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Correlation and Path Coefficient Analysis in Onion (*Allium cepa* L.)

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Abstract: Correlation and path coefficient analysis in onion showed that total bulb yield (kg ha^{-1}) had significant positive correlation with plant height, leaf number per plant, bulb diameter and bulb yield per plant but had significant negative association with plant spacing. Path analysis indicated that bulb diameter, plant height and leaf number per plant were the principal components of yield.

Key words: Onion, correlation and path coefficient

Introduction

Onion (*Allium cepa* L.) is one of the most important crops among the vegetables and spices in Bangladesh both in acreage and production (Badaruddin and Haque, 1977; Monadal and Chaudhury, 1980), cultivated to consume either as spice or condiment. The total area and production of onion in Bangladesh are 34008 ha and 13900t respectively (Anonymous, 2000). The average yield of onion in Bangladesh is very low as compared to that of other countries (Bhuyan and Haque, 1979). A little attention has been given to improve the yield potential of this crop. Yield is a complex character, which is dependent on a number of agronomic characters and is highly influenced by many genetic factors as well as environmental fluctuations (Paul *et al.*, 1976, 1978; Joardar *et al.*, 1978; Uddin *et al.*, 1985). As such, direct selection for yield can be misleading. So, to improve the yield through selection of better genotype (s), knowledge of the nature of association of yield and yield contributing characters is very essential. Therefore, this study was undertaken to assess the nature of association of yield contributing characters among themselves and also the direct and indirect effects of yield contributing characters on yield through path analysis.

Materials and Methods

The experiment was conducted at the experimental field of Horticulture Research Centre, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur, during the period from October, 1997 to April, 1998. The seeds of onion line On-043 were sown in 4 different times with 15 days interval to obtain seedlings of 30 days old at each transplanting date, as the planting dates were at 15 days of interval. The land was ploughed to a desirable filth. The field was fertilized with cow dung, urea, TSP and MP @ 5t, 260, 136 and 162kg ha^{-1} respectively. The entire quantity of cow dung and TSP were applied during final land preparation. Urea and MP were applied in two equal installments at 30 and 60 days after transplanting.

The experiment was laid out in a split plot design. The 12 different treatment combinations were replicated 3 times with spacing in the main plot and time of planting in the sub-plots. The 3 different plant spacing were 5, 10 and 15 cm respectively and the 4 different time of plantings were 1 and 16 December, 1 and 16 January respectively. Row to row spacings were kept constant of 20cm. The unit plot size was 3 x $2m^2$. Data on plant height, leaf number per plant, bulb diameter, bulb yield per plant and bulb yield per plant were recorded from 10 randomly selected plants from each unit plot. Simple correlation coefficients were estimated using the formula of Steel and Torrie (1960) and path coefficient analysis was done according to the methods of Dewey and Lu (1959).

Results and Discussion

The performance of the variety under different environmental conditions of growth was observed that the variety showed variation in average performance for all the characters studied. The heighest plant height (49.64cm) was recorded from 16 December planting with 10cm spacing and the lowest (32.40cm) from 16 January planting with 10cm spacing. The maximum number or leaves per plant (8.60) was obtained from 1 December planting with 15cm spacing and the lowest (4.10) from 16 January planting with 10 cm spacing. The highest diameter of bulb (3.80cm) was found in 1 December planting with 10cm spacing and the lowest (2.15) in 16 January with 5cm spacing. December, 16 with 5cm spacing produced the maximum bulb yield per hectare (9630 kg) while 16 January planting with 15 cm spacing produced the lowest (1330 kg).

The correlation coefficients between all possible combinations of 6 characters are presented in Table 2. Among the 15 associations, 13 were found significant. Total bulb yield showed significantly positive association with plant height, leaf number per plant, bulb diameter and bulb yield per plant and negative association with spacing. Spacing had significant positive correlation with plant height and bulb yield per plant; but it did not show any association with leaf number per plant and bulb diameter. Plant height exhibited strong positive correlation with leaf number per plant, bulb diameter and bulb yield per plant among themselves. The strong correlation among these characters indicated that these characters were governed by the same genetic system that is the characters were expected to be linked to each other. Thus selecting plants for better plant type and other characters may lead to an improvement of yield in onion. Significant positive correlation's of onion yield were reported with plant height and bulb yield per plant (Vadivel *et al.*, 1981) and with leaf number per plant (Pandian and Muthukrishnan, 1982). Rahman and Das (1985) reported non-significant negative association of bulb yield with leaf number per plant, bulb diameter and bulb yield per plant.

Lee *et al.* (1977) found significant positive relationship of bulb yield with bulb diameter in garlic, which were party in agreement with the present finding.

Path analysis revealed that bulb yield per plant had very high negative direct effect (-5.5409) on total bulb yield, though its correlation with yield was positive and highly significant. This might be due to high positive indirect effects via bulb diameter (3.8074), spacing (1.4175), plant height (0.5057) and leaf number per plant (0.4300). The negative direct effect indicated that variety with low bulb weight could be developed without sacrificing total bulb yield. Bulb diameter had the highest positive direct effect (4.2276) in building up the correlation with total bulb yield (0.5993). Its negative indirect effect via bulb yield per plant (-4.9901) counterbalanced the high positive direct effect to some extent. Spacing, plant height and leaf number per plant also showed high positive direct effects. The direct effect of leaf number per plant (0.5631) was more or less similar to its total correlation coefficient (0.5800), which indicated that the variability

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Table 1: Average performance of different characters of onion (grown with different planting time and spacing)

Planting time (Date)	Spacing (cm)	Plant height (cm)	No. of leaves / plant	Diameter of bulb (cm)	Bulb yield/ plant(g)	Bulb yield (kg ha^{-1})
1st December	5	38.25	7.27	3.48	17.65	9120
	10	47.24	7.67	3.80	19.97	8000
	15	48.12	8.60	3.70	22.42	5120
16th December	5	40.25	7.10	3.12	16.04	9630
	10	49.64	7.73	3.15	20.69	7000
	15	43.32	8.17	3.65	20.17	5670
1st January	5	37.83	5.47	2.71	11.07	6280
	10	44.36	5.87	3.38	17.88	5170
	15	40.52	5.27	2.89	13.18	3500
16th January	5	32.40	4.17	2.15	6.35	1820
	10	34.12	4.10	2.16	6.53	2250
	15	37.56	4.77	2.48	7.56	1330

Table 2: Correlation coefficients among different characters in onion

Characters	Plant height (cm)	Leaf No./Plant	Bulb diameter (cm)	Bulb yield/Plant (g)	Bulb yield (kg ha^{-1})
Spacing (cm)	0.3575*	0.1391	0.2019	0.6714**	0.4177*
Plant height		0.6750**	0.7050**	0.7901**	0.3776*
Leaf No./plant			0.8330**	0.7635**	0.5800**
Bulb diameter				0.9006**	0.5993**
Bulb yield/plant					0.6197**

Table 3: The break up of total correlation with yield into direct and indirect components

Characters	Spacing (cm)	Plant height (cm)	Leaf No./plant	Bulb diameter (cm)	Bulb yield/plant	Total correlation coefficients
Spacing	2.1113	0.2288	0.0783	0.8840	3.7201	0.4177*
Plant height	0.7548	0.6401	0.3801	2.9805	4.3779	0.3776*
Leaf No./plant	0.2937	0.4321	0.5631	3.5216	4.2305	0.5800**
Bulb diameter	0.4415	0.4513	0.4691	4.2276	4.9901	0.5993**
Bulb yield/plant	1.4175	0.557	0.4300	3.8074	5.5409	0.6197**

Residual effect = 1.4879; Note: Direct paths are underlined; * and ** = significant at 5% and 1% level respectively

for this character was not much influenced by the changes in the variability in other traits.

In both correlation and path coefficient analysis it may be concluded that bulb diameter, bulb yield per plant and plant population were important for total bulb production. Higher spacing may increase individual bulb weight but due to accommodation of less number of plants per unit area total production would below.

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