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Evaluation of ginger (*Zingiber officinale* Rosc.) varieties in high altitude and tribal zone of Srikakulam district of Andhra Pradesh

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Abstract

The yield performance and simple association between yield and its components were studied in eight varieties of ginger during *kharif* 2007 and 2008. The variety *Suprabha* was taller and recorded more number of leaves, tillers plant^{-1} and number of finger rhizomes plant^{-1}. It produced significantly more fresh rhizome yield of 21.71 t ha^{-1} than all the other the varieties tested. Among the varieties *Chintapalli local* produced more number of mother rhizomes plant^{-1}. Number of tillers plant^{-1}, number of mother and finger rhizomes plant^{-1} and fresh rhizome yield showed high GCV, PCV, heritability and genetic advance as per cent mean. The simple correlation studies indicated that number of tillers plant^{-1}, number of mother and finger rhizomes plant^{-1} recorded highly significant association with yield.

Keywords: character association, genetic variability, ginger

Association of plant character has always been helpful as a basis for selecting desired genotypes. Many varieties of ginger (*Zingiber officinale* Rosc.) are available in India which are region specific, varying in plant habit, yield and quality parameters. The performance of ginger grown in tribal zone of Andhra Pradesh has shown an immense potential for its commercial cultivation in large area. However, the information on varieties suitable to this region is scanty and no systematic efforts were made to evaluate the improved ginger cultivars for their suitability to this region. Hence, the present investigation was under taken to identify a suitable variety for High Altitude and Tribal Zone of Andhra Pradesh for commercial cultivation. The traits that contribute to yield can be identified by variability and correlation analysis. Correlation analysis provides a true picture of genetic association among different traits (Bhatt 1973).

Considering these aspects and importance of ginger, the present study was initiated to estimate heritability, genetic advance of yield and yield components. The association among important yield and yield attributing characters through simple correlation analysis was also studied in order to develop selection criteria for improving rhizome yield potential of ginger.

The investigation was carried out at Agricultural Research Station, Seethampeta, Srikakulam District of Andhra Pradesh for two years during *kharif* 2007–08 and 2008–09 with

eight genotypes. The available phosphorus and potassium content in the soil were 24 kg ha^{-1} and 245 kg ha^{-1} respectively. The soil type was clay loam and pH was 6.82. The experiment was conducted in a randomized block design with three replications using eight varieties of ginger *viz*., *Suprabha*, V1S1-2, Z-Local, ACC-117, V1S1-8, *Varada*, ACC-35 and *Chintapalli local*. The finger rhizomes were planted on ridges at a spacing of 45 cm × 15 cm during second fortnight of April. 106 kg ha^{-1} Urea, 150 kg single super phosphate, 82 kg muriate of potash were applied along with other recommended cultural practices. Observations were recorded on plant height, tillers $plant^{-1}$, number of leaves $plant^{-1}$, number of mother and finger rhizomes $plant^{-1}$ and fresh rhizome yield $plant^{-1}$ from five randomly selected plants in each plot. The rhizome yield was accounted on plot basis. Character means pooled for two years were statistically analysed following standard procedure. Data recorded on various characters were subjected to statistical analysis *viz*., genotypic and phenotypic coefficient of variation (GCV and PCV, respectively) (Burton 1952), heritability (Allard 1960) and genetic advance (Johnson *et al.* 1955).

A perusal of data presented in Table 1 showed highly significant variations among the genotypes for yield. It was noted that yield attributing characters such as tillers $plant^{-1}$, number of mother and finger rhizomes $plant^{-1}$ and yield $plant^{-1}$ varied significantly among genotypes. Plant height ranged from 32.73-50.60 cm and highest was recorded by *Suprabha* (50.60 cm). However, lowest plant height was recorded by *Varada* (32.73cm). The number of leaves varied from 13.93 in *Chintapalli Local* and *Varada* to 18.87 in *Suprabha*. More number of tillers $plant^{-1}$ was produced by *Suprabha* (10.07), whereas *Varada* (4.13) produced less number of tillers $plant^{-1}$. The number of finger rhizomes was highest in *Suprabha* (11.67). However, lowest number of finger rhizomes was recorded by ACC-35 (7.00). The number of mother rhizomes varied from 7.00 in *Varada* and V1S1-8 to 11.0 in *Chintapalli Local*. The data showed highly significant variation among the ginger varieties with regard to the fresh rhizome yield. The variety *Suprabha* produced significantly higher fresh rhizome yield (21.71 t ha^{-1}) followed by *Chintapalli Local* (17.04 t ha^{-1}), whereas, the variety *Varada* recorded significantly lower fresh rhizome yield (6.67 t ha^{-1}). On the contrary, Naidu *et al.* (2000) reported that the variety IISR *Varada* was significantly superior in its productivity of fresh rhizome and suitable for the high altitude areas of Visakhapatnam district.

Table 1. Mean performance of ginger varieties in tribal zone of Srikakulam district

Variety	Plant height (cm)	Number of leaves $plant^{-1}$	Number of tillers $plant^{-1}$	Number of finger rhizomes $plant^{-1}$	Number of mother rhizomes $plant^{-1}$	Rhizome yield (t ha^{-1})
Suprabha	50.60	18.87	10.07	11.67	10.00	21.71
Chintapalli Local	49.87	13.93	9.40	11.33	11.00	17.40
V1S1-2	42.73	15.07	8.40	10.00	8.67	12.78
Z Local	34.27	16.40	9.07	9.33	10.33	13.35
ACC-117	48.60	16.67	7.40	9.67	8.67	12.60
V1S1-8	42.60	16.20	6.33	8.00	7.00	6.91
Varada	32.73	13.93	4.13	8.00	7.00	6.67
ACC-35	41.00	15.00	7.60	7.00	7.33	8.18
SEd	4.98	1.60	1.13	0.96	1.14	1.76
CD (P<0.05)	7.50	2.41	1.70	1.44	1.72	2.65
CV (%)	14.24	25.15	8.78	13.37	14.90	17.31

The results presented in Table 2 revealed that the mean plant height of all the genotypes was 42.8 cm and it ranged from 34.3-50.6 cm. with genetic advance as per cent of mean was of more value than the former alone in predicting the effect of selection in crop

Table 2. Genetic components of variation for yield and yield related characters in ginger

Yield contributing characters	Mean	Range	GCV	PCV	Heritability	Genetic advance
Plant height (cm)	42.80	32.73.-50.60	26.18	29.8	77.17	47.37
Number of tillers plant^{-1}	7.80	4.13-10.07	39.78	47.06	71.44	69.26
Number of leaves plant^{-1}	15.75	13.93-18.87	17.29	19.39	79.48	31.75
Number of mother rhizomes plant^{-1}	8.75	7.00-11.00	30.13	32.96	83.55	56.72
Number of finger rhizomes plant^{-1}	9.38	7.00-11.67	29.19	32.77	79.32	53.54
Yield (t ha^{-1})	12.45	6.67-21.71	72.46	74.50	94.60	145.18

Average number of leaves plant^{-1} was 15.75 (range 13.93 to 18.87). For tillers plant^{-1}, the mean of all the genotypes was 7.8 (ranged 4.13 to 10.07). Average number of mother and finger rhizomes plant^{-1} was 8.75 and 9.38, respectively. The fresh rhizome yield among the genotypes ranged from 6.67 to 21.71 t ha^{-1} with an average of 12.45 t ha^{-1}. The PCV values were higher than GCV values for all the characters studied (Table 2) indicating that the apparent variance was not only due to the genotypes but also due to the influence of environment. The results of the present study showed that variability accompanied by higher values for GCV was recorded in rhizome yield. These results are supported by Islam *et al.* (2008) and Monima *et al.* (2011) in ginger. They also reported high GCV and PCV for fresh rhizome yield.

High estimates of heritability were observed for all the characters *viz*., plant height (77.17), number of tillers plant^{-1} (71.44), number of leaves plant^{-1} (79.48) number of mother rhizomes plant^{-1} (83.55), number of finger rhizomes plant^{-1} (79.32) and rhizome yield (94.60) indicating that a major part of the phenotypic variability in these characters was contributed by additive gene effects and hence improvement can be made by simple selection. These results are in close agreement with the findings of Tiwari (2003) for tillers plant^{-1}, Singh *et al.* (2003) for plant height and Monima *et al.* (2011) for rhizome yield.

Johnson *et al.* (1955) suggested that heritability improvement programme. In the present study, yield and its components *viz*., plant height, number of tillers plant^{-1}, number of leaves plant^{-1}, number of mother and finger rhizomes plant^{-1} was highly heritable with high level of genetic advance. Hence, there is a scope to isolate superior genotypes for improving yield through simple selection procedures. These results are supported by the findings of Islam *et al.* (2008). They reported that the genetic advance in percentage of mean along with heritability was very high for tillers plant^{-1}, plant height, leaf length, leaf breadth, leaves tiller^{-1}, number of primary fingers rhizome^{-1}, number of secondary fingers rhizome^{-1} and number of tertiary fingers per rhizome. Similarly, Monima *et al*. (2011) reported relatively high heritability with genetic advance for fresh rhizome yield in ginger.

Yield is a complex character and associated with several yield contributing characters. Selection for yield as such may not be effective unless other yield components influencing it directly or indirectly are taken into consideration. When selection pressure is exercised for improvement of any character highly associated with yield, it simultaneously affects a number of other correlated traits. Hence, the knowledge regarding association of character with yield and among themselves provides a guideline to the plant breeder for making crop improvement through selection. Analyzed data from Table 3 revealed that the rhizome yield displayed positive and significant association with

Table 3. Correlation coefficient among yield and yield attributing characters in ginger

Yield contributing characters	Plant height (cm)	Number of leaves plant^{-1}	Number of tillers plant^{-1}	Number of finger rhizomes plant^{-1}	Number of mother rhizomes plant^{-1}	Rhizome yield (t ha^{-1})
Plant height (cm)	1.0000	0.3966	0.5896	0.6672	0.4325	0.6707
Number of leaves plant^{-1}		1.0000	0.4736	0.3744	0.2369	0.5233
Number of tillers plant^{-1}			1.0000	0.7305	0.8400*	0.8600*
Number of finger rhizomes plant^{-1}				1.0000	0.8451*	0.9377*
Number of mother rhizomes plant^{-1}					1.0000	0.8642*
Rhizome yield (t ha^{-1})						1.0000

*Significant

number of tillers plant^{-1}, number of mother rhizomes and finger rhizomes plant^{-1}. The results indicated that these traits had certain inherent relationship with yield and it is suggested that selection of these characters would directly improve the yield in ginger. Similar findings of positive significant association between tiller number with rhizome yield was reported by Sasikumar *et al.* (1992). Islam *et al.* (2008) reported positive and significant correlation of rhizome yield with number of primary fingers rhizome^{-1}, number of secondary fingers rhizome^{-1} and number of tertiary fingers rhizome^{-1}. Further, number of tillers plant^{-1} showed positive and significant association with number of mother rhizomes plant^{-1}. Similarly number of mother rhizomes plant^{-1} showed significant positive correlation with number of finger rhizomes plant^{-1}. Thus, it can be concluded that among the ginger varieties evaluated under High Altitude and Tribal Zone of Srikakulam district of Seethampeta, the variety *Suprabha* produced highest fresh rhizome yield and is suitable for commercial cultivation in tribal area of high altitude zone of Srikakulam district.

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