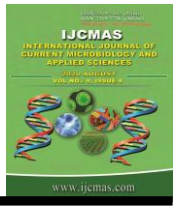
Int.J.Curr.Microbiol.App.Sci (2020) *9*(8): 2944-2950

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 9 Number 8 (2020)**
Journal homepage: http://www.ijcmas.com



Original Research Article https://doi.org/10.20546/ijcmas.2020.908.330

Character Association and Path Co-efficient Analysis for Yield Attributing Traits in Dahlia (*Dahlia variabilis* L.)

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Keywords

Dahlia, Correlation, Path analysis, Selection

Article Info

Accepted:
24 July 2020
Available Online:
10 August 2020

A B S T R A C T

An experiment was conducted with 32 cultivars of dahlia (*Dahlia variabilis* L.) to study correlation and path analysis among the yield attributing traits and their effect. Correlation among component characters showed that flower yield per plant had a highly significant positive genotypic correlation with leaf area index (0.617), crop duration (0.771), flowering duration (0.800), tuber weight (0.668) and change in fresh weight at day 3. Path-coefficient analysis revealed a positive direct effect of duration of crop, duration of flowering, flower diameter, vase life, total chlorophyll content and change in fresh weight at day 3 on flower yield per plant proving that direct selection of these traits can be implemented for yield improvement. Hence the parameters selected in the study are sufficient for direct selection of cultivars for cut flower attributing traits in dahlia.

Introduction

Dahlia (*Dahlia variabilis* L.) is a tuberous rooted herbaceous perennial belonging to the family Asteraceae having its origin in Mexico. It is popular plant for landscaping, cut flower and loose flower purposes (Smith, 1971).Knowledge on inter-relationship of characteristics of crop is of paramount importance as it helps in selecting appropriate components, which would result with improvement of complex characteristics that are correlated with each other (Al-Jibourie *et al.,* 1958). However, ccorrelation coefficient alone cannot provide a complete representation of the causal basis of relationship and path coefficient analysis is relied upon to do so (Islam and Khan, 1991 and McGiffen *et al.,* 1994). Therefore, the present investigation was undertaken to estimate associations among desired traits and their direct and indirect contributions toward yield in thirty two cultivars of dahlia.

Materials and Methods

The experiment was carried out at department of Floriculture and Landscape Architecture, Kittur Rani Channamma College of Horticulture, Arabhavi which is situated in the

Northern dry zone (Zone III) of Karnataka. The experiment was laid out in Randomized Block Design with spacing of 60 cm × 40 cm, which was replicated twice with 32 genotypes in open field condition. Treatments details of cultivars used are enlisted in Table 1.Recommended agro techniques were followed and observations were made on the different vegetative and floral parameters. Genotypic and phenotypic correlation coefficients were calculated according to the formula suggested by Johnson *et al.,* (1955) and Hanson *et al.,* (1956). Correlation coefficient were further partitioned into components of direct and indirect effects by path coefficient analysis originally developed by Wright (1921) and later described by Dewey and Lu (1959).

Results and Discussion

Yield is a complex trait determined by several other parameters. Hence, the association of these characters with yield and among themselves is of paramount factor in selection of best genotypes. It is evident from Table 2 that, flower yield per plant had a highly significant positive genotypic correlation with leaf area index (0.617), crop duration (0.771), flowering duration (0.800), tuber weight (0.668) and change in fresh weight at day 3 (0.347), while non-significant negative correlation was observed between flower yield per plant and plant height at 90 DAP (-0.021). A positive non-significant association with flower yield per plant was observed for all the other traits. A highly significant positive phenotypic correlation was observed between flower yield per plant and leaf area index (0.592), duration of crop (0.686) and duration of flowering (0.778), while tuber weight (0.646) showed a significant positive correlation. All other traits except plant height at 90 DAP showed a non-significant positive correlation (Table 2). These observations regarding vase life were in parallel with studies done by Mathad *et al.,* (2005) in marigold; Kumari *et al.,* (2017) in chrysanthemum. The degree of association between characters as indicated by the correlation coefficients has always been a helpful instrument for the selection of desirable characters under a breeding program (Islam *et al.,* 2010).

According to Table3, at genotypic level, duration of crop (5.848), duration of flowering (2.663) and flower diameter (2.506) had a very high direct positive effect on flower yield per plant while vase length (0.770), total chlorophyll content (0.595) and change in fresh weight at day 3 (0.419) had a high direct positive effect. Plant height at 90 DAP showed a negligible positive effect whereas, water uptake at day 3 (-2.390), plant spread in E-W (-1.664), stalk length (-1.593), tuber weight (-1.508) and LAI (-0.373) showed a direct negative. plant height at 90 DAP had a non-significant negative correlation with flower yield per plant (-0.021) due to indirect negative effect *via* water uptake at day 3 (-1.475), plant spread in E-W (-1.210), stalk length (-1.119), total chlorophyll content (-0.204) and duration of flowering (-0.003) whereas, flower diameter (2.095), duration of crop (1.309), vase life (0.376), change in fresh weight at day 3 (0.081), LAI (0.045) and tuber weight (0.029) had an indirect positive effect. duration of crop had a positive and highly significant correlation with flower yield per plant (0.771) *via* the indirect positive effect of flower diameter (0.659), vase life (0.353), change in fresh weight at day 3 (0.122), plant height at 90 DAP (0.012) and total chlorophyll content (0.0100.), duration of flowering had a highly significant positive correlation with flower yield per plant (0.800) which was due to the indirect positive effect of duration of crop (5.350), flower diameter (0.296), vase life (0.289), change in fresh weight at day 3 (0.138), total

chlorophyll content (0.061)and plant height at 90 DAP (0.0001)Parallel findings were reported by Raghupathi *et al.*, (2019) and Basavaraj (2006) in dahlia; Magar *et al.*, (2010) in gerbera. Hence, direct selection of duration of crop, duration of flowering, flower diameter, vase life, total chlorophyll content and change in fresh weight at day 3 is appropriate for yield improvement.

Table.1 Details of the dahlia genotypes used in present study

Sl. No.	Genotype	Plant stature	Flower colour and scheme
1	Krishna	Tall	Light blend (Pink and light yellow)
2	Barakachri	Tall	Monochromatic (Yellow)
3	Binayananda	Tall	Light blend (orange)
4	Good Day	Tall	Monochromatic (Pink)
5	Glory of India	Tall	Monochromatic (Pink)
6	M Trangini	Tall	Light blend (Tan)
7	Gargi	Tall	Monochromatic (White)
8	Master Pic	Tall	Monochromatic (Red)
9	Hiranmayi	Tall	Bicolour (Red and white)
10	Satya Samrat	Tall	Monochromatic (Orange)
11	Silpa	Tall	Monochromatic (Red)
12	Santashima	Tall	Light Blend (Red and white)
13	Sachin	Tall	Monochromatic (White)
14	Pagaltahaker	Tall	Monochromatic (White)
15	Eternity	Tall	Monochromatic (Yellow)
16	Buddha's Mother	Tall	Bicolour (Red and white)
17	Santi	Tall	Monochromatic (Orange)
18	Jayal Singh	Tall	Monochromatic (Red)
19	Nilkamal	Tall	Light blend (White and red)
20	Salini	Medium	Monochromatic (Yellow)
21	Pusona	Medium	Monochromatic (Pink)
22	Jisu	Medium	Light Blend (White and maroon)
23	Sowmitha	Medium	Light Blend (White and orange)
24	Kaviguru	Medium	Monochromatic (Red)
25	WOK	Medium	Monochromatic (Pink)
26	Sourav	Medium	Monochromatic (Orange)
27	Guddy	Dwarf	Monochromatic (Yellow)
28	OK	Dwarf	Monochromatic (Orange)
29	YBK	Dwarf	Light Blend (Orange and yellow)
30	YK	Dwarf	Light Blend (White and orange)
31	WBK	Dwarf	Monochromatic (Orange)
32	WK	Dwarf	Monochromatic (Orange)

Table.2 Genotypic and phenotypic correlation co-efficient for growth, flowering, quality and yield parameters in dahlia genotypes

	PH	LAI	PS	DC	DF	TW	FD	SL	VL	WU3	CF3	CHL	FPP	GCC= Genotypic correlation coefficient
PH	1	-0.121	0.727**	0.223	0.223*	-0.019	0.836**	0.702**	0.488**	0.638**	0.194	-0.342**	-0.021	
LAI	-0.121	1	-0.058	0.632**	0.632**	0.635**	0.113	0.149	0.314*	0.247*	0.397**	-0.168	0.617**	
PS	0.654**	-0.061	1	0.459**	0.426**	0.154	0.689**	0.624**	0.326**	0.498**	-0.046	-0.015	0.216	
DC	0.206	0.585**	0.337**	1	0.914**	0.807**	0.263*	0.344**	0.459**	0.498**	0.291*	0.016	0.771**	
DF	0.206	0.585**	0.337**	0.835**	1	0.832**	0.118	0.076	0.375**	0.290*	0.329**	0.103	0.800**	
TW	-0.01	0.609**	0.141	0.692**	0.798**	1	0.09	0.250*	0.235*	0.188	0.414**	0.228	0.668**	
FD	0.746**	0.102	0.575**	0.1987	0.113	0.075	1	0.722**	0.677**	0.716**	0.320**	-0.300*	0.139	
SL	0.667**	0.146	0.548**	0.315*	0.063	0.225	0.623**	1	0.419	0.471**	0.244	0.002	0.042	
VL	0.483**	0.303*	0.326**	0.409**	0.371**	0.221	0.600**	0.406**	1	0.910**	0.393**	-0.348**	0.237	
WU3	0.632**	0.245	0.456**	0.462**	0.286*	0.185	0.655**	0.448**	0.898**	1	0.322**	-0.509**	0.173	
CF3	0.182	0.381**	-0.042	0.273*	0.310*	0.361**	0.287*	0.223	0.375**	0.31	1	-0.181	0.347**	
CHL	-0.331**	-0.167	-0.011	0.007	0.098	0.218	-0.262*	0.01	-0.338**	-0.498**	-0.184	1	0.213	
FPP	-0.018	0.592**	0.165	0.686**	0.778**	0.646**	0.103	0.015	0.219	0.170	0.310*	0.198	1	
PCC= Phenotypic correlation coefficient														

(PH-Plant height at 90 DAP (cm), LAI-Leaf Area Index, PS-Plant spread in E-W (cm), DC-Duration of crop (days), DF-Duration of flowering (days), TW-Tuber weight (g) FD-Flower diameter (cm), SL-Stalk length (cm), VL-Vase life days, WU3-Water uptake at day 3 (ml), CF3-Change in fresh weight at day 3 (%), CHL-Total chlorophyll content, FPP-Number of flowers per plant

* Significant at P = 0.05 ** Significant at P = 0.01 r value at 5% = 0.246 and 1% = 0.319

Table.3 Estimates of genotypic and phenotypic path coefficient analysis for growth, flowering, quality and yield parameters in dahlia

Genotypic path coefficient analysis												
	PH	**LAI**	**PS**	**DC**	**DF**	**TW**	**FD**	**SL**	**VL**	**WU3**	**CF3**	**CHL**
PH	**0.054**	-0.006	0.039	0.012	0.000	-0.001	0.045	0.038	0.026	0.033	0.010	-0.018
LAI	0.045	**-0.373**	0.021	-0.236	-0.238	-0.237	-0.042	-0.055	-0.117	-0.077	-0.148	0.062
PS	-1.210	0.097	**-1.664**	-0.763	-0.363	-0.256	-1.147	-1.038	-0.543	-0.700	0.076	0.027
DC	1.309	3.699	2.684	**5.848**	5.350	4.722	1.539	2.009	2.686	2.526	1.705	0.097
DF	-0.003	-1.700	-0.581	-2.436	**2.663**	-2.215	-0.315	-0.202	-0.999	-0.772	-0.876	-0.274
TW	0.029	-0.958	-0.232	-1.218	-1.255	**-1.508**	-0.136	-0.377	-0.355	-0.096	-0.625	-0.344
FD	2.095	0.283	1.727	0.659	0.296	0.226	**2.506**	1.809	1.696	1.715	0.802	-0.754
SL	-1.119	-0.237	-0.995	-0.547	-0.121	-0.399	-1.151	**-1.593**	-0.667	-0.648	-0.388	-0.004
VL	0.376	0.241	0.251	0.353	0.289	0.181	0.521	0.322	**0.770**	0.714	0.303	-0.268
WU3	-1.475	-0.493	-1.006	-1.032	-0.693	-0.152	-1.635	-0.972	-2.216	**-2.390**	-0.823	1.170
CF3	0.081	0.166	-0.019	0.122	0.138	0.173	0.134	0.102	0.164	0.144	**0.419**	-0.076
CHL	-0.204	-0.099	-0.009	0.010	0.061	0.136	-0.179	0.001	-0.207	-0.291	-0.108	**0.595**
FPP	-0.021	0.618**	0.216	0.771**	0.800**	0.668**	0.139	0.042	0.237	0.157	0.347*	0.213
Phenotypic path coefficient analysis												
	PH	**LAI**	**PS**	**DC**	**DF**	**TW**	**FD**	**SL**	**VL**	**WU3**	**CF3**	**CHL**
PH	**0.261**	-0.031	0.171	0.054	0.0005	-0.002	0.195	0.174	0.126	0.159	0.047	-0.086
LAI	-0.049	**0.405**	-0.024	0.237	0.253	0.247	0.041	0.059	0.122	0.083	0.154	-0.067
PS	0.052	-0.004	**0.08**	0.027	0.016	0.011	0.046	0.044	0.026	0.031	-0.003	-0.001
DC	0.054	0.154	0.088	**0.263**	0.22	0.182	0.052	0.083	0.107	0.104	0.072	0.001
DF	0.0005	0.191	0.064	0.255	**0.305**	0.244	0.034	0.019	0.113	0.087	0.095	0.03
TW	0.0006	-0.036	-0.008	-0.041	-0.048	**-0.06**	-0.004	-0.013	-0.013	-0.003	-0.021	-0.013
FD	0.082	0.011	0.063	0.021	0.012	0.008	**0.109**	0.068	0.066	0.068	0.031	-0.028
SL	-0.277	-0.06	-0.227	-0.13	-0.026	-0.093	-0.258	**-0.414**	-0.168	-0.162	-0.092	-0.004
VL	-0.027	-0.017	-0.018	-0.023	-0.021	-0.012	-0.034	-0.023	**-0.057**	-0.052	-0.021	0.019
WU3	-0.021	-0.007	-0.013	-0.013	-0.01	-0.002	-0.021	-0.013	-0.031	**-0.034**	-0.011	0.016
CF3	0.023	0.047	-0.005	0.034	0.039	0.045	0.036	0.028	0.047	0.041	**0.125**	-0.023
CHL	-0.117	-0.059	-0.004	0.002	0.035	0.077	-0.093	0.003	-0.12	-0.17	-0.065	**0.355**
FPP	-0.018	0.592**	0.165	0.686**	0.778**	0.646**	0.103	0.015	0.219	0.152	0.310*	0.198

(PH-Plant height at 90 DAP (cm), LAI-Leaf Area Index, PS-Plant spread in E-W (cm), DC-Duration of crop (days), DF-Duration of flowering (days), TW-Tuber weight (g) FD-Flower diameter (cm), SL-Stalk length (cm), VL-Vase life days, WU3-Water uptake at day 3 (ml), CF3-Change in fresh weight at day 3 (%), CHL-Total chlorophyll content, FPP-Number of flowers per plant.

* Significant at P = 0.05 ** Significant at P = 0.01 r value at 5% = 0.246 and 1% = 0.319 Residual effect = 0.195 Bold: Direct effect Above and below diagonal: indirect effect

At phenotypic level, high direct positive effect was exhibited by LAI (0.405), total chlorophyll content (0.355) and duration of flowering (0.305) while moderate direct positive effect was exhibited by duration of crop (0.263) and plant height at 90 DAP (0.2610).Change in fresh weight at day 3 (0.125) and flower diameter (0.109) showed a low direct positive effect while negative effect was exhibited by stalk length (-0.414), tuber weight (-0.060), vase life (-0.057) and water uptake at day 3 (-0.034).Plant height at 90 DAP had a non-significant negative correlation with flower yield per plant (-0.018) due to negative and indirect effect of stalk length (-0.277), total chlorophyll content (-0.117), LAI (-0.049), vase life (-0.027) and water uptake at day 3 (-0.021) while there was also an indirect positive effect of flower diameter (0.082), duration of crop (0.054), plant spread in E-W (0.052), change in fresh weight at day 3 (0.023), tuber weight (0.0006) and duration of flowering (0.0005). Duration of crop showed a highly significant positive correlation with flower yield per plant (0.686) *via* the indirect positive effect of duration of flowering (0.255), LAI (0.237), plant height at 90 DAP (0.054), change in fresh weight at day 3 (0.034), plant spread in E-W (0.027), flower diameter (0.021) and total chlorophyll content (0.002) while there was an indirect negative effect *via* stalk length (-0.130), tuber weight (-0.041), vase life (-0.023) and water uptake at day 3 (-0.013).

Similar reports were confirmed by Karuppaiah and Kumar (2010), Bharati *et al.*, (2014), Panwar *et al.*, (2014), Anuja and Jahnavi (2012) in marigold; Kumari *et al.*, (2017) in China aster; Deka and Paswan (2014) in chrysanthemum. Hence, direct selection of duration of crop, duration of flowering, flower diameter, vase life, total chlorophyll content and change in fresh weight at day 3 is appropriate for yield improvement.

In conclusion, since more emphasis must be given to restricted selection based on positive direct effects rather than indirect effects, direct selection of duration of crop, duration of flowering and flower diameteris appropriate for simultaneous progression of more than one trait, especially in a complex character like yield which influenced by many other traits. Direct selection of traits that had high direct positive effect is appropriate for yield improvement. The residual effects appeared to be considerably low (0.195) which indicated that the characters included in this study explained almost all variability towards yield.

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How to cite this article:

Maguluri Sree Devi, G. K. Seetharamu, B. C. Patil, C. N. Hanchinamani, Laxman Kukanoor, D. Satish and Sandhyarani Nishani. 2020. Character Association and Path Co-efficient Analysis for Yield Attributing Traits in Dahlia (*Dahlia variabilis* L.). *Int.J.Curr.Microbiol.App.Sci.* 9(08): 2944-2950. doi: https://doi.org/10.20546/ijcmas.2020.908.330