

## INHERITANCE OF PLANT HEIGHT AND FLOWERING DURATION IN FOUR RICE CROSSES\*

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Studies on the inheritance of plant characters are of great importance in guiding plant breeding programmes. Investigations conducted on the genetics of plant height in rice in the past have yielded contradictory results. Ramaiah (1933) suggested that the presence of multiple genes controlled culm height. Syakudo *et al* (1954) found that the genes determining the heading periods affected the culm height also. Bhide (1926) observed the dominance of lateness in a monogenic ratio. The present studies were undertaken to understand the inheritance of plant height and flowering duration in some rice crosses.

### Material and Methods

The crosses (Female X male) studied were:

1. Vellayani 1                    x    Tainan 3
2. Tainan 3                        x    Vellayani 1
3. Vellayani 1                    X    Taichung Native 1
4. Taichung Native 1            X    Vellayani 1

Of these Tainan 3 was a *japonica* variety while the others were *indica* varieties.

All the available seedlings of the four crosses were planted separately in singles in the main field, 25 days after sowing at a spacing of 30 cm either way, in such a way that seeds obtained from one F<sub>1</sub> plant represented one F<sub>2</sub> family. The usual manuring schedule of 33 kg N, 33 kg P<sub>2</sub>O<sub>5</sub> and 33 kg K<sub>2</sub>O per hectare in the form of ammonium sulphate, single superphosphate and muriate of potash, was adopted over the basal dose of 500 kg of green leaf. Height was measured from the base of the plant to the tip of the main panicle after the grains attained full maturity. Number of days from the date of seeding to the opening of the spikelet in the first emerging panicle was taken as the flowering duration.

### Results and Discussion

Results are presented in Tables 1 and 2. Height of Vellayani 1 and Tainan 3 ranged from 45 to 114 cms and 50 to 104 cms respectively (Table 1). The F<sub>2</sub> progeny of the cross Vellayani 1 X Tainan 3 showed

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Table 1  
 Frequency distribution of individuals (Parents and F<sub>2</sub>) for  
 Plant height (in cm)

| Parent or hybrid<br>Classes | Vellayani 1 | Tainan 3 | Taichung<br>Native 1 | Vellayani 1<br>X Tainan 3 | Tainan 3<br>X Veilayani 1 | Vellayani 1<br>X Taichung<br>Native 1 | Taichung<br>Native 1 x<br>Vellayani 1 |
|-----------------------------|-------------|----------|----------------------|---------------------------|---------------------------|---------------------------------------|---------------------------------------|
| 40-44                       |             |          |                      | 2                         | 7                         |                                       |                                       |
| 45-49                       | 1           |          |                      | —                         | 4                         | 1                                     | 4                                     |
| 50-54                       | —           | 1        |                      | —                         | 6                         | 4                                     | 5                                     |
| 55-59                       | —           | —        | 2                    | 3                         | 11                        | 6                                     | 11                                    |
| 60-64                       | 1           | 2        | 4                    | 5                         | 26                        | 26                                    | 21                                    |
| 65-69                       | 1           | —        | 6                    | 13                        | 24                        | 20                                    | 15                                    |
| 70-74                       | 2           | 3        | 18                   | 24                        | 48                        | 32                                    | 26                                    |
| 75-79                       | 3           | 5        | 11                   | 33                        | 56                        | 17                                    | 22                                    |
| 80-84                       | 7           | 8        | 11                   | 29                        | 56                        | 20                                    | 23                                    |
| 85-89                       | 4           | 18       | 2                    | 39                        | 54                        | 33                                    | 22                                    |
| 90-94                       | 15          | 14       | 1                    | 28                        | 45                        | 26                                    | 32                                    |
| 95-99                       | 13          | 9        |                      | 25                        | 37                        | 8                                     | 18                                    |
| 100-104                     | 11          | 2        |                      | 21                        | 23                        | 10                                    | 14                                    |
| 105-109                     | 3           |          |                      | 15                        | 11                        | 12                                    | 7                                     |
| 110-114                     | 2           |          |                      | 19                        | 8                         |                                       | 1                                     |
| 115-119                     |             |          |                      | 9                         | 4                         |                                       | 1                                     |
| 120-124                     |             |          |                      | 5                         | 2                         |                                       | 1                                     |
| 125-129                     |             |          |                      |                           | 1                         |                                       |                                       |
| 130-134                     |             |          |                      |                           | 1                         |                                       |                                       |
| 135-139                     |             |          |                      |                           | 1                         |                                       |                                       |
| Total                       | 63          | 62       | 55                   | 270                       | 425                       | 215                                   | 223                                   |
| Mean                        | 91.8        | 86.5     | 74.1                 | 88.9                      | 82.3                      | 78.5                                  | 80.6                                  |

Table 2  
Frequency distribution of individuals (Parents and F<sub>2</sub>) for flowering duration in days

| Parent or hybrid Classes | Vellayani 1 | Tainan 3 | Taichung Native 1 | Vellayani 1 X Tainan 3 | Tainan 3 X Vellayani 1 | Vellayani 1 X Taichung Native 1 | Taichung Native 1 x Vellayani 1 |
|--------------------------|-------------|----------|-------------------|------------------------|------------------------|---------------------------------|---------------------------------|
| 50-52                    |             |          |                   | 1                      |                        |                                 |                                 |
| 53-55                    |             |          |                   | 1                      |                        |                                 |                                 |
| 56-58                    |             |          |                   | 1                      |                        |                                 |                                 |
| 59-61                    |             |          |                   | 15                     | 1                      |                                 |                                 |
| 62-64                    |             |          |                   | 29                     | 4                      |                                 | 3                               |
| 65-67                    | 1           |          |                   | 37                     | 21                     | 8                               | 29                              |
| 68-70                    | 3           | 1        |                   | 43                     | 32                     | 19                              | 18                              |
| 71-73                    | 15          | 1        | 1                 | 38                     | 57                     | 60                              | 53                              |
| 74-76                    | 1           | 1        | 1                 | 25                     | 115                    | 14                              | 4                               |
| 77-79                    | 16          | 5        | 3                 | 39                     | 79                     | 20                              | 26                              |
| 80-82                    | 17          | 26       | 38                | 17                     | 54                     | 68                              | 60                              |
| 83-85                    | 6           | 7        | 3                 | 5                      | 11                     | 8                               | 9                               |
| 86-88                    | 1           | 9        | 3                 | 6                      | 11                     | 3                               | 6                               |
| 89-91                    | 3           | 7        | 4                 | 3                      | 14                     | 6                               | 9                               |
| 92-94                    |             | 1        | 2                 | 4                      | 10                     | 6                               | 3                               |
| 95-97                    |             | 1        |                   | 1                      | 9                      | 3                               | 2                               |
| 98-100                   |             | 3        |                   | 2                      | 1                      |                                 | 1                               |
| 101-103                  |             |          |                   | 1                      | 2                      |                                 |                                 |
| 104-106                  |             |          |                   | 1                      | 3                      |                                 |                                 |
| 107-109                  |             |          |                   | 1                      | 1                      |                                 |                                 |
| Total                    | 63          | 62       | 55                | 72.3                   | 425                    | 215                             | 223                             |
| Mean                     | 78.0        | 83.9     | 82.2              | 27.0                   | 77.3                   | 77.2                            | 76.3                            |

a wider range of plant height (40-114 cms) than the parental lines. The reciprocal of the above cross also showed almost the same pattern of segregation in F<sub>2</sub>. The highest frequencies of F<sub>2</sub> individuals in both direct and reciprocal crosses were observed to be between 80 and 90 cms and these coincided with the means of the two parental values.

Height of Taichung Native 1 ranged from 55 to 94 cms. The F<sub>2</sub> progeny of the cross Vellayani 1 X Taichung Native 1 showed a range of variation between 45 and 109 cms. The mean of the F<sub>2</sub> was near to the mean of the two parents. The reciprocal cross also showed a similar pattern of segregation with a wider range of variation in F<sub>2</sub> than in the parents. A few of the F<sub>2</sub> individuals in all the four crosses, resembled the respective parents in plant height. A minor portion of the F<sub>2</sub> population was found to surpass the parental limits in the expression of the character. This transgression was on both sides in three of the four crosses studied.

No significant reciprocal difference was seen in the pattern of segregation of plant height in F<sub>2</sub>.

Ramaiah (1933) suggested that multiple genes controlled the culm height. Results obtained in the present studies also showed that plant height was governed by many genes as indicated by the closeness of the mean value of F<sub>2</sub> population with the parental means, transgressive segregation and the variability in F<sub>2</sub>. The wider range of variability in F<sub>2</sub> was indicative of segregation of a large number of factors. Approximately equal number of individuals was seen on both sides of the modal class which gave a normal curve. In both *indica* X *indica* and *indica* X *japonica* hybrids, the mode of inheritance followed almost a similar pattern.

Vellayani 1 flowered earlier with a mean flowering duration of 78 days (Table 2). Tainan 3 and Taichung Native 1 showed a mean flowering duration of 83.9 and 82.2 days respectively. The F<sub>2</sub> progeny of the cross between Vellayani 1 and Tainan 3 showed transgressive variation with its mean nearing to the mean of the two parents. The reciprocal cross also showed almost similar results.

In the cross between Vellayani 1 and Taichung Native 1, the range of variation in the F<sub>2</sub> was found to be within the limits of the variation exhibited by the parents. However, the mean of the F<sub>2</sub> was similar to the mean of the two parental values. The reciprocal cross did not differ from the direct cross in its pattern of segregation, the means of the two being 77.2 and 76.3, which also agreed with the parental mean. In two of the four crosses, there was clear evidence of transgressive segregation.

In general the *indica* X *japonica* hybrids showed transgressive segregation for flowering duration with its mean near to the mean of the two parents. The *indica* X *indica* hybrids showed a variation within the limits

of the variation shown by the parents with the mode close to that of the parents. Chandrasekharan and Parthasarathy (1960) stated that this type of inheritance could not be considered as due to blending of characters, but due to the characters being governed by a very large number of factors. Thus all the four cross combinations studied showed a mode of inheritance typical of quantitative characters. This is in agreement with the observation of Nandi *et al* (1940) and Nagai (1959).

### Summary

A study on the F<sub>2</sub> generation of inter-racial, (Vellayani 1 X Tainan 3) and intra-racial (Vellayani 1 X Taichung Native 1) rice hybrids of both direct and reciprocal combinations of crosses showed that in both the crosses plant height and flowering duration were inherited as quantitative characters controlled either by multiple genes or one or two major genes and a few minor genes. No appreciable reciprocal difference was observed in either of the two racial groups. Transgressive segregation was seen in all the cases.

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