Short Communication

Difference of Proportion of Hull Weight to Whole Grain between Indica and Japonica Rice

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Proportion of hull weight to whole grain (hull content : hull weight/grain weight) is one of important traits for high yield in rice (*Oryza sativa* L.). Varietal difference of the hull content was associated with grain thickness and hull thickness. The varieties with low hull content obviously had thick grains and thin hulls. Hull content of 25 varieties ranged from 17.1% to 22.1%. Most of Indica varieties had higher hull content than standard Japonica varieties. Average of hull content of 20 Indica varieties was 2.3% higher than that of 5 Japonica varieties because Indica varieties had thicker hulls. However, it was found that 2 Indica varieties (UPR 254-85 and IET 1785) had same low hull content as that of Japonica varieties.

Key words : *Oryza sativa*, rice, hull, husk, husking ratio, varietal difference, grain.

Introduction

Proportion of hull weight to whole grain (hull content : hull weight/grain weight) or husking ratio (1-hull content) is one of important traits for high yield in rice (*Oryza sativa* L.) because a low hull content gives high rice recovery (BHATTACHARYA 1983). However, varietal difference of hull content has not been studied in detail. In this study, including the difference between Indica and Japonica, varietal difference of hull content was examined.

Materials and Methods

Twenty Indica varieties having different grain shape were grown together with 5 Japonica varieties in an experimental field plot in the off season (April to September) in 1985, at Malaysian Agricultural Research and Development Institute (MARDI), Bumbong Lima, West Malaysia (Fig.1). From the varieties, 11 Indica and 2 Japonica varieties (Table 1) were chosen and grown in the same field again in main season (October 1985 to February 1986). One seedling per hill was planted at a spacing of 30×25 cm, and 24 plants per variety were planted with 2 rows. Total of 90 kg/ha of nitrogen was supplied. Two panicles were sampled from each variety. Grain weight and hulled grain weight were measured with 10 filled grains taken from each panicle. Grain length and width of the 10 grains were also measured. Hull weight was calculated from the difference between grain weight and hulled grain weight. Grain thickness and hull thickness were evaluated from 1-grain weight/(grain length×grain width) and 1-hull weight/(grain length×grain width), respectively.

Results and Discussion

Results of 13 varieties in 2 seasons are shown in Table 1. Hull content ranged from

Table 1. Varietal differences in hull content and some other traits¹⁾

Varieties	Maturation ²⁾ (days)	Grain length (mm)	Grain width (mm)	1-grain weight (mg)	Hull thickness (mg/mm ²)	Grain thickness (mg/mm ²)	Hull content (%)
IR 44	131	7.7	3.0	27.1	0.253	1.19	21.3
BR 171-2B	127	7.8	2.9	25.4	0.245	1.13	21.7
PAU 50B	131	7.9	2.8	25.9	0.244	1.18	20.7
IR 26	124	7.1	2.9	23.4	0.264	1.15	23.1
IR 18349	125	8.2	3.0	29.4	0.268	1.21	22.2
UPR 254-85	131	7.2	3.0	27.9	0.232	1.28	18.1
IR 1163-132	127	7.9	3.0	29.9	0.261	1.26	20.6
IET 1785	125	7.6	3.1	31.2	0.251	1.32	19.0
Biblap	130	6.9	3.2	29.8	0.278	1.36	20.5
DGWG	127	6.7	3.4	29.5	0.271	1.31	20.8
BR 316-15	130	7.0	3.1	26.8	0.267	1.24	21.7
Ardito (J) ³⁾	118	5.8	3.5	26.8	0.240	1.25	19.3
Shin chu 56 (J)	124	5.5	3.8	27.6	0.237	1.32	17.8
L. S. D. (5%)	—	0.17	0.07	1.46	0.013	0.05	0.93

¹⁾ Average of 2 seasons, ²⁾ Maturation ; 30 + Days from seeding to heading,³⁾ J ; Japonica.

17.8% to 23.1% while the L. S. D. was 0.9%. There were varietal differences in grain thickness and hull thickness. Generally, hull content is associated with those traits. The varieties with low hull content obviously showed thick grains and thin hulls.

IRRI (1976) reported that hull content of 12 varieties ranged from 18.6% to 25.4%, and varieties with large grains had low hull content. TAKEDA (1976) also presented similar results and showed that varieties with round large grains can have low hull content. However in the present study, grain size or grain shape was not highly related with hull content.

The results of 20 Indica and 5 Japonica varieties in one season are shown in Fig. 1 and Table 2. The hull content ranged from 17.1% to 22.1%. Most of Indica varieties showed thinner grains and thicker hulls than Japonica varieties. As the results, average of hull content of Indica varieties were 2.3% higher than that of Japonica varieties. However, 2 Indica varieties (UPR 254-85 and IET 1785) showed same low hull content as standard Japonica varieties.

Fig. 1. Relationship between hull thickness and grain thickness

◆(Slender grain Indica) ; 1 Cica 4, 2 IR 26, 3 BR 171-2B, 4 PAU 50B, 5 ITA 212, 6 IR 44, 7 IET 2815, 8 IR 18349, 9 UPR 254-85, 10 IR 1163-132
 ■(Wide grain Indica) ; 11 IR 854-119, 12 IR 3273-67P, 13 IR 8, 14 IET 785, 15 RD 17, 16 Biblap, 17 IET 2707, 18 DGWG, 19 BR 316-15, 20 Milyang 42,
 ●(Japonica) ; 21 Kyokukei 865, 22 Ardito, 23 Shin 2, 24 Reimei, 25 Shin chu 56.

Table 2. Differences in hull content and some other traits between Indica and Japonica varieties¹⁾

Varieties (Grain width)	1-grain weight (mg)	Grain length (mm)	Grain width (mm)	Hull thickness (mg/mm ²)	Grain thickness (mg/mm ²)	Hull content (%)
Indica (Slender)	26.6	7.5	2.9	0.253	1.22	20.5
Indica (Wide)	29.6	7.1	3.2	0.265	1.30	20.2
Japonica (Wide)	26.2	5.6	3.5	0.244	1.34	18.1

¹⁾ Average of 10 Indica (slender), 10 Indica (wide) and 5 Japonica varieties in off season, 1985.

They obviously had thick grains and thin hulls.

Generally, it is considered that wide grains can have thick grains and low hull content when hull thickness is the same. When 20 Indica varieties are classified to 2 groups, 10 slender grain and 10 wide grain varieties, wide grain varieties had thicker grains. However, there was no difference in hull content between the groups because wide grain varieties had not only thick grains but also thick hulls. When the wide grain Indica and wide grain Japonica are compared, Indica showed 9% thicker hulls. It seems that the thicker hulls are responsible for the high hull content of Indica varieties because there was not much difference in grain thickness between them.

Although hull content has been measured many times, it has not been known whether Indica rice and Japonica rice behave similarly on this trait, because their traits have never been compared under the comparable condition. In the present study, it was found that Japonica varieties have lower hull content because they have thicker grains and thinner hulls.

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インド型イネと日本型イネにおける籾殻重歩合の差異

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イネの収量を考えた場合, 籾殻重歩合 (籾殻重/籾重=1-籾摺歩合) は低いことが望ましい。マレーシアにおいてインド型 20 品種と日本型品種の籾殻重歩合を調査したところ, その範囲は 17.1~22.1% であった。籾のサイズまたは籾形 (長幅比) と籾殻重歩合との間に密接な関係は認められず, 籾が厚く, 籾殻が薄い品種に籾殻重歩合の低い傾向が認められた。インド型品種は日本型品種より籾殻が厚く, 籾殻重歩合は 20.4% であり, 日本型品種より 2.3% 高かった。しかしインド型品種の中にも, UPR 254-85, IET 1785 など日本型品種とほぼ同等の低い籾殻重歩合を示す品種のあることが明らかになった。