Studies on the Fertile Percentage in Varietal Crosses of Rice Hybrids

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ALTHOUGH some difficulties, such as the low percentage of seed-setting or sterility of hybrids, have not been entirely overcome in crossing of rice plants, nevertheless the method of crossing is the most important in rice breeding. Regarding the crossability of rice, Chao (1928, 1933), Jones (1929), Liang (1936), Jodon (1938), and Pan et al. (1940) reported that the percentage of seed-setting was rather high, but the authors (1945) have reported that the mean value of the crosses between the Indica and Japonica types of rice is 21.21±2.29, and within the types, 29.83±3.48. Moreover, in the progenies of hybrids the fertility is usually somewhat higher and more stable in crosses within types than in crosses between types. In order to improve the quality of rice in Szechuan province of China, the authors have made many crosses between early nonglutenous Indica and late nonglutenous Japonica types of rice. Unfortunately, the character in fertility is still in segregation even in the lines of F3. With respect to the problem of fertility variation in the hybrids, the percentages of seed-setting of these hybrids were studied genetically in relation to the other characteristics of the rice plant and various environmental factors. The results of this study are hereby reported.

Forty-seven varieties, including 16 early nonglutinous Indica varieties, 17 late nonglutinous Japonica, 12 late glutinous Japonica, and 2 early glutinous Indica types of rice were used in these studies from the collection of world famous rice varieties for experimentation. From these varieties, 49 combinations of crosses were made. The fertility was calculated by dividing the number of fertile spikelets by the total number of spikelets. Four of the normally headed panicles of each plant were selected for counting fertility. When a plant had fewer than four individual panicles, all panicles were used. The daily mean values of temperature, sunlight, and moisture of the 5 months from July to November in 1943 were taken from the reports supplied by the Szechuan Provincial Climatic Observa-

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Results

Fertility and Varieties

Kato (1930) reported that the average fertility in the crosses between types is 4.70; and within types 81.20. A similar result was obtained by the authors. It was also studied by the authors. Table 1 shows the results in the crosses between early nonglutinous Indica and late nonglutinous Japonica types, the mean is 10.74±3.20, and between early nonglutinous Indica and late glutinous Japonica types, 7.94±2.64; within the crosses within types the mean values of 3.59 within early nonglutinous Indica and late nonglutinous Japonica types, and 70.44 within late glutinous Japonica types. Thus, from the fertility of F1, it is evident that Oryza sativa L. might be classified into two subspecies, namely, Indica and Japonica. Except for two early nonglutinous rice varieties (early Indica type in morphology), Hung-Hsi and Pa-Yueh Hsien, and any of the other three nonglutinous Indica, late nonglutinous Indica, and late glutinous Japonica types. The results are shown in Table 2. It can be seen that the fertilities are all smaller than those obtained in other crosses within the types of rice, as comparison with those between types of rice, they are still higher. From the criterion of fertility, therefore hard to decide whether these two nonglutinous rice varieties belong to the Indica or Japonica type.

Fertility and Pollen Abortion

When the mature pollen grains of F1 were treated with iodine solution and then examined with microscope, it was found that whatever the cross, abortive pollen grains could be found 58.70±4.74 between early nonglutinous Indica and late glutinous Japonica types and 52.87±5.34 between late nonglutinous Japonica and late glutinous Japonica types.