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Relationship between the Second Leaf Blade Length and Elongation Ability of Plant in Deepwater Rice

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The relationship between the second leaf-blade (2LB) length and elongation ability of plant was examined in Asian and African deepwater rice (DWR) varieties. A large variation in the 2LB length was observed in both DWR varieties. In the Asian varieties, the avarage 2LB length was slightly larger for the Bangladeshi and Indian DWR varieties compared with that for the Cambodian, Chinese, Myanmarese, Thai and Vietnamese ones. The average 2LB length of the African DWR varieties was almost similar to that of the Indian ones. The 2LB length was highly correlated with the elongation ability of the plant in each of the Thai, Bangladeshi and African DWR varieties, while such correlation was not observed in the DWR varieties from other countries and also in all the Asian DWR varieties. This relationship may be helpful for the analysis of the elongation ability and the development of techniques for screening at the very early seedling stage of the Thai, Bangladeshi and African DWR varieties.

INTRODUCTION

In japonica rice, it has been reported that the length of the second leaf blade (2LB) was shorter in lowland varieties than in upland varieties (Harashima, 1936 ; Matsuo, 1952). According to Matsuo (1952), the 2LB length varies among different ecotypes in *satiua* rice. Hamamura (1979) reported an association between the 2LB length and elongation ability of plant in Thai deepwater rice (DWR) varieties.

In the present study, Asian and African DWR varieties were examined to determine whether the 2LB length could express the elongation ability of the plant at the early seedling stage.

MATERIALS AND METHODS

Seven hundred and twenty-nine Asian DWR varieties (*Oryza satiua* L.) originated from Bangladesh, Cambodia, China, India, Myanmar, Thailand and Vietnam, 60 non-DWR varieties (0. *sativa* L.) from Bangladesh and 36 African DWR varieties (0. *glaberrima* Steud.) obtained from the International Institute of Tropical Agriculture (IITA), Nigeria, were used.

The experiments were conducted in the summer seasons of 1988 and 1989. Seedlings were grown in plastic trays. Each tray (34 *X* 53 *X* 7.5 cm) contained 10 kg of paddy soil subjected to basal fertilization with 25 g of compound fertilizer containing 4 % each of nitrogen, phosphate and potassium. In each tray 60 varieties, and for each variety 6 to 8 seedlings were grown. The 2LB length was measured at the third

leaf stage. As the results were almost similar in the two consecutive years, only the data that were obtained in 1989 were contributed in the present paper.

Data on the position of the lowest elongated internode (LEI) exhibiting the elongation ability of DWR under submerged conditions were obtained during the previous studies (Inouye, 1985, 1987 ; Inouye et *al.*, 1988, 1989 ; Islam and Inouye, 1988).

RESULTS

Length of the 2LB′

As shown in Table 1, the Bangladeshi DWR varieties showed the largest variation in the 2LB length, followed by the Vietnamese, Thai, Indian, Cambodian, Myanmarese, and Chinese DWR varieties. In most of the DWR varieties from Bangladesh (66.4 %) and India (69.1 %), the 2LB length ranged from 41 to 60 mm. In most of the varieties from Cambodia (89.3 %), Myanmar (68.8 %), Thailand (74.5 %) and Vietnam (79.3 %), on the other hand, the 2LB length ranged from 31 to 50 mm. In Myanmar, the 2LB length of 25 % of the DWR varieties was 30 mm or less, while in other countries the number of those varieties accounted for less than 10 %.

The average 2LB length for the Bangladeshi DWR varieties was the largest (50 mm), which was very close to that for the Indian DWR varieties (48 mm). The length was almost similar for the DWR varieties from Cambodia (41 mm), Vietnam (41 mm), China (39 mm), and Myanmar (39 mm). The value of the average 2LB length (44 mm) of the Thai varieties was intermediate between those of the Indian and Cambodian ones.

Among the three agro-ecotypes of rice in Bangladesh, the average 2LB length was the largest (46 mm) for the aus rice and the smallest (41 mm) for the transplanted aman rice (Table 2). The value of the average 2LB length of the boro rice was intermediate (44 mm) between those of the aus and the transplanted aman rice varieties.

No large difference in the average 2LB length was observed between the African and Asian DWR varieties. The variation and the average value of the 2LB length in the former were similar to those of the Indian varieties among the latter. The average

Table 1. The second leaf blade (2LB) length of Asian and African deepwater rice varieties.

Origin of varieties	Total no. of vars.	No. of varieties (%) with the 2LB at indicated length (mm)							Average ± S. D.
		-30	31-40	41-50	51-60	61-70	71-80	81-	
Bangladesh	488	1.4	18.4	30.7	35.7	11.5	2.1	0.2	50±10.1
Cambodia	28	—	60.7	28.6	7.1	3.6	—		41± 7.2
China	3	—	66.6	33.3					39± 6.0
India	42	2.4	19.0	42.9	26.2	9.5			48± 8.9
Myanmar	16	25.0	31.3	37.5	6.3				39± 8.9
Thailand	93	2.1	35.1	39.4	17.0	6.4			44± 8.3
Vietnam	58	8.6	41.4	37.9	10.3	1.7			41± 8.1
Asia	729	2.6	24.6	33.2	28.8	9.3	1.4	0.1	48±10.1
Africa	36		2.8	66.7	25.0	5.6			49± 6.0

Table 2. The second leaf blade (2LB) length of Bangladeshi non-deepwater rice varieties.

Agro-ecotype	Total no. of vars.	No. of varieties (%) with the 2LB at indicated length (mm)				Average±S.D.
		-30	31-40	41-50	51-60	
Aus	34		26.5	44.1	29.4	46± 7.4
Transplanted aman	16	18.8	37.5	18.8	25.0	41-t 9.7
Boro	10	20.0	20.0	40.0	20.0	44±11.4

2LB length was 49 mm for the African DWR varieties.

Relationship between the 2LB length and the LEI position

In all the Asian DWR varieties a positive but not significant correlation (r = 0.0326) was observed between the 2LB length and the LEI position (Table 3). Country wise, a positive correlation between the 2LB length and the LEI position was observed in the DWR varieties from Bangladesh (r = 0.1778***), India (r = 0.3526*) and Thailand (r = 0.4707***). In the varieties from other countries, the correlation was not significant.

In the African DWR varieties, on the other hand, the correlation was positive and significant (r= 0.4469**).

DISCUSSION

According to Hamamura (1979), most of the deepwater rice varieties in Central Thailand have a short second leaf. He also observed a significant correlation (r = -0.687**) between the 2LB length and elongation ability of the plant in this type of rice.

In the present study, no particular indication of the relationship between the 2LB length and the LEI position which reflects the elongation ability of the plant could be

Table 3. Correlation coefficients between the second leaf blade (2LB) length and position of the lowest elongated internode (LEI) in Asian and African deepwater rice varieties.

Origin of varieties	Total no. of varieties	Correlation coefficient
Bangladesh	488	0.1778***
Cambodia	28	-0.1268""
China	3	-0.7387""
India	42	0.3526*
Myanmar	16	-0.4053""
Thailand	94	0.4707***
Vietnam	58	0.0510ns
Asia	729	0.0326""
Africa	36	0.4469**

*, **,***: significant at the 5%, 1% and 0.1%, respectively
ns : non-significant

detected in all the Asian DWR varieties. The Asian DWR varieties could be broadly classified by the elongation ability of the plant into three groups : high, intermediate, and low, which corresponded to the Bangladeshi and Indian, Cambodian, Chinese, Thai and Vietnamese, and Myanmarese DWR varieties, respectively. On the other hand, the Asian DWR varieties could not be classified into such groups based on the 2LB length.

In the African DWR varieties, in contrast, the average 2LB length tended to increase with the increase in the LEI position. The 2LB length, therefore, was highly correlated with the LEI position. In the Asian DWR varieties, also, a highly significant correlation between the 2LB length and the LEI position was observed in the Bangladesh and Thai varieties, but not in the Cambodian, Vietnamese and Myanmarese varieties.

Therefore, in the African DWR varieties and also in the Thai and Bangladeshi DWR varieties, the 2LB length may be a useful parameter for the analysis of the elongation ability and for the development of techniques for screening at the very early seedling stage.

In Bangladesh, three agro-ecotypes of rice i.e. aus, transplanted aman and boro are cultivated besides the DWR varieties. The average 2LB length for each of the three ecotypes was found to be smaller than that for the DWR varieties. Among the three ecotypes, transplanted aman rice, which is cultivated with the DWR varieties almost in the same season, exhibited the smaller 2LB length on the average compared with that of the DWR varieties. This observation was not in agreement with the report that the DWR varieties had the shorter 2LB than the non-DWR varieties in Thailand (Hamamura and Saengpetch, 1977). Nevertheless, the shorter 2LB of the transplanted aman rice compared with that of the DWR varieties in Bangladesh appears to be a useful character for distinguishing the former from the latter.

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