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Selection of Early Maturing Rice for Duble Cropping before Growing of *Alisma plantago*

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ABSTRACT

In order to obtain basic information for selecting early maturing rice varieties which is suitable for early cropping before *Alisma plantago* in the southern part of Korea. Six rice varieties were grown from May to August in 2002 at Youngjeon Experiment Field, Sunchon and yield components and yield of plants were investingated. Early maturing rice cv. Grubyeo showed higher rough rice yield than any other varieties used in the experiment. It showed high yield components, such as culm length, panicle length, number of panicles per plant, number of spikelets per panicle and ratio of ripened grains. Therefore, it was concluded that Grubyeo was the most suitable variety with high yield for the cultivation before growing of *Alisma plantago* at the southern part of Korea. The heritability of culm length number of spikelets per panicle and rough rice yield were high and that of panicle length number of panicle per plant, ratio of ripened grain and 1,000 grain wt. of milled rice were low. According to the result of path coefficient analysis, characters highly correlated with rough rice yield showed large direct effects on rough rice yield.

Key Words : Early maturing rice varieties, agronomic characters, hiritability, path coefficient analysis.

INTRODUCTION

Systematic Alsima ploutago cultivation has been conducted long since early cultivation of rice at Haeryong-myon, Suncheon-city, Jeonnam was introduced. The harvest of rice in early cultivation is before and after the 30th of August every year and the harvest of *Alisma plantago* by late cultivation is before and after the 10th of December. National cultivation area of *Alisma plantago* is 130 ha and the cultivation area of *Alisma plantago* at Haeryong-myon, Suncheon-city is 100 ha, which comprises 76% of the national cultivation area. Nevertheless, most of farmhouses cultivate their own rice variety or a rice imported cultivation from Fukuoka, Japan by a farmer 10 years ago and there is no encouraged variety and the difference between harvest period and growth period is severed because there are so much mixed varieties. For these reasons, this study is to select early variety of rice with excellent adaptability in rice-*Alisma plantago* cultivation system at Suncheon bay and distribute it as

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encouragement variety.

Therefore, this experiment examines the range of variation centering around expected quantity character which is closely related to the quantity of early rice cultivation, calculates genetic correlation (Jonson et al, 1955) according to components and heritability (Grafius et al, 1952) of variation of characters, interprets involvement of each character in quantity shown by genetic correlation and then is to obtain information of selecting breeding in early cultivation stage.

MATERIALS AND METHOD

This experiment was conducted at test plot of *Alisma plantago* Cultivation Complex. Published early breeding rice varieties are Grubyeo and 5 others(Table 1). Selected varieties are brine assorted, disinfected, seed soaking and sprouting, and the amount of fertilizer applied(N-P_2O_5-K_2O) of 1-1-1g/box is used at commercial bed soil and 200 gr per box are sown in the 5th of April. Greening treatment of rice seed bed was performed at the fourth day after sowing when the length of coleoptile is 8～10mm. At this time, temperature is set to 25℃ in the daytime and 20℃ in the night for two days, keeping out of the sun. Hardening was done at thermal layer rice seed bed from the fifth day after seeding till transplanting and in the early period of hardening (for 8 days), temperature was set to 15～20℃ in the daytime and 15℃ in the night. Then the temperature should be set to 25℃ with good ventilation due to hindrance of high temperature and to less than 10℃ by covering it in the night.

Test plot of this rice field was placed by three replications using randomized block design and area of one plot was 20m² and transplanting was done with young rice seed bed of 10 days with planting density of 30 x 15cm by the hands in the 15th of April. The fertilizing amount was N-P_2O_5-K_2O=11-7-8kg/10a and nitrogen was given in transplanting with 1/2 of base manure and 1/2 was given by fertilization at tillering and fertilization at panicle, phosphoric acid was given in the whole quantity of base manure, potassium was by 2/3 of base manure and 1/3 of fertilization at panicle. Other cultivation managements were according to standard cultivation method of National Crop Experiment Station.

Measurement value of each character get the mean value and variance analysis was done. Genetic correlation, expressive correlation and heritability of each character were calculated by variance analysis of Grafius et al(1952) and Robinson et al(1949, 1951) and route coefficient analysis to know the effects of each character on quantity calculates direct and indirect effects by using partial regression analysis of Dewey et al(1959).

RESULTS AND DISCUSSION

1. Comparison among varieties of major agricultural varieties

The mean resulted from variety groups are shown in Table 1. The range of measurements of characters by each character as shown in Table 1 include 59~79cm of culm length, 18~22cm of panicle length, 13~17 No. of panicles, 84~91 in the number of leaves per panicles, 85~91% in the rate of ripened and 528~594kg/10a in rough rice yield, and then highly significant difference was recognized because of a large range of variation ($P<0.01$).

Grubyeo rice showed relatively high value in the features of characters examined with 79cm of culm length, 23cm of panicle length, 17 panicles, 91 leaves per panicles, 91% in the rate of ripened, and 594kg/10a in rough rice yield. These results are higher than native species of Suncheon as 0.9cm of culm length, 4.1cm of panicle length, 4 grains 6.0 spikelets per panicles , 5.8% in the rate of ripened and 66kg/10a in rough rice yield.

These experimental results show that even early rice

Table 1. Mean values and L.S.D.' s of observed characters with 6 varieties of early maturity rice in 2002.

Varieties	Heading date	Culm length (cm)	Panicle length (cm)	No. of panicles /plant	No. of spikelets /panicles	Ratio of ripened grains(%)	1,000 grain wt. of milled rice(g)	Rough rice yield (kg/10a)
Sunchon local	July 28	78.8	18.4	13.0	84	85.4	20.3	528
Grubyeo	July 4	79.7	22.5	17.0	91	91.2	22.9	594※
Jinbubyeo	July 16	61.7	19.2	15.2	90	90.0	22.5	559※
Joryeongbyeo	July 27	72.1	18.6	14.0	86	90.5	22.1	541
Junghwabyeo	July 18	76.2	18.9	14.0	87	87.2	21.4	538
Shinunbongbyeo	July 25	59.8	19.5	15.3	88	88.5	22.3	561※
L.S.D.(0.05)	-	12.72	2.34	2.25	8	4.12	0.88	31.4

Table 2. Genotypic variances(σ^2G), environmental variances(σ^2E) and heritabilities(h^2) of agronomic characters.

Characters	σ^2G	σ^2E	h2(%)
Panicle length(cm)	0.7100	1.0551	38.01
No. of panicles/plant	0.2521	1.0031	25.71
No. of spikelets/panicles	23.1234	2.1111	87.80
Ratio of ripened grains	1.2521	2.3322	42.21
1,000 grain wt. of milled rice(g)	0.7515	1.2561	46.21
Rough rice yield(kg/10a)	212.0211	98.1542	63.31

variety improved for mountain cultivation may have a different adaptability according to local environment and it is considered that Grubyeo, Jinbubyeo, and Shinunbongbyeo have higher significance in quantity and among them, Grubyeo is harvested earlier in the 4th of July and has high quantity and is recognized as the best early rice variety.

2. Estimation of Heritability

Although the condition which has the greatest potential in selecting variety breeding is quantity, the fact that the quantity cannot be an object of selecting character is due to the difficulty in knowing the variation of character since the gene effects are influenced by environment. Therefore, since it is very important to prepare an index of selection by analyzing the substance of variation among these components, it is also critical to divide the components of dispersion into genetic and environmental dispersion, calculate the genetic dispersion from the whole dispersion, examine and evaluate heritability. According to heritability obtained by percentage of genetic dispersion in a broad sense (Robinson et al, 1949), culm length, number of leaves per panicles and rough rice yield have a high heritability and panicle length, No of panicles, Ratio of ripened grains and 1,000 grain wt. of milled rice have a low heritability as shown in Table 3.

Such characters as culm length , no. of panicles and rough rice yield have high heritability among variety groups suggests that they have been under less environmental influence and considering their relation to growth of early rice variety it also supports that the growth of these characters has not great gap in rich and bad harvest by weather conditions and has been governed less by weather conditions. These results can be also found in Lee et al (1981), Ahn et al (1989), Kwon et al (1988) and Park et al (1987).

Dispersion shown in Table 2 was higher in the

Table 3. The direct and indirect effects of each yield component upon grain yield of early maturity rice estimated by path coefficient analysis.

Panicle length(cm)	No. of panicles/ plant	No. of spikelets /panicles	Ratio of ripened grains(%)	1,000 grain wt. of milled rice(g)
r1y=0.2688	r2y=0.4345	r3y=0.3015	r4y=0.7495	r5y=0.6829
P1y=0.1265	P2y=0.3532	P3y=0.1502	P4y=0.7138	P5y=0.6133
r12P2y=0.0411	r12P2y=0.2056	r13P1y=0.0034	r14P1y=0.2080	r15P1y=0.1717
r13P3y=0.0388	r23P3y=0.2002	r23P3y=0.0002	r24P4y=0.0687	r23P2y=0.0515
r14P4y=0.0005	r24P4y=0.2292	r34P4y=0.0176	34P3y=0.0752	r35P3y=0.0707
r15P5y=0.0122	r25P5y=-0.0688	r35P5y=0.0035	r45P5y=0.0492	r45P4y=0.0506

character with a greater and higher range of character mean value like the trend compared in Table 1 and the range of genetic and environmental dispersion was also great. It is considered that these characters have higher heritability and can be an index of selecting a character for breeding.

3. Direct and Indirect Effects

Since quantity is a complex complete character shown as one by the simultaneous involvement of several characters, is influenced by environment a lot and selection of breeding is mostly done by referring to phenotype, it is very important to interpret the genetic effects of appearance of each character on quantity as an index of selection. Results of calculating direct and indirect effects between quantity and characters by means of route coefficient analysis of Dewey et al (1959) are shown in Table 3.

Direct effects of five characters on rough rice yield were great in ratio of ripening (P4y=0.7138) and panicles (P2y=0.3532), followed by culm length (P1y=0.1265), the number of leaves per panicles (P3y=0.1502) and panicle length (P1y=0.1265). The size of direct effects is almost identical with the trend shown in correlation between rough rice yield and other characters in Table 3.

According to indirect effects of characters, culm length has a great indirect effect of panicle lingth (r12P2y=0.2056), panicle length has a great indirect effect of culm length (r12P1y=0.0411), panicles has a great indirect effect of the number of leaves per panicles(r24P4y=0.2292), the number of leaves per panicles has a great indirect effect of panicles (r34P3y=0.0752) and ratio of ripening has a great indirect effect of culm length (r15P1y=0.1717).

To related direct effect with indirect effect, ratio of ripening has the greated influence on rough rice yield and long culm length and panicle length and variety of a lot of panicles and the number of leaves per panicl

es are profitable to enhance rough rice yield.

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