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RELATIONSHIP BETWEEN PLANT HEIGHT AND YIELD IN RICE

Height of the plant is one of the important yield determining characters in rice crop. Most of the high yielding varieties are short in nature when compared to local varieties. Information about the type of association between these two characters is useful for rice breeders. Workers on rice in different parts of the country have found different degrees of correlation between plant height and yield. Many of them reported yield to be independent of height. In tall indica rice varieties, height was found to be fairly correlated with yieid (Ghoose *et al.* 1960), Paramasivam (1980) also found significant positive correlation between height and yield in some tall indica rice varieties. But Rajagopalan *et at.* (1973) found a low correlation between yield and height in dwarf indica types. In all the above cases simple correlation between the two variables was discussed. Usually, a simple correlation is worked out on the assumption that the relationship between two variables is linear. The present investigation was undertaken to see whether the relationship between plant height and yield is exclusively linear and to study how far the linear relationship holds good.

Five varieties viz., Rohini. Thriveni, Culture *28,* Culture 202 and Jyothi belonging to short duration group were utilized for the study. Theses vatieties were grown in plots of size 4x4 m^2 with a spacing of 20 x 15 cm in a randomised block design with two replications. Fifty plants were selected randomly from each plot for taking observations. Height of the plant at harvest (x) and the corrosponding grain yield (y) at 14% moistura content were recorded. The data consisting a sample of five hundred observations were grouped properly in a two-way table. Using this bivariate table ordinary correlation coefficient (rxy) and correlation ratios (η_{yx} and η_{xy}) between yield and height were calculated. Column means were worked out from the bivariate table to get the average yield for height at different size groups. A multiple regression equation was fitted to the data using the square of x as a third variable.

A simple correlation coefficient of 0.20 was observed between height and yield. But the correlation ratios, an appropriate measure of curvilinear relationship between the two variables (Tablel)were found equal to 0.3511 (η_{yx}) and 0.264 (η_{xy}). Both correlation ratios were greater than the coefficient of simple correlation. When the line of relationship between the two variables approaches linear form, the two correlation ratios will become identical. Here the different values for η_{yx} and η_{xy} indicated the presence of a strong non-linear relation between the two characters. A linearity test suggested by Blakeman {Venkatwsan 1958} was used after correcting the correlation ratios using Pearsons correction formula

$$\eta^2 \text{ (corrected)} = \frac{\eta^2 - \frac{k-3}{N}}{1 - \frac{k-3}{N}}$$

where k is the number of arrays in the

bivariate table. The difference η^2-r^2 was worked out and it was observed that ηyx^2-r^2 exceeded $\frac{11.5}{N}$. The difference η^2-r^2, a measure of divergence from linearity (Mills, 1955) was tested for significance by the method suggested by Harry (1936). For both correlation ratios, this difference was of significant level which also established a curvilinear relationship between the two variables. A low ordinary correlation coefficient and high correlation ratio indicated that the height yield relationship can be measured more effectively by correlation ratio. The multiple regression equation fitted was $Y=-181.33+4.715x-0.028x^2$. A test of significance of departure from linearity of the regression (Table 2) revealed that there was significant curvilinearity in the regression. The curve plotted for estimated y with observed y was found to have downward bent for smaller as well as larger values of x. The optimum height which has maximum estimated yield was obtained by considering the first differential coefficient of the above equation and equating to zero. Optimum was obtained as 84.2 cm.

Height yield relationship in short duration rice was curvilinear. Correlation ratio was a better measure of association between the two variables.

Table I

Correlation ratio and correlation coefficient between plant height and yield in rice

Correlation ratio between y & x	Correlation ratio between x & y	Correlation coefficient between x & y	Difference between sq. of correlation ratio and sq. of correlation coefficient		Test factor	Standard deviation of difference	
ηyx	ηxy	rxy	ηyx^2-r^2	ηxy^2-r^2	$\frac{11.5}{N}$	$\sqrt{\eta yx^2-r^2}$	$\sqrt{\eta xy^2-r^2}$
0.3511	0 2641	0.2005	0.06696	0,01630	0.023	0.001035	0,000510

Table 2

Test of departure from linear regression

Source	DF	SS	MSS	F
Deviation from linear regression	10	143.441	—	—
Deviation from curved regression	9	50.626	5.625	16.50"
Reduction	1	92.815	92.815	

** Significant at P = 0-01

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