International Journal of Agriculture Sciences
ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 11, Issue 14, 2019, pp.-8782-8784.
Available online at https://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Research Article

CORRELATION AND PATH COEFFICIENT ANALYSIS IN OKRA (*ABELMOSCHUS ESCULENTUS* (L.) MOENCH)

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Received: June 30, 2019; Revised: July 24, 2019; Accepted: July 26, 2019; Published: July 30, 2019

Abstract: An experiment was conducted at Horticulture Research Station, Dr Y. S. R. Horticultural University (Dr YSRHU), Venkataramannagudem, Andhra Pradesh, India during kharif season, 2018, to investigate the interrelationship between yield related characters and extent of their contribution to fruit yield in okra. Correlation analysis revealed that internodal length of main stem (rg=0.859, rp=0.315), number of nodes per plant (rg=0.352, rp=0.226) and average fruit weight (rg=0.992, rp=0.390) registered a positive and significant correlation at both phenotypic and genotypic levels with fruit yield per plant, signifying the importance of these traits in selection for yield. Path coefficient analysis revealed that number of primary branches per plant (0.795), number of nodes per plant (0.594), fruit length (0.765), fruit girth (1.106), leaf chlorophyll content (1.533) and mucilage content (0.352) exerted a high positive direct effect on fruit yield per plant.

Keywords: Okra, Correlation, Path coefficient analysis, Direct and indirect effects

Citation: Kelemoge O.D., *et al*., (2019) Correlation and Path Coefficient Analysis in Okra (*Abelmoschus esculentus* (L.) Moench). International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 11, Issue 14, pp.- 8782-8784.

Introduction

Okra (*Abelmoschus esculentus* (L.) Moench), popularly known as lady's finger and bhendi, belongs to the class dicotyledonae, order Malvales and family Malvaceae [1]. It is grown extensively in tropical, subtropical and Mediterranean climatic zones of the world [2]. Okra fruits are rich in vitamins, calcium, potassium and other mineral matters. Okra seed oil is rich in unsaturated fatty acids such as linoleic acid [3], which is essential for human nutrition. Fruit yield in okra is an intricate quantitative character, which is determined by the relationship between different growth and physiological processes during the life cycle [4]. For improving this crop through conventional breeding and selection, adequate knowledge of association that exists between yield and yield related characters is essential for the identification of selection procedure. Several studies on such aspect had already been conducted using genetic pool *viz*. cultivars, elite lines, accessions and land races of okra. However, few studies included hybrids where breeders have to restrain fundamentally on first filial generation with precise and strong interactions of heterotic effects. In this study, an attempt was made to estimate the interrelationship among characters and the direct and indirect effects of some important yield attributing characters on fruit yield in F1 hybrids of okra by adopting correlation and path coefficient analysis.

Materials and methods

The present experiment was carried out at Horticulture Research Station, Dr. Y. S. R. Horticultural University (Dr. YSRHU), Venkataramannagudem, Andhra Pradesh, India during kharif, 2018. The experimental material consisted of 28 hybrids of okra and a check (Table-1) and the experiment was laid out in a Randomized Block Design with three replications. Seeds of okra were sown at the spacing of 60 × 45 cm. Standard agronomic practices were followed to ensure a good crop stand. The observations were recorded from five randomly selected plants from each treatment and their average values were used for statistical analysis. The data was recorded for various characters *viz*., number of primary branches per plant, internodal length of main stem (cm), number of nodes per plant, days to fifty percent flowering, node at which first flower appear, fruit length (cm), fruit girth (cm), average fruit weight (g), number of seeds per fruit, leaf chlorophyll content (SPAD Units), fruit mucilage content (g/kg), fruit moisture content (%), yellow vein mosaic virus infestation (YVMV) on plants (%) and fruit yield per plant (g). Phenotypic and genotypic correlations were worked out by using formula suggested by [5]. Significance of correlation coefficients was tested by comparing phenotypic correlation coefficients with the table values at (n-2) degrees of freedom [6]. The direct and indirect effects of various characters to yield were calculated through path coefficient analysis as suggested by [7] and elaborated by [8].

Results and discussion

The phenotypic and genotypic correlation coefficients were worked out among fourteen characters and presented in Table 2, Fig-1 and Fig-2. The experimental findings revealed that estimates of genotypic correlation coefficients were higher than their corresponding phenotypic correlation coefficients. In the present study, internodal length of main stem (rg=0.859, rp=0.315), number of nodes per plant (rg=0.352, rp=0.226) and average fruit weight (rg=0.992, rp=0.390) had significant positive association with fruit yield per plant at both phenotypic and genotypic levels. [9-11] discovered similar results for internodal length of main stem, [12] for number of nodes per plant and [10, 11] for average fruit weight. Fruit length (rg=0.522) had significant positive association with fruit yield per plant only at genotypic level and leaf chlorophyll content (rp=0.235) only at phenotypic level. Fruit girth (rg=-0.663), number of seeds per fruit (rg=-0.764), mucilage content (rg=-0.830) and yellow vein mosaic virus (rg=-0.345) had significant negative association with fruit yield per plant only at genotypic level. Fruit yield and yield contributing attributes are interrelated among themselves. This impairs the true association existing between a component and fruit yield. Thus, path coefficient analysis breaks the correlation coefficients into the measures of direct and indirect effect and points out the precise causes of association [13].

Path coefficient analysis at genotypic level is given in Table 3 and Fig 3. Path coefficient analysis revealed that number of primary branches per plant (0.795), number of nodes per plant (0.594), fruit length (0.765), fruit girth (1.106), leaf chlorophyll content (1.533) and mucilage content (0.352) exerted a high positive direct effect on fruit yield per plant. Negative direct effect on fruit yield per plant was recorded for days to fifty percent flowering (-2.208), node at which first flower appear (-1.037), internodal length of main stem (-0.200), average fruit weight (-0.776), number of seeds per fruit (-0.531), fruit moisture content (-1.967) and yellow vein mosaic virus infestation on plants (-1.390). Similar results were reported by [12] for number of primary branches per plant [14, 15] for fruit length, [15] for fruit girth and [16] for days to fifty percent flowering (-2.208).

Table-1 *Germplasm accessions of okra*

T1	(Acc-1 × Acc-29)	T16	(Acc-17 × Acc-29)
T2	(Acc-3 × Acc-01)	T17	(Acc-17 × Acc-40)
T3	(Acc-3 × Acc-16)	T18	(Acc-17 × Acc-41)
T4	(Acc-3 × Acc-17)	T19	(Acc-17 × Acc-43)
T5	(Acc-3 × Acc-29)	T20	(Acc-40 × Acc-01)
T6	(Acc-3 × Acc-40)	T21	(Acc-40 × Acc-29)
T7	(Acc-3 × Acc-41)	T22	(Acc-40 × Acc-41)
T8	(Acc-3 × Acc-43)	T23	(Acc-40 × Acc-43)
T9	(Acc-16 × Acc-01)	T24	(Acc-41 × Acc-01)
T10	(Acc-16 × Acc-17)	T25	(Acc-41 × Acc-29)
T11	(Acc-16 × Acc-29)	T26	(Acc-41 × Acc-43)
T12	(Acc-16 × Acc-40)	T27	(Acc-43 × Acc-01)
T13	(Acc-16 × Acc-41)	T28	(Acc-43 × Acc-29)
T14	(Acc-16 × Acc-43)	T29	Standard check (Mona 002)
T15	(Acc-17 × Acc-01)		

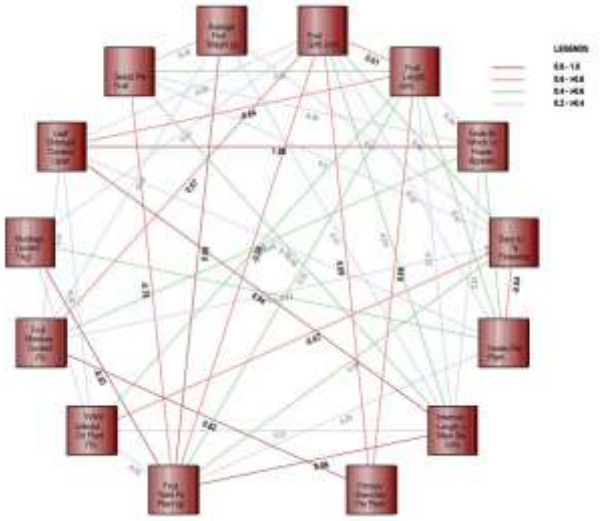

Fig-1 Diagrammatic representation of genotypic correlation between yield and yield contributing characters

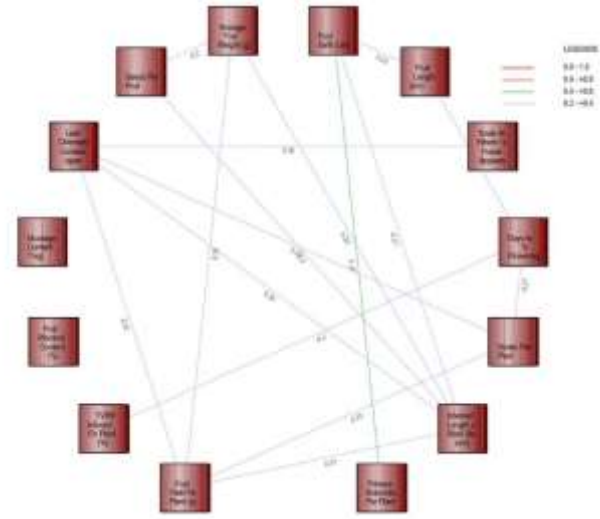

Fig-2 Diagrammatic representation of phenotypic correlation between yield and yield contributing characters

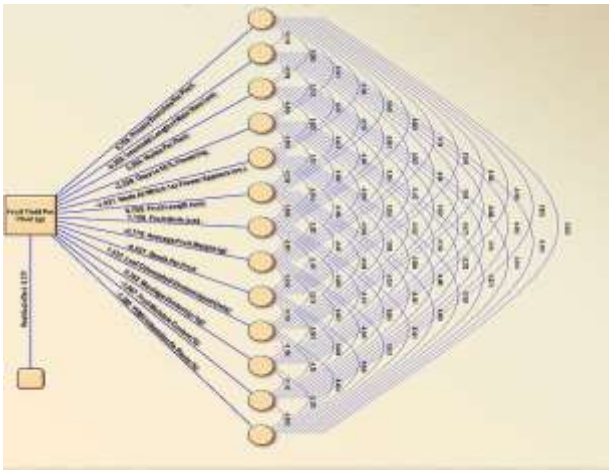

Fig-3 Genotypic path diagram representing direct and indirect effects of fruit yield per plant

Conclusion

The nature and extent of correlation among various characters varied. Correlation study indicated that internodal length of main stem, number of nodes per plant and average fruit weight had significant positive association with fruit yield per plant at both phenotypic and genotypic levels. In addition to this fruit yield per plant shown direct effect in positive direction with number of primary branches per plant, number of nodes per plant, fruit length, fruit girth, leaf chlorophyll content and mucilage content. These parameters could be used as selection parameters for the development of elite hybrids via heterosis breeding or for the development of inbred lines following pure line selection scheme in succeeding generations in okra.

Application of research: Development of best hybrids through heterosis breeding or for the development of inbred lines following pure line selection scheme in subsequent generations in okra.

Research Category: Crop improvement

Abbreviations: NPB- number of primary branches per plant, ILM- internodal length of main stem, NNP- number of nodes per plant, DFF- days to fifty percent flowering, NFF- node at which first flower appear, FL- fruit length, FG- fruit girth, AFW- average fruit weight, NSF- number of seeds per fruit, LCC- leaf chlorophyll content, MC- mucilage content, FMC- fruit moisture content, YVMVI- yellow vein mosaic virus infestation on plants, FYP- fruit yield per plant.

Acknowledgement / Funding: Authors are thankful to Dr Y.S.R. Horticultural University, Venkataramannagudem, West Godavari, 534101, Andhra Pradesh. Authors are also thankful to Indian Council of Agricultural Research, New Delhi, India for providing financial support

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Research project name or number: MSc Thesis

Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: Horticulture Research Station, Dr. Y.S.R. Horticultural University, Venkataramannagudem, West Godavari, 534101, Andhra Pradesh

Table-2 *Genotypic and phenotypic correlation coefficient for different characters of okra genotypes*

Character		ILM	NNP	DFF	NFF	FL	FG	AFW	NSF	LCC	MC	FMC	YVMVI	FYP
NPB	rg	-0.115	-0.086	0.121	0.153	0.661***	0.689***	0.18	0.194	0.156	-0.195	0.823***	-0.021	-0.055
	rp	-0.08	-0.052	0.079	0.056	0.077	0.410***	-0.018	-0.016	0.089	0.028	0.184	-0.036	0.188
ILM	rg		-0.078	-0.133	0.230*	-0.217*	-0.591***	0.307***	-0.560***	0.940***	-0.068	0.018	-0.374	0.859***
	rp		0.032	-0.187	0.17	-0.019	-0.213*	0.235*	-0.201	0.382***	0.157	0.067	-0.184	0.315***
NNP	rg			-0.639***	0.502***	-0.474***	-0.347***	0.074	0.117	0.307***	-0.471***	0.15	0.161	0.352***
	rp			-0.268*	0.074	0.023	0.003	0.113	-0.107	0.252*	-0.105	0.082	0.034	0.226*
DFF	rg				-0.003	0.07	0.556***	-0.206	0.204	-0.167	0.133	-0.232*	-0.671***	-0.563***
	rp				-0.111	-0.204	0.147	-0.159	0.032	-0.075	-0.004	-0.088	-0.203	-0.112
NFF	rg					-0.238*	-0.054	-0.165	-0.384***	1.089***	0.088	0.489***	0.181	-0.082
	rp					-0.111	-0.068	0.017	-0.029	0.281***	0.041	0.132	0.124	0.154
FL	rg						0.608***	0.083	-0.490***	-0.636***	-0.037	-0.161	0.589***	0.522***
	rp						0.234*	0.1	-0.075	-0.113	-0.002	0.016	0.194	0.059
FG	rg							-0.051	-0.141	-0.292***	-0.372***	0.665***	-0.181	-0.663***
	rp							-0.04	0.03	-0.02	0.017	0.04	0	0.001
AFW	rg								-0.424***	0.015	0.052	-0.386***	0.011	0.992***
	rp								-0.203	0.053	0.033	-0.065	0.055	0.390***
NSF	rg									-0.101	-0.063	0.049	0.028	-0.764***
	rp									-0.086	0.18	-0.133	0.03	-0.103
LCC	rg										-0.156	0.220*	-0.354***	0.129
	rp										0.068	0.109	-0.062	0.235*
MC	rg											0.113	-0.383***	-0.830***
	rp											-0.139	0.026	0.088
FMC	rg												-0.025	0.075
	rp												-0.054	-0.158
YVMVI	rg													-0.345***
	r_p													0.089

, * significant at 5% and 1% level, respectively.*

NPB- number of primary branches per plant, ILM- internodal length of main stem, NNP- number of nodes per plant, DFF- days to fifty percent flowering, NFF- node at which first flower appear, FL- fruit length, FG- fruit girth, AFW- average fruit weight, NSF- number of seeds per fruit, LCC- leaf chlorophyll content, MC- mucilage content, FMC- fruit moisture content, YVMVI- yellow vein mosaic virus infestation on plants, FYP- fruit yield per plant.

Table-3 *Path coefficient analysis for different characters of okra genotypes at genotypic level*

Character	NPB	ILM	NNP	DFF	NFF	FL	FG	AFW	NSF	LCC	MC	FMC	YVMVI	FYP
NPB	0.795	-0.091	-0.068	0.096	0.122	0.525	0.548	0.143	0.154	0.124	-0.155	0.654	-0.016	-0.055
ILM	0.023	-0.2	0.016	0.027	-0.046	0.043	0.118	-0.061	0.112	-0.188	0.014	-0.004	0.075	0.859***
NNP	-0.051	-0.046	0.594	-0.38	0.298	-0.282	-0.206	0.044	0.069	0.182	-0.28	0.089	0.096	0.352***
DFF	-0.268	0.294	1.411	-2.208	0.006	-0.154	-1.228	0.454	-0.451	0.369	-0.293	0.513	1.481	-0.563***
NFF	-0.159	-0.238	-0.52	0.003	-1.037	0.247	0.056	0.171	0.398	-1.129	-0.092	-0.507	-0.188	-0.082
FL	0.506	-0.166	-0.363	0.053	-0.182	0.765	0.465	0.063	-0.375	-0.487	-0.029	-0.123	0.451	0.522***
FG	0.762	-0.654	-0.384	0.615	-0.06	0.672	1.106	-0.057	-0.156	-0.323	-0.411	0.736	-0.2	-0.663***
AFW	-0.14	-0.239	-0.057	0.16	0.128	-0.064	0.04	-0.776	0.329	-0.011	-0.041	0.3	-0.009	0.992***
NSF	-0.103	0.297	-0.062	-0.108	0.204	0.26	0.075	0.225	-0.531	0.053	0.033	-0.026	-0.015	-0.764***
LCC	0.24	1.441	0.47	-0.256	1.669	-0.976	-0.448	0.022	-0.154	1.533	-0.24	0.337	-0.543	0.129
MC	-0.069	-0.024	-0.166	0.047	0.031	-0.013	-0.131	0.018	-0.022	-0.055	0.352	0.04	-0.135	-0.830***
FMC	-1.62	-0.035	-0.295	0.457	-0.963	0.316	-1.309	0.76	-0.097	-0.432	-0.222	-1.967	0.049	0.075
YVMVI	0.029	0.52	-0.224	0.932	-0.252	-0.818	0.251	-0.016	-0.039	0.492	0.533	0.034	-1.39	-0.345***

R SQUARE = 0.8625, RESIDUAL EFFECT = 0.3709

*Data underlined was direct effect. *, *** significant at 5% and 1% level, respectively.*

NPB- number of primary branches per plant, ILM- internodal length of main stem, NNP- number of nodes per plant, DFF- days to fifty percent flowering, NFF- node at which first flower appear, FL- fruit length, FG- fruit girth, AFW- average fruit weight, NSF- number of seeds per fruit, LCC- leaf chlorophyll content, MC- mucilage content, FMC- fruit moisture content, YVMVI- yellow vein mosaic virus infestation on plants, FYP- fruit yield per plant.

Cultivar / Variety / Breed name: Okra (*Abelmoschus esculentus* (L.) Moench)

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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