3435	*Matara wee*	124	Late	3607	*Kiri Murunga wee*	125	Late
3440	*Kaharamana I*	127	Late	3610	*Heendikki*	131	Late
3447	*Karabewa*	123	Late	3612	*Jamis wee I*	128	Late
3451	*Halabewa*	123	Late	3613	*Lumbini II*	120	Medium
3445	*Yakada wee I*	119	Medium	3614	*Sinnanayam*	120	Medium
3638	*Lumbini I*	118	Medium	3615	*Yakada wee II*	124	Late
3639	*Polayal II*	111	Medium	3616	*Jamis wee II*	120	Medium
3641	*Heendik wee*	128	Late	3550	*Bathkiri el*	130	Late
3642	*Kahata Samba*	118	Medium	3713	*Kalukanda*	129	Late

<90-Very early, <105-Early, <120-Medium, <135-Late, <150-Very late

Table 3: Grouping of traditional rice cultivars on the basis of grain yield in *Yala* and *Maha* seasons

Increased yield in *Maha* season			Yield remained constant in *Maha* and *Yala* seasons			Increased yield in *Yala* season		
	Yala	***Maha***		**Yala**	***Maha***		**Yala**	***Maha***
Kotathavalu I	8.95^{b}	15.46^{a}	*Dena wee*	8.18^{a}	7.56^{a}	*Kaluhandiran*	7.59^{a}	5.32^{b}
Hondarawala	6.95^{b}	34.58^{a}	*Herath Banda*	9.87^{a}	7.91^{a}	*Kirikara*	11.54^{a}	7.43^{b}
Dandumara	11.00^{b}	19.30^{a}	*Kottakaram*	10.55^{a}	9.45^{a}	*Karayal I*	11.84^{a}	9.47^{b}
Dewaredderi	14.28^{b}	19.39^{a}	*Sudu wee*	8.52^{a}	7.72^{a}	*Sudu Goda wee*	10.47^{a}	16.26^{b}
Kiri Naran	9.82^{b}	13.40^{a}	*Karayal II*	12.93^{a}	14.65^{a}	*Puwakmalata Samba*	7.38^{a}	5.01^{b}
Akuramboda	10.47^{b}	19.72^{a}	*Palasithari 601*	12.19^{a}	12.47^{a}	*Murungakayan 3*	11.14^{a}	8.83^{b}
Bala Ma wee I	13.72^{b}	16.50^{a}	*Suduru*	4.69^{a}	6.12^{a}	*Murungakayan 101*	12.46^{a}	8.19^{b}
Pokuru Samba	8.61^{b}	17.25^{a}	*Ingrisi wee*	10.99^{a}	11.12^{a}	*Suduru Samba I*	10.38^{a}	4.94^{b}
Rata wee	11.70^{b}	16.96^{a}	*Kalu Karayal*	16.27^{a}	16.84^{a}	*Yakada wee I*	10.32^{a}	6.10^{b}
Kotathavalu II	12.98^{b}	20.91^{a}	*Ranruwan*	7.02^{a}	7.20^{a}	*Gunaratna*	22.43^{a}	11.26^{b}
Madoluwa	9.08^{b}	16.19^{a}	*Rajes*	12.50^{a}	13.94^{a}	*Polayal II*	6.33^{a}	3.47^{b}
Tissa wee	6.63^{b}	13.38^{a}	*Handiran*	9.90^{a}	10.39^{a}	*Buruma Thavalu*	25.81^{a}	11.14^{b}
Sudu Karayal	9.34^{b}	13.22^{a}	*Polayal I*	6.24^{a}	4.92^{a}	*Seeraga Samba Batticaloa*	15.59^{a}	9.15^{b}
Giress	8.07^{b}	10.66^{a}	*Podisayam*	6.23^{a}	8.15^{a}	*Gangala*	23.10^{a}	12.72^{b}
Naudu wee	8.43^{b}	11.67^{a}	*Murunga wee*	10.27^{a}	8.69^{a}	*Sinnanayan 398*	9.37^{a}	5.74^{b}
Kokuvellai	8.92^{b}	20.34^{a}	*Matara wee*	14.90^{a}	16.61^{a}	*Sudu wee Ratnapura*	18.02^{a}	12.13^{b}
Karayal III	7.49^{b}	64.97^{a}	*Halabewa*	8.37^{a}	8.60^{a}	*Maha Murunga Badulla*	19.64^{a}	5.34^{b}
Kaharamana I	9.28^{b}	11.46^{a}	*Kalu gires*	9.89^{a}	8.56^{a}	*Seevalee Ratnapura*	14.43^{a}	10.79^{b}
Karabewa	4.52^{b}	13.44^{a}	*Balakara*	8.89^{a}	8.02^{a}	*EAT Samba*	19.80^{a}	15.85^{b}
Lumbini I	7.19^{b}	13.00^{a}	*H 10*	13.19^{a}	11.39^{a}	*BG 35-2*	10.50^{a}	7.73^{b}
Heendik wee	17.08^{b}	20.68^{a}	*Manchel Perunel*	12.48^{a}	13.70^{a}	*Bala Ma wee II*	18.47^{a}	15.76^{b}
Kahata Samba	20.77^{b}	24.52^{a}	*Thunmar Hamara*	17.44^{a}	17.76^{a}	*Chinnapodiyan*	10.46^{a}	7.93^{b}
Muthumanikam	12.28^{b}	19.25^{a}	*Miti Riyan*	9.88^{a}	11.21^{a}	*Heendikki*	16.00^{a}	11.71^{b}
Induru Karayal	6.52^{b}	9.99^{a}	*Heenpodi wee*	10.62^{a}	10.06^{a}	*Lumbini II*	13.53^{a}	9.19^{b}
Madabaru	6.08^{b}	9.93^{a}	*Geeraga Samba*	6.55^{a}	6.05^{a}	*Yakada wee II*	19.32^{a}	12.88^{b}
Dingiri Menika	11.34^{b}	15.32^{a}	*Suwanda Samba*	9.80^{a}	9.02^{a}			
Madael	11.88^{b}	16.77^{a}	*Muthu Samba*	13.27^{a}	14.59^{a}			
Suduru Samba II	4.20^{b}	8.19^{a}	*Podi sudu wee*	16.10^{a}	14.25^{a}			
Dik wee 328	10.51^{b}	29.94^{a}	*BG 35-7*	15.54^{a}	13.48^{a}			
MI 329	3.39^{b}	10.99^{a}	*Mudukiriel*	13.06^{a}	14.12^{a}			
Madael Galle	11.61^{b}	17.19^{a}	*Kiri Murunga wee*	9.66^{a}	9.10^{a}			
Madael Kalutara	7.90^{b}	12.10^{a}						
SirappuPaleusithri	13.46^{b}	16.90^{a}						
Wanni Heenati	9.05^{b}	12.22^{a}						
BG 34-8	11.36^{b}	14.33^{a}						
A 6-10-37	14.05^{b}	19.65^{a}						
Periamorungan	4.37^{b}	8.76^{a}						
Suduru Samba III	6.17^{b}	9.00^{a}						
Kaharamana II	14.07^{b}	26.82^{a}						
Jamis wee I	9.73^{b}	19.30^{a}						
Sinnanayam	13.82^{b}	14.12^{a}						
Jamis wee II	17.84^{b}	31.41^{a}						
Bathkiri el	27.91^{b}	38.95^{a}						
Kalukanda	17.83^{b}	28.75^{a}						

DMRT groupings are denoted in superscript lettes. The same letters in the adjacent columns are not significantly changed changes in yield/plant in *Yala* and *Maha* seasons (Table 3). Yang *et al*. (2008) achieved significantly higher grain yields in dry season than in wet season. The reason has been explained as that mean daily radiation was higher in dry season than wet season, particularly during grain filling stage than before flowering. The greater the radiation during ripening in dry season contributed to the higher grain yield (Yang *et al*., 2008). At Mapalana, Sri Lanka where the experiment was carried out *Maha* season was wet and *Yala* season was dry as usual in the years of experiment.

Trait determination of traditional rice cultivar is varied with the cropping season. Among 100 evaluated traditional rice cultivars only 12, 34, 36, 60 and 31 number of cultivars remained unchanged in plant height, number of tillers/plant, number of fertile tillers/plant, percent fertility and yield/plant respectively in *Yala* and *Maha* seasons. The most suitable cropping season for the individual rice cultivar can be determined using the data of the present study. As an example cultivars such *as Kotathavalu I, Hondarawala, Dandumara, Dewaredderi, Kiri Naran, Akuramboda, Bala Ma wee I, Pokuru Samba, Rata wee, Kotathavalu II, Madoluwa* and *Tissa wee* are more suitable for cultivating in *Maha* season while cultivars such as *Kaluhandiran, Kirikara, Karayal I, Sudu Goda wee, Puwakmalata Samba, Murungakayan 3, Murungakayan 101* and *Suduru Samba I* are more suitable for *Yala* season

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