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Correlation and Path Analysis in Cut Chrysanthemum (*Dendranthema grandiflora* Tzvelev.) Genotypes

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ABSTRACT

The study was conducted during the year 2022-23 at ICAR-ELP polyhouse, Department of Floriculture and Landscape Architecture, College of Horticulture, Mudigere to study the correlation and path analysis among twenty cut chrysanthemum genotypes. The Correlation studies revealed the number of flower stems per m^2 had highly significant positive correlation with plant spread (N-S), leaf length, leaf width, leaf area, flower diameter and plant spread (E-W) and days taken for bud initiation had significant positive correlation. Path analysis showed number of flower stems per m^2 indicated maximum positive direct effect of flower diameter followed by plant spread (N-S), leaf width, vase life, leaf area, number of leaves per plant, days for bud initiation, plant height which indicated the possibility of increasing flower yield by selecting these characters directly.

Key words: *Cut Chrysanthemum, Correlation and Path analysis.*

Introduction

Chrysanthemum (*Dendranthema grandiflora* Tzvelev.) is one of the most important flower crops. It has been originated from China. The chromosome number is 18 and the family is Asteraceae. In the cut flower trade, the chrysanthemum ranks next to the rose (De and Bhattacharjee, 2003). The word chrysanthemum is derived from the Greek word 'chrysos' means 'golden' and 'anthemon' means 'flower'. It is known as 'Queen of East' and 'Glory of the East', (Thiripurasundari *et al*., 2021).

Chrysanthemum is grown throughout the world as cut, loose and also as potted plants. But recently it is cultivated for cut flower purposes. It can be grown in polyhouse, greenhouse and shade house and also grown in open conditions. For cut flower production of chrysanthemum the value of production is 15.94 thousand tonnes and for loose flower the production value is 454.20 thousand tonnes means the total production value of chrysanthemum is 470.14 thousand tonnes (Anonymous, 2022). Chrysanthemums are mainly classified under two categories such as large- flowered (standard types) and small- flowered (spray types). Standard types are mostly grown for cut flowers and small types are grown for loose flowers (Siddiqua *et al*., 2018).

Flower yield is a complex character controlled by

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a large number of contributing characters and their interactions. A study of correlation between different quantitative characters provides the association that could be effectively exploited to formulate selection strategies for improving yield components. It is essential to know the degree of mutual association (correlation) prevailing between yield and its component characters, which forms a basis for selecting the desirable genotypes. However, the correlation is between the yield and its component characters themselves. The analysis of inter componential correlation is very essential to expose the direct and indirect contribution of each of the components which is determined by path coefficient analysis.

Keeping in view the above facts of present investigation was undertaken with an objective to analyze and determine the traits having greater interrelationship with flower yield utilizing the correlation and path analysis and to help breeders in improvement of cut chrysanthemum.

Materials and Methods

The present investigation was conducted in ICAR-TSP polyhouse, Department of Floriculture and Landscape Architecture, College of Horticulture, Mudigere, Karnataka during 2022-23. Twenty genotypes of cut chrysanthemum were evaluated in randomized complete block design with three replications. Rooted terminal cuttings from nursery were transplanted in the main field with a spacing of 15 cm × 15 cm. Observations were recorded for all the growth, flowering, quality and yield parameters. The observations were recorded at an interval of 30 days from transplanting till completion of harvest.

The estimates of correlation coefficient were done by the method suggested by Hayes *et al*. (1955) and Al-jibouri *et al*. (1958). The path coefficient analysis was carried out by using the technique outlined by Dewey and Lu (1959) for flower yield and its components keeping flower yield as resultant variable and its component as causal variables.

Results and Discussion

Association Analysis

The simple correlation coefficients between yield and various yield components and interrelationship among the traits were computed and they are presented in Table 1. The results obtained through the correlation coefficients indicate a strong association between plant morphological characters with yield. A positive correlation between desirable characters is favourable to the plant breeder which helps in simultaneous improvement. In general, genotypic correlation was higher than phenotypic correlations for most of the characters studied. Genotypic correlation also provides an estimate of inherent association between genes controlling any two characters

Table 1. Phenotypic correlation among different characters on number of flower stems per m^2 in cut chrysanthemum genotypes

Traits	1	2	3	4	5	6	7	8	9	10	11	12
1	1.0000	0.1393	0.285*	-0.0757	0.0947	-0.0147	0.2315	-0.1348	0.0185	0.816**	0.1969	-0.0603
2		1.0000	0.607**	0.804**	0.729**	0.627**	-0.679**	0.2022	0.796**	0.0016	-0.0519	0.726**
3			1.0000	0.304*	0.400*	0.473**	-0.1956	-0.2188	0.583**	0.0930	0.406*	0.361*
4				1.0000	0.928**	0.772**	-0.811**	0.301*	0.814**	-0.0448	0.1233	0.844**
5					1.0000	0.754**	-0.778**	0.355*	0.803**	0.0821	0.282*	0.841**
6						1.0000	-0.651**	0.2227	0.644**	0.0536	0.1735	0.627**
7							1.0000	-0.468**	-0.719**	0.2217	0.0560	-0.774**
8								1.0000	0.0423	-0.2500	-0.469**	0.264*
9									1.0000	-0.0059	0.1608	0.850**
10										1.0000	0.296*	-0.0986
11											1.0000	0.1064
12												1.0000

*&**indicates significant @ 5% and 1% level respectively.

1. Plant height (cm)
2. Plant spread (N- S) (cm)
3. Plant spread (E-W) (cm)
4. Leaf length (cm)
5. Leaf width (cm)
6. Leaf area (cm^2)
7. Number of leaves per plant
8. Days taken for bud initiation
9. Flower diameter (cm)
10. Stalk length (cm)
11. Vase life (days)
12. Number of flower stems per m^2

thus formulating an effective selection scheme. Further the phenotypic expression of correlation is reduced due to the influence of environment, although there is a strong association between various characters.

At genotypic level, the number of flower stems per m^2 had highly significant positive correlation with plant spread (N-S) (0.726), leaf length (0.844), leaf width (0.841), leaf area (0.627), flower diameter (0.850) and plant spread (E-W) (0.361) and days taken for bud initiation (0.264) had significant positive correlation. In future breeding programmes, the significant positive association revealed in this study evidenced the inherent genetic relationship among these traits, which could be of knowledge for simultaneous improvement of related traits. These results are corroboration with the results of Bennurmath *et al.* (2021) in chrysanthemum for plant spread (N-S), diameter of flower and leaf area, Suvija *et al*. (2016) in chrysanthemum for plant spread (E-W), plant spread (N-S), and diameter of flower, Kameswari *et al.* (2015) for plant spread (E-W), plant spread (N-S) in chrysanthemum, Hariskumar *et al.* (2018) and Ramya *et al.* (2019) in china aster, Manjula and Nataraj (2016) in Dahlia.

Path Analysis

Yield is a complex character and is composed of component characters which contribute directly as well as indirectly through each other. The study of correlation alone when considered on the criteria for selection for high yield would be misleading. Since a character may not be directly correlated with yield but may be depend on other characters, by path analysis it is possible to find out the direct and indirect influence of component characters on the yield. The technique of path analysis developed by Wright (1921) and demonstrated by Dewey and Lu (1959) facilitates in partitioning the correlation coefficients into direct and indirect contribution of various characters to the yield. The simple correlation coefficient of annual chrysanthemum was apportioned into direct effects and indirect effects by path analysis and the results are presented in Table 2.

The residual effect (0.360) of the path analysis was low, indicating that the character considered for path analysis was appropriate.

Path analysis showed that number of flower stems per m^2 had maximum positive direct effect of flower diameter (0.7669) followed by plant spread (N-S) (0.5083), leaf width (0.4450), vase life (0.2344), leaf area (0.1894), number of leaves per plant (0.0800), days for bud initiation (0.0785), plant height (0.0705) and direct negative effect on plant spread (E-W) (-0.5478), leaf length (-0.5744) and stalk length (-0.2414). Thus, the higher magnitude of the positive direct effect of these traits explains the higher value of association between these traits and number of flower stems per m^2. Therefore, direct selection for these traits would reward for improve-

Table 2. Phenotypic path coefficient analysis among different characters on number of flower stems per m^2 in cut chrysanthemum genotypes

Traits	1	2	3	4	5	6	7	8	9	10	11	rP
1	0.0705	0.0098	0.0200	-0.0053	0.0067	-0.0010	0.0163	-0.0095	0.0013	0.0575	0.0139	-0.0603
2	0.0708	0.5083	0.3088	0.4086	0.3707	0.3188	-0.3452	0.1028	0.4045	0.0008	-0.0264	0.726**
3	-0.1558	-0.3327	-0.5478	-0.1666	-0.2192	-0.2593	0.1071	0.1198	-0.3192	-0.0510	-0.2224	0.361*
4	0.0435	-0.4617	-0.1747	-0.5744	-0.5328	-0.4432	0.4659	-0.1727	-0.4676	0.0257	-0.0708	0.844**
5	0.0422	0.3245	0.1780	0.4127	0.4450	0.3353	-0.3462	0.1578	0.3573	0.0365	0.1253	0.841**
6	-0.0028	0.1188	0.0896	0.1461	0.1427	0.1894	-0.1232	0.0422	0.1219	0.0102	0.0329	0.627**
7	0.0185	-0.0543	-0.0156	-0.0649	-0.0622	-0.0520	0.0800	-0.0374	-0.0575	0.0177	0.0045	-0.774**
8	-0.0106	0.0159	-0.0172	0.0236	0.0278	0.0175	-0.0367	0.0785	0.0033	-0.0196	-0.0368	0.264*
9	0.0142	0.6102	0.4469	0.6244	0.6159	0.4938	-0.5517	0.0324	0.7669	-0.0045	0.1233	0.850**
10	-0.1969	-0.0004	-0.0225	0.0108	-0.0198	-0.0129	-0.0535	0.0603	0.0014	-0.2414	-0.0715	-0.0986
11	0.0462	-0.0122	0.0952	0.0289	0.0660	0.0407	0.0131	-0.1100	0.0377	0.0694	0.2344	0.1064

Diagonal values indicates direct effect Residual = 0.306 rP = Phenotypic correlation with number of flower stems per m^2

1. Plant height (cm)
2. Plant spread (N- S) (cm)
3. Plant spread (E-W) (cm)
4. Leaf length (cm)
5. Leaf width (cm)
6. Leaf area (cm^2)
7. Number of leaves per plant
8. Days taken for bud initiation
9. Flower diameter (cm)
10. Stalk length (cm)
11. Vase life (days)
12. Number of flower stems per m^2

ment of yield. The results are in accordance with reports of Bindhushree *et al*. (2019) in chrysanthemum for plant spread (N-S), leaf area, days to bud initiation, Prakash *et al.* (2018) in chrysanthemum for diameter of flower, Kameswari *et al*. (2015) for plant spread (N-S), Suvija *et al*. (2016) in chrysanthemum for days for bud initiation, Magar *et al.* (2010) in Gerbera and Ramya *et al*. (2019) in china aster and Manjula and Nataraj (2016) in Dahlia.

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Conflict of Interest

The authors have declared that no conflict of interest exists.

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