The Pharma Innovation Journal 2018; 7(6): 371-372

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2018; 7(6): 371-372

www.thepharmajournal.com
Received: 08-04-2018
Accepted: 10-05-2018

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Correlation and path analysis for improved seed yeild in zinnia (*Zinnia elegans* Jacq.) cv. gaint flowered mixed

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Abstract
Simple correlation and path coefficients were worked out in assessing the relative contribution of different yield attributing characters on seed yield of *Zinnia elegans* cv. Gaint Flowered Mixed. The results of the present investigation envisaged that the number of flowers per plant showed maximum association and highest positive direct effect on seed yield. On the contrary leaf area per plant exhibited maximum negative direct effect.

Keywords: Correlation, path analysis, improved seed (*Zinnia elegans* Jacq.) cv. gaint

Introduction
Zinnia (*Zinnia elegans* Jacq.) is a very popular garden flower and is preferable to many other flowering annuals. It is mainly propagated through seeds, but the information on various aspects of its seed production is scanty. The present study was, therefore, carried out to determine correlation and path coefficients which proved helpful in identifying the characters beneficial in augmenting the seed yield and also selecting a fertilizer dose under which the characters responded better. Simple correlation studies are often misleading as they cannot interpret the actual cause of association between the characters; so path analysis is carried out, which is useful in predicting direct and indirect causes of association and provides information regarding the dependence of seed yield on the correlated parameters.

Materials and methods
Field experiments were carried out on *Zinnia* cv. Gaint Flowered Mixed at two separate locations in two different seasons (i.e. rainy and winter seasons). The rainy season and winter season trials were carried out at Students Instructional Farm, Jaguli and Horticultural Research Station, Mondouri, respectively and both these places comprise of the farm area of B.C.K.V., Nadia, West Bengal. The trials were laid out in Randomized Block Design with 9 treatments and three replications in each year. Treatments consisted of various combinations of N, P and K. Two levels of N, P and K (100 and 200 kg ha^{-1} each) were used to make a total of eight combinations representing eight treatments and the ninth treatment designated as control represented a treatment without N, P and K fertilizers. Seedlings were transplanted in experimental plots 25 days after sowing maintaining a spacing of 50 cm within the rows and 25 cm between the plants. Half dose of N and full doses of P and K along with well rotten FYM @ 30 t ha^{-1} were applied as basal dose. Another half dose of N was applied one month after transplanting. Observations regarding height, primary branches, secondary branches, leaf number, leaf area and seed yield per plant and number of seeds and seed weight per flower were recorded. The experimental data was averaged for different characters and pooled over both the years and the average values were then statistically analysed for their coefficient of correlations following the procedures as described by Ranghaswamy (2000). Path coefficient analysis was carried out as described by Dewey and Lu (1959) [2].

Results and discussion
Correlation and path analysis on the seed yield of Zinnia revealed that almost all characters were showing significant and positive correlations with seed yield which could be discussed as follows

1. Correlations: The data on correlation studies is presented in Table-1. Analysis of simple correlation between the characters indicated positive correlation (significant at 1% level) for seed yield per plant with most of the characters. It is evident from Table 1 that number of flowers plant^{-1} had maximum correlation (0.879) with yield followed by plant height (0.875) and seed weight flower^{-1} (0.882) whereas, secondary branches per plant showedleast correlation (0.688). These results closely follow the views of Punia and Gill (1994) [5] and El-Hosary *et al.* (1999) [3]. The present investigation revealed significant positive association of seed yield plant^{-1} with number of flowers per plant, plant height, seed weight flower^{-1},leaf are plant^{-1}, number of seeds flower^{-1}, number of leaves plant^{-1},primary branches plant^{-1}, secondary branches plant^{-1} and these results are in line with those obtained by Misra and Sani (1990) who reported positive correlation between plant height, spike length and number of florets spike^{-1} in gladiolus. John *et al*. (1994) in Celosia and Sirohi and Behera in chrysanthemum could also obtain significant positive correlations of number of branches plant^{-1} with number of flowers plant^{-1}. Gowda (1989) also reported that plant height, spike length and number of leaves in gladiolus to have significant positive association with each other.

2. Path analysis: It is evident from Table 2 number of flowers plant^{-1} showed maximum positive direct effect (0.5125) on seed yield plant^{-1}. Number of flowers plant^{-1} seemed to be an important character as all other characters showed more positive indirect effect through the very character on the seed yield than their individual direct effects on the same. Sirohi and Behera (1999) [4] also reported that number of flowers plant^{-1} of chrysanthemum had a high direct effect on its seed yield. It is also revealed that leaf area plant^{-1} showed the highest negative direct effect (-0.3236) on seed yield. Bandopadhyay *et al.* (1997) [1] had also reported that the leaf area constant had greatest negative direct effect on seed yield of marigold.

From the results it is clearly evident that number of flowers plant^{-1} of *Zinnia* is of vital importance, as it seemed to augment or nullify the positive or negative direct effect of other characters on seed yield. It may be also mentioned that this character is highly improved by application of N, P and K @ 200, 100 and 200 kg ha^{-1}, respectively. So, for better seed yield of *Zinnia* N (200 kg ha^{-1}), P (100 kg ha^{-1}) and K (200 kg ha^{-1}) should be recommended.

Table 1: Correlation coefficients of different characters

Characters	Plant height	Pry. Branches plant^{-1}	Sec. Branches plant^{-1}	No. of leaves plant^{-1}	Leaf area plant^{-1}	No. of flowers plant^{-1}	No. of seeds flower^{-1}	Seed wt. Flower^{-1}	Seed yield plant^{-1}
Plant height.	1	0.854**	0.765**	0.826**	0.852**	0.831**	0.644**	0.622**	0.875**
Pry. Branchs Plant^{-1}		1	0.547**	0.661**	0.668**	0.688**	0.480**	0.526**	0.749**
Sec. Branches Plant^{-1}			1	0.795**	0.818**	0.612**	0.665**	0.510**	0.688**
No. of leaves plant^{-1}				1	0.887**	0.764**	0.623**	0.542**	0.751**
Leaf area plant^{-1}					1	0.765**	0.591**	0.083**	0.792**
No. of Flowers Plant^{-1}						1	0.681**	0.718**	0.879**
No. of seeds plant^{-1}							1	0.823**	0.761**
Seed weight floewer^{-1}								1	0.832**
Seed yield plant^{-1}									1

** Significant at 1% level

Table 2: Direct and indirect effects of different characters and their association with seed yield.

Characters	Plant height	Pry. Branches plant^{-1}	Sec. Branches plant^{-1}	No. of leaves plant^{-1}	Leaf area plant^{-1}	No. of flowers plant^{-1}	No. of seeds flower^{-1}	Seed wt. Flower^{-1}
Plant height	0.414118	0.097643	0.072143	0.030336	-0.27577	0.425431	0.216609	-0.10551
Pry. Branches Plant^{-1}	0.353657	0.114336	0.051585	0.024276	-0.21621	0.349571	0.161448	-0.08966
Sec. Branches Plant^{-1}	0.3168	0.062542	0.094305	0.029197	-0.26476	0.313179	0.223673	-0.08693
No. of leaves plant^{-1}	0.342061	0.075576	0.074973	0.036726	-0.2871	0.391602	0.209546	-0.09239
Leaf area plant^{-1}	0.352828	0.076376	0.77142	0.032576	-0.32367	0.392114	0.198783	-0.01415
No. of flower plant^{-1}	0.0343718	0.077977	0.05762	0.028059	-0.24761	0.512568	0.229054	-0.12239
No. of seeds plant^{-1}	0.266692	0.054881	0.062713	0.02288	-0.19129	0.349059	0.33635	-0.14029
Seed weight flower^{-1}	0.256339	0.060141	0.048096	0.019906	-0.02686	0.368024	0.276816	-0.17046

Pry = 0.389

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