Study of Variation in Yield Components of Rice Varieties

by

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Introduction: A correct estimation of yield components and its role are of invaluable help to the breeder to eliminate much of his difficulties and uncertainties in the early stage of selection of the breeding material. Much work has been done on the components affecting grain yield in rice and definite correlation have been established. The varieties possessing similar yielding capacity, however, differ widely, in their other characters. Often the breeder is confronted with the problem of synchronising this variation with their total effect on yield. Here, an attempt has been made to assess the range of variation in yield components and their interdependence.

Review of Literature: Sikka and Gupta (1949) pointed out though morphological characters are variable they may be the best indicators of yield and their relationship. Vibar (1920), Narasinga Rao (1937), Chakravarthy (1940), Ramaiah (1953) and Eikichi (1954) have reported different degrees of correlation between number of tillers, length of panicle, number of grain per panicle, weight of earhead and size of grain. Other workers Mendiola (1926) Mahalanobis (1934) and Ghose *et al.* (1960) found inter-varietal variation in correlation of many characters with yield. Gose *et al.*, (1960) have reviewed that ear length was negatively correlated with number of ear heads and positively correlated with plant height at harvest and suggested that the grain weight and density are important contributory factors in the estimation of varietal yields. Chandra Mohan (1961) studying ten varieties from four geographical groups found that significant differences in plant characters like plant height, number of tillers, number of grain per plant.

Materials and Methods: Ten strains in each of short (up to 120 days), medium (150 days) and long (above 150 days) durations were selected. Single seedlings were planted per hill with a spacing of 25 cm. x 10 cm. Normal manuring schedule was adopted. The date of flowering was reckoned as the day on which 75 per cent of panicles flowered. Fifteen earheads were marked out and matured ears collected on the 30th day of flowering at random. Then the earheads were given an uniform drying for five days. The length and weight of earheads were recorded. Number of grain and chaff were counted separately from each earheads.

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The data collected were statistically analysed to measure the variability, dispersion and pattern of distribution as per the method suggested by Panse and Sukatme (1957). The total and partial correlation between the characters and regressions were worked using Gauss multipliers with Doolittle solution as suggested by Goulden (1952) and the prediction equation for all the characters were also formulated.

Results and Discussion : (a) *Study of variation :* The results of analysis of variance within and between the three duration groups are given in Table 1.

TABLE 1

Sl. No.	Particulars	Duration Group						C. V. for all the three groups
		Short		Medium		Long		
		S. E.	C. V.	S. E.	C. V.	S. E.	C. V.	
1.	Panicle length	0·20*	11·7	0·41*	9·5	0·48*	9·9	12·5
2.	Panicle weight	0·14*	29·1	0·16*	47·4	0·21*	32·0	41·4
3.	Number of grains per panicle	6·12*	33·2	7·42^{NS}	29·1	8·79*	12·0	41·2
4.	Number of chaff per panicle	2·12*	61·2	4·13*	72·4	3·52*	74·0	80·3

* Significant at 1 per cent level of significance.

It was noticed that the differences between the varieties in each group were significant for the four characters studied except for the number of grains in medium duration. The Chi-square tests revealed that the three duration groups also significantly in the expression of these characters. The means indicate that except in panicle length, there is a definite and gradual increase in weight of panicle, number of grains per panicle and number of chaff with the lengthening of the duration. The large variation found within and between the duration groups would be sufficient for the aggregates studies of the population and its parameters. Hence the data were grouped and frequency polygens were drawn for the three important characters (*vide* Text Fig.) While the distribution of length of panicle was normal with mean, mode and median coinciding, the distribution for numer of chaff per panicle were positively skewed. The curves were flatter and positively skewed with the constants of distribution, β_1 and β_2 as 1·31 and 1·7179 for number of grains and 1·1613 and 1·254 for number of chaff per panicle, respectively. So it can be inferred that large number of panicles tends to possess more grain and chaff than the average

The variation in panicle length between the three duration groups was found to be negligible, while in the case of panicle weight, the variation was greater in medium duration group than the other two. For number of
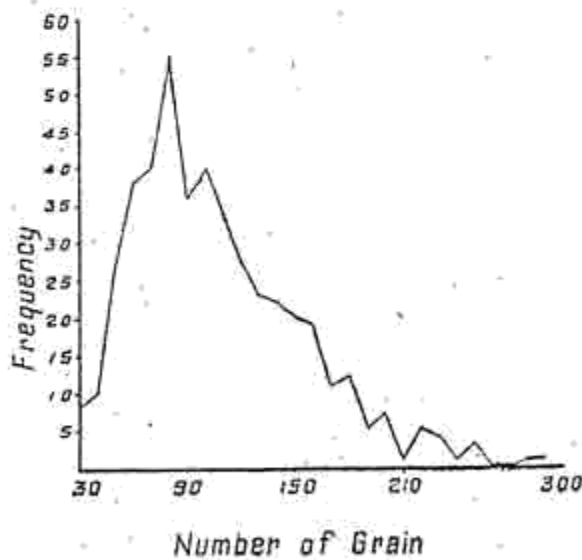
Distribution of length of Panicle
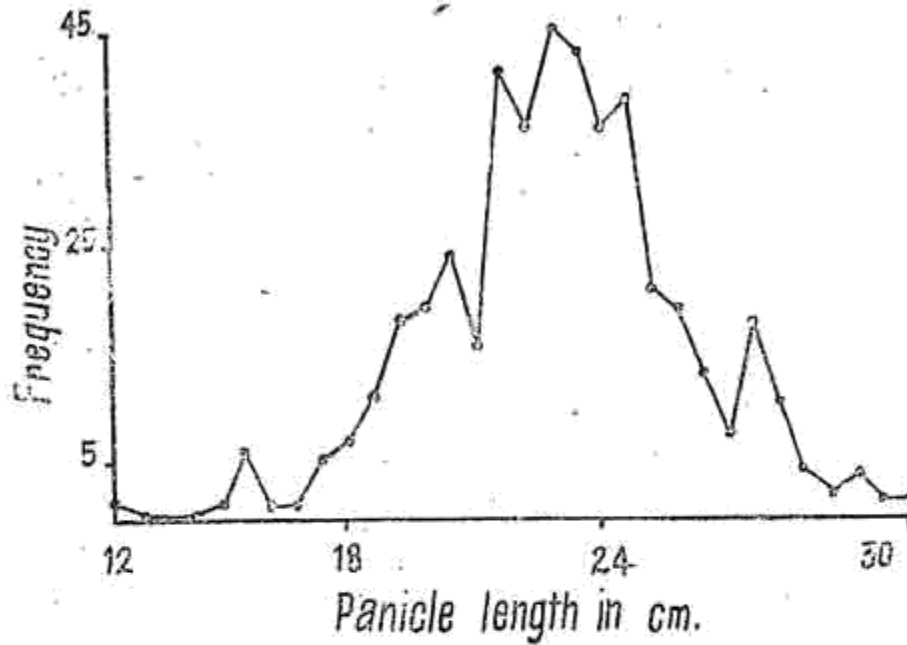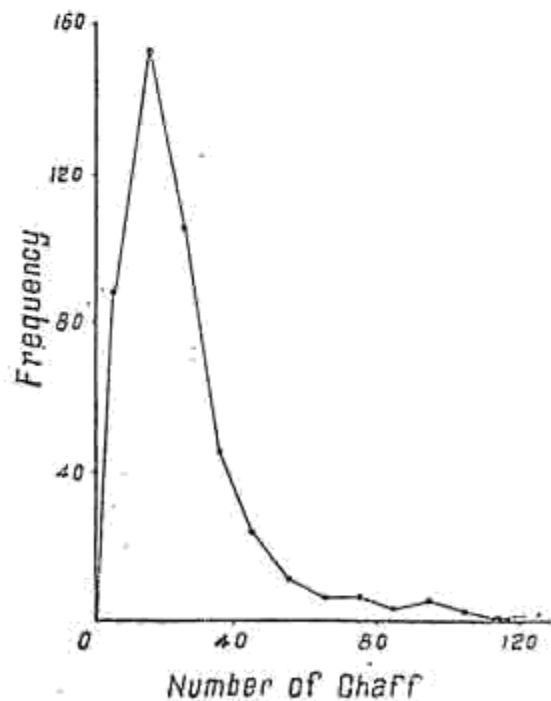
Distribution of Number of Grains

Distribution of Chaff

grains per panicle, the co-efficient of variation was highest for short duration group. Among the four components studied, greater variation was noticed in number of chaff per panicle. High values obtained for all these characters is indicative of the larger variations found in these traits.

(b) *Correlation studies:* In order to assess the strength of association between these four characters simple, partial and multiple correlations were worked out and data are presented in Table 2.

<div align="center">TABLE 2</div>

No.	Particulars	Panicle length Total	Panicle length Partial	Panicle weight Total	Panicle weight Partial	No. of grain per panicle Total	No. of grain per panicle Partial	No. of chaff per panicle Total	No. of chaff per panicle Partial
1.	Panicle length			0·5991[b]	0·1835*	0 8705*	0·2399*	0·6467*	0·3604*
2.	Panicle weight	0·0861 NS				0·5994*	0·8028*	0·5128*	0·2476*
3.	Number of grains per panicle	0·2399*		0·8028*				0·3539*	0·1597*
4.	Number of chaff per panicle	0·3664*		0·2476*		0·1597*			

* = Significant at 1 per cent level.

NS = Non - significant.

The total correlation between the characters, panicle weight, panicle length, number of grains per panicle and number of chaff per panicle were all found to be highly significant and positive. The correlation was highest between panicle length and number of grain per panicle. Moderate to high correlation existed between weight of panicle, grain and number of chaff per panicle and between length of panicle, weight of panicle and number of grain and chaff per panicle. The correlation between number of grain and chaff per panicle was feable. The partial correlations worked out did not improve the relationship when other characters were eliminated, though the importance of number of grain per panicle and weight of panicle have been emphasised. The correlation studies have established a definite relationship in which the characters occur and as plant food available at the reproductive stage has to be apportioned between them, the expression of one might affect the other.

Hence multiple regression equations have been worked out for each of the character and the contribution of other three characters were evaluated. The data with prediction equations were presented in Table 3.

<div align="center">TABLE 3</div>

No.	Particulars	Prediction equation	Multiple correlation co-efficient
1.	Panicle length	$x_1 = 0·2779\ x_1 + 0·3681\ x_2 + 0·3225\ x_3 - 25·9696$	0·5525
2.	Panicle weight	$x_1 = 0·0552\ x_1 + 0·7882\ x_2 + 0·1395\ x_3 - 88·6653$	0·7815
3.	Number of grains per panicle	$x_2 = 0·8178\ x_1 + 0·1565\ x_4 - 0·0917\ x_3 - 106·7223$	0·7733
4.	Number of chaff per panicle	$x_2 = 0·4397\ x_1 + 0·4164\ x_4 - 0·2784\ x_2 - 8·5340$	0·3114

The equations clearly show the amount by which a particular character increase by a unit increase in other characters. The fact that multiple correlation coefficient was less in the case of panicle length and

number of chaff suggests the possibility of other factors like height and tillering influencing the expression. The panicle weight and number of grain per panicle are greatly influenced by each other with the panicle weight improving by 0·78 for a unit increase in the number of grains and the number of grains increase by 0·81 times for a unit increase in panicle weight. Contrary to the common belief that the length of panicle has to contribute only to a lesser extent of 0·15 times in increasing the number of grains per panicle.

Summary: The pattern of distribution and variability as prevalent in the cultivated rices in respect of panicle length, panicle weight, number of grains per panicle and number of chaff per panicle were studied. The differences in the yield components were found to be a varietal trait and they differ significantly among and within the three duration groups. The distribution of length of panicle was normal while it was positively skewed in the case of number of grains and chaff per panicle. The association between these characters was positive and highly significant. No single factor affect the other characters to a large extent as evident from the partial correlation analysis. Prediction equation for each character was also formulated.

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