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Study of Plant Characters and their Relationship in Rice

by

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Introduction: Many traits, more particularly those that are measurable have been reported to be useful by themselves or in association with other characters in effecting selection of promising plants from a bulk population. An assessment of the extent of variability of these traits in plants of a strain or strains in rice crop as well as the strength of association or correlation among them to judge their reliability would aid the rice breeders in making the selection easy, quick and effective in their breeding programmes and in biometric studies. In the present investigation, an attempt has been made in the study of some important characters such as ear length, number of productive tillers, flowering duration, height of plant etc., and their relationship between one another.

Materials and Methods: Three short duration rice strains namely Co. 29, TKM. 6 and PTB. 10 were grown during the *Navarai* season (January-February to April - May) of the year, 1963–64 and these were taken up for the study. The varieties were sown in a nursery and transplanted in experimental plots of size 1.20 m × 6.00 m adopting a spacing of 15 cm × 15 cm with single seedling per hole. The transplanted field was fertilized adopting usual practice. Forty plants were fixed at random in each variety for the study. The individual culms in each clump were observed daily for their flowering. The first flowered culm in a clump was considered as the primary tiller and the tillers that followed were numbered respectively as second, third etc. The pattern of tiller formation was taken as identical in all the varieties studied as stated by Wilson (1963). Length and breadth of boot leaf, length of topmost internode and emergence were also recorded for all the culms in the plants. After maturity the plants were harvested. The earlength of each culm was recorded after harvest.

Results and Discussion: *Earlength:* Length of the panicle is a good criterion for yield (Juliano *et al.* 1940). The earlength of the first five culms in all the clumps in each variety was statistically analysed. There was no significant difference among the length of panicle of the first four tillers in all the varieties except in the variety Co. 29 in which the first three tillers did not show significant difference. Again when the earlength of the six tillers was analysed no significant difference was observed among the panicle length

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of the first four tillers in all the varieties. The same results were found to hold good when the number of tillers was increased to nine. The length of panicle of the first four tillers in a plant was found to be on a par and they differed significantly from the rest of the tillers. The results furnished in Table 1 gives an indication that when selecting earheads for biometric studies in an experiment, selection can be relied on measurements upto the fourth tiller. It was also observed that the first formed tiller possessed longer earheads only in 23% of the plants in the variety TKM. 6, 35% in Co. 29 and 39% in PTB. 10. Thus it is inferred that the primary tiller need not necessarily possess longer earhead in a plant.

Height: It was found that the mean differences in height between the primary tiller and the subsequently formed seven tillers did not attain the level of significance. This observation is in confirmity with that of Ramiah (1944) who also observed that the height of different tillers of plant of normal growth was almost the same, the differences being within 10% of the mean. Ghose *et al* (1956) also recorded that the contribution of height towards yield was negligible in almost all the varieties. Hence much emphasis need not, therefore, be placed on height of culm while selecting tillers for panicle measurements at time of selection.

Heading: In the strain, TKM. 6, it took 21 days for all the culms to complete the heading; on an average, it took 11.4 days for all its culms in each plant to flower. In Co. 29, on an average, a plant took 12.1 days for flowering in all its tillers. All the tillers flowered in 23 days. In the strain PTB. 10, the flowering was completed in 24 days and on an average a plant took 91 days for all its tillers to flower. Thus in general it is seen that the plant in the strains take 9 to 12 days for all its culms to flower. It is also found that the flowering was rapid upto 15 to 16 days from the day of commencement of flowering and then the flowering was slow. A gradual increase in the duration of flowering from the primary tiller to the subsequently formed tillers was also noticed. Matsuo (1957) also observed proportionate delay in flowering in the latter formed tillers.

Exertion: The mean exertion of panicle was found to be 6.08, 8.02 and 1.71 cm in Co. 29, TKM. 6 and PTB. 10 respectively. The strain TKM. 6, a fine variety possessed longest exertion, Co. 29, a medium variety possessed lesser exertion and PTB. 10, a coarse variety had the least exertion.

Variation in quantitative attributes: The co-efficient of variation in respect of traits, earlength, height of plant, flowering duration, emergence and length of boot leaf was determined and furnished in Table 2.

TABLE 1. *Main panicle lengths of culms in the order of their flowering (in cm)*

T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	S.E.	C.D(P=0.05)
Variety Co. 29										
20.65	20.00	20.14	19.59	18.74	—	—	—	—	0.27	0.74
20.63	20.02	20.08	19.76	18.77	18.11	—	—	—	0.44	1.23
20.80	19.87	20 33	19.79	18.91	19.18	17.27	—	—	0.42	1.17
21.03	19.79	20.40	20.23	19.21	18.27	17.68	16.89	—	0.48	1.35
21.09	19.82	20.20	20.35	19.56	18.78	18.37	17.31	16.42	0.58	1.61
Variety TKM. 6										
22.68	22.58	22.41	22.33	21.37	—	—	—	—	0.08	1.01
22.55	22.51	22.44	22.24	21.64	21.47	—	—	—	0 21	0.58
22.52	22.55	22.58	22.59	21.86	21.86	20.98	—	—	0.21	0.57
22.45	22.79	22.34	22.60	21.54	21.53	21.19	21.23	—	0.44	1.20
22.50	22.84	22.42	23.11	21.86	21.73	21.23	21.37	20.19	0.29	0.81
Variety PTB. 10										
22.1	21.8	22.4	21.5	19.0	—	—	—	—	0.43	1 19
22.0	22.1	22.4	21.7	19.4	20.1	—	—	—	0.48	1.34
22.7	22.5	22.9	21.8	19.6	21.1	20.0	—	—	0.63	1.73
22.6	22.6	23.2	22.3	19.1	21.0	21.7	20.3	—	0 45	1.25

Differences are highly significant in all the rows.

Co. 29

$\overline{T_1\ T_3\ T_2}\ T_4\ T_5$

$\overline{T_1\ T_3\ T_2\ T_4}\ \overline{T_5\ T_6}$

$\overline{T_1\ T_3\ T_2\ T_4\ T_5\ T_6\ T_7}$

$\overline{T_1\ T_3\ T_4\ T_2\ T_5\ T_6\ T_7\ T_8}$

$\overline{T_1\ T_4\ T_3\ T_2\ T_5\ T_6\ T_7\ T_8\ T_9}$

PTB. 10

$\overline{T_3\ T_1\ T_2\ T_4}\ T_5$

$\overline{T_3\ T_2\ T_1\ T_4\ T_6\ T_5}$

$\overline{T_3\ T_1\ T_2\ T_4\ T_6\ T_7\ T_5}$

$\overline{T_3\ T_1\ T_2\ T_4\ T_7\ T_6\ T_8\ T_5}$

TKM. 6

$\overline{T_1\ T_2\ T_3\ T_4\ T_5}$

$\overline{T_1\ T_2\ T_3\ T_4\ T_5\ T_6}$

$\overline{T_4\ T_3\ T_2\ T_1\ T_5\ T_6\ T_7}$

$\overline{T_2\ T_4\ T_1\ T_3\ T_5\ T_6\ T_8\ T_7}$

$\overline{T_4\ T_2\ T_1\ T_3\ T_5\ T_6\ T_8\ T_7\ T_9}$

T_1 = First flowered tiller

T_2 = Second flowered tiller

T_3 = Third flowered tiller etc.

TABLE 2. *Co-efficient of variation in different characters.*

S.No.	Character	Percentage of co-efficient of variation		
		TKM. 6	Co. 29	PTB. 10
1.	Earlength ...	8.42	14.50	13.78
2.	Flowering duration ...	4.75	4.49	4.54
3.	Height ...	8.08	8.09	7.92
4.	Emergence ...	35.75	31.06	101.50
5.	Length of boot leaf ...	13.90	19.44	18.67

From the above, it is seen that flowering duration registered 4.49 to 4.75% C. V. which was found to be the least when compared to the other characters. Thadani *et al* (1927) recorded a C. V. of 2.3 to 3.16% in respect of flowering in the three rice varieties they studied.

TABLE 3. *Total correlation coefficients between different characters.*

S.No.	Characters	Co. 29	TKM. 6	PTB. 10
1.	Earlength and culm height	0.611 **	0.115 NS	0.703 **
2.	Earlength and flowering duration	-0.542 **	-0.344 **	-0.369 **
3.	Earlength and length of boot leaf	0.620 **	0.432 **	0.615 **
4.	Earlength and topmost internode	0.753 **	-0.064 NS	0.241 *
5.	Earlength and emergence	0.384 **	0.374 **	0.042 NS
6.	Earlength and breadth of boot leaf	0.282 **	-0 036 NS	0.446 **
7.	Earlength and number of productive tillers	0.989 **	0 982 **	0.988 **
8.	Height of culm and emergence	0.453 **	0.359 **	0.086 NS
9.	Height of culm and flowering duration	-0.309 **	0.261 **	-0.176 NS
10.	Height of culm and length of boot leaf	-0.664 **	0.033 NS	0.208 *
11.	Height of culm and length of topmost internode	-0.190 NS	0.410 **	0.650 **
12.	Height of culm and breadth of boot leaf	0.233 *	0.188 NS	0.350 **
13.	Emergence and flowering duration	-0.294 **	-0.106 NS	-0.711 **
14.	Emergence and length of boot leaf	0.214 *	0.217 *	0.484 **
15.	Emergence and length of topmost internode	0.568 **	0.863 **	0.421 **
16.	Emergence duration and breadth of boot leaf	0.072 NS	0.317 **	-0.299 **
17.	Flowering duration and length of boot leaf	0.006 NS	0.427 **	-0.159 NS
18.	Flowering duration and length of topmost internode	-0 483 **	-0.414 **	-0.595 **
19.	Flowering duration and breadth of boot leaf	-0.152 NS	0 068 NS	-0.096 NS
20.	Length of boot leaf and length of topmost internode	0.488 **	0.274 **	0.696 **
21.	Length of boot leaf and breadth of boot leaf	0.484 **	0.018 NS	-0.383 **

* Significant at 5%
** Significant at 1%
NS Not Significant

Correlation studies between different characters: Correlation studies were taken up between different characters with an intention to what extent they can be employed in selection work in breeding programmes. Highly significant correlation between earlength and height of culm observed in Co. 29 (r=0.611) and PTB. 10 (r=0.703) and feeble correlation in TKM. 6 (r=0.115) was in conformity with the previous workers, Bhide *et al* (1928) Sethi *et al* (1931), Ramiah (1933), Grist (1953), Ghose *et al* (1956) and Sen Gupta (1965). High negative correlation coefficients obtained between earlength and flowering duration indicates that the earlier the tillers formed the longer the earhead lengths they possess. High positive correlation observed between earlength and length of boot leaf in all the three strains studied would prove the close positive relationship between these two traits, indicating thereby that boot leaf appears to contribute much towards increased earhead length which will ultimately lead to increased yield. This relationship may be due to the reason that the flag leaf takes over the major role in plants physiolcgical function as pointed out by Matsuo (1961). Between earlength and emergence, high positive correlations in Co. 29 and TKM. 6 and feeble correlation in PTB. 10 were obtained. Thus based on the correlation of culm height, length of boot leaf and emergence with the earlength, one of the first four culms including the primary tiller can easily be fixed in a plant for biometric studies.

Besides, the high positive correlations obtained between earlength and the total number of earbearing tillers in three varieties will provide the information that plants possessing more number of tillers will give high earlength and consequently more yield as high correlation between earbearing tillers and yield exists (Chandramohan, 1964). Positive correlation between height of culm and emergence in the culms was observed. The negative correlation between emergence and flowering duration of the tillers gives an idea that earlier flowered tillers invite longer emergence. Significant correlations between emergence and length of boot leaf, emergence and length of topmost internode and length of boot leaf and length of topmost internode will help the research workers in fixing the primary tiller in a plant. The earlier flowered tillers possess longer topmost internodes and this fact has been revealed by the high negative correlation coefficients obtained in all the varieties. No definite relationship was established between length and breadth of boot leaf. Tanaka *et al* (1966) obtained negative correlation coefficient between these two traits. The total correlation coefficients obtained between different characters are furnished in Table 3.

Interclass correlations in the different traits will give a measure of variability among the tillers themselves in a plant when the culms of plants can be differentiated as primary tiller, secondary tiller etc. based on their flowering duration (Fisher, 1936 and Mather, 1964). Interclass correlations

were worked out in respect of flowering duration and earlength between different tillers in all possible combinations. In TKM. 6 the correlation coefficients ranged from 0 593 to 0.862, in Co. 29 from 0 546 to 0.901 and in PTB 10 from 0.455 to 0.916. These significant interclass correlation coefficients further established the fact of existence of lesser variability among the different tillers of a plant with respect to their flowering duration. In earlength, the correlation coefficients were found to be low and vary from one combination to the other. This finding confirms the existence of variation to a larger degree between earlengths of different culms.

Summary: The important traits like earlength, height, flowering behaviour and exertion of plants in rice were studied. The earlengths of the first emerged tiller and those of the culms emerged subsequently were studied comparatively in the three rice strains namely KTM. 6, Co. 29 and PTB. 10. No significant difference was established between the earlengths of the first four culms in a plant. Thus any one of the first four tillers can be fixed for biometric studies. The height of first nine tillers did not show significant difference. A plant takes on an average a period of 9.1 to 12.1 days for completion of flowering of all its tillers. For all the culms to flower in a pure crop, about three weeks are found to be required. A strain takes 10 to 11 days for its 75% flowering. The amount of flowering of tillers is more at the beginning i.e., upto 15 days and then there is no appreciable increase till they complete flowering. The coefficient of variation was found to be least in flowering duration than other characters.

Correlation studies between different characters were found to give sufficient basis for the fixation of any one of the first four tillers including the primary tiller for biometric studies with respect to its different traits. Earlier flowered tillers in a plant can be identified by looking into their longer emergence, longer boot leaves and longer topmost internodes. Number of productive tillers bears a very high positive correlation with earlength which will lead to high yield. High interclass correlations in flowering duration among the different culms of the plants in a variety proves lesser variability in that trait.

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