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Path Coefficient Analysis of Some Mango Varieties Grown Under Orissa Agro-Climatic Condition

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Abstract

An experiment was conducted in a private orchard with eight commercial mango varieties of Orissa of age five years during 2000-2002 and 17 characters were studied for two seasons, to assess the genotypic and phenotypic path coefficient in correlation to yield of mango. This was primarily done to enumerate the characters to be considered before going for mango improvement program. The data collected over two years were pooled over and subjected to statistical analysis. The result indicated that canopy area in m^2 (24.266), number of laterals per m^2(10.55), days for flower initiation (7.381), panicle width (7.064), sex ration (5.079) pulp % (4.954), number of leaves per shoot (1.417) and fruit weight in grams (0.004) have direct effect on yield at genotypic level and should be considered for improvement by the breeder during selection of a variety. While phenotypic path coefficient analysis indicated that days for flower initiation (1.322), canopy area (0.974), number of perfect flowers (0.693), fruit set per panicle (0.538), sex ratio (0.477), fruit weight (0.151), pulp % (0.121), number of laterals per m^2 (0.105), number of rachis per panicle (0.054) direct effect on yield. Characters like canopy area (m^2), flower initiation (days), pulp% had direct effect on yield both at genotypic and phenotypic level.

Key words : Path coefficient analysis, Mango varieties, Yield improvement.

Mango is a fruit of tropics and subtropics. It is valued for its lucious taste, sweet flovor and vibrant color (1). About 1,000 genotypes are under cultivation in different agro-climatic zones of India. However, only 40 varieties are of commercial importance and that too have alternate bearing and low yield potential. Many experiments are conducted for increasing the yield of mango and other advantages like earliness, regularity, dwarfness and resistance to biotic and abiotic stress but the experiments usually take a long time as it is a tree which takes a long time for its yield stability with many small flowers which the hybridization process difficult and takes years to achieve success. So, the present experiment was conducted to assess the characters of mango plant that contributes for enhancing the yield. The degree of association between the yield and its contributing characters will determine the component characters on which selection can be made. The efficiency will depend on the amount of existing variation in the material and the extent to which it is heritable.

Methods

An experiment was made in a private orchard at Bhubaneswar during 2000-2002 to evaluate eight commercial mango varieties of Orissa. The experiment was laid out in (randomized block design) with three replications (Table 1).

A set of three trees aged about 5 years were selected for the study. The trees were subjected to uniform cultural treatment during the course of investigation.

The characters studied were plant height (m), number of laterals/m^2, canopy area (m^2), leaf area (cm^2) number of leaves per shoot, flower initiation (days), flower duration (days), panicle length (cm), panicle width (cm), number of panicles/m^2, number of rachies/ panicle, number of perfect flowers/panicle, sex ratio, fruit set/panicle, pulp %, fruit weight (g) and yield.

Pooled mean data for two seasons were recorded and were statistically analyzed for determinig the genotypic and phenotypic path coefficients. The results are enumerated for genotypic and phenotypic path coeficients.

Results and Discussion

The correlation of fruit yield with other charac-

Table 1. Brief information about the mango cultivars under study.

	Cultivars	Source/parentage	Remarks
V_1	Alphonso	Ratnagiri Maharashtra	Rated to be best, fruits are attractive, medium sized, oval, taste and flavor superb, moderate yielding and biennial in bearing habit. Good sugar: acid blend. Keeping quality is good
V_2	Amrapalli	Dasheri × Neelum (IARI)	Dwarf, cluster bearing, regular bearer, suitable for high density plantation. Mid to late maturing, fruits are good, pulp is firm, fiberless with excellent orange color, keeping quality is good
V_3	Arka Puneet	Alphonso × Banganpalli (IIHR)	Vigorous plant type with regular and prolific bearing, medium size fruit with good aroma and flavour, free from spongy tissue, good keeping qualitysuitable for table purpose and processing. Good sugar : acid blend
V_4	Sindhu	Ratna × Alphonso	Regular bearer, Very small seed, suitable for high density planting, very good fruit quality.
V_5	Mallika	Neelum × Dasheri (IARI)	Precocious, highly regular, and prolific bearer, bearer, fruits contain high vitamin A, larger fruit, moderate keeping quality, suitable for export
V_6	Prabhasankar	Bombay × Kalapadi (F. R. S. Sabour)	Regular bearer, pulp is very sweet having fibers on stone
V_7	Ratna	Neelum × Alphonso (Vengurulla, Maharashtra)	Regular bearer, larger fruit size than its parents, very sweet in taste and pleasant flavor, good keeping quality and free from spongy tissue and fiber
V_8	Kesar	Gujarat	Fruits are medium to large in size, oblong with very attractive light apricot yellow color, moderate yielding and biennial in bearing habit, Flesh is sweet and fiberless good processing quality

ters was partitioned into components of direct and indirect effects that would show the nature of these associations and relative importance of the components in determining fruit yield in mago.

The results obtained in path coefficient analysis revealed that yield per plant was greatly influenced by major variables that is canopy area in m^2 (24.266), number of laterals per m^2 (10.55), days to flower initiation (7.381) panicle width (7.064 cm), sex-ratio (5.079), pulp% (4.954), and fruit weight (0.004). Bhol (2) reported, that number of flowers/panicle and number of perfect flowers/panicle have direct positive effect on yield genotypically (Table 2).

Phenotypic path analysis revealed that days taken for flower initiation (1.322) had highest positive direct effect followed by canopy area in m^2 (0.974), number of perfect flowers (0.693), fruit set/panicle (0.538), sex ratio (0.477), fruit weight (0.151), pulp% (0.121), number of laterals/m^2 (0.105) and number of rachis/panicle (0.054) (Table 3).

The contribution of these characters for yield enhancement was positive in direct ways. These traits should be considered for selection and hybridization program for further improvement of yield.

Conclusion

The yield which is an important economic character is the ultimate effect of interaction of several qualitative traits and is highly varied based on the change in environment. The canopy area exerted highest direct positive effect on yield followed by no. of laterals/m^2, days to flower initiation, panicle width,

Table 2. Path coefficient analysis of fruit yield per plant verses important quantitative characters in mango at genotypic level. The bold letters indicate the direct path of the characters in correlation to yield.

Characters	Plant height (m)	Number of laterals /m²	Canopy area (m²)	Leaf area (cm²)	Number of leaves/ shoot	Flowering initiation (days)	Flowering duration (days)	Panicle length (cm)	Panicle width (cm)
Plant height (m)	**-5.424**	-7.353	16.319	0.443	1.133	-4.119	-0.632	3.105	-3.780
Number of laterals/m²	3.780	**10.550**	-14.317	0.468	-0.346	-0.725	2.255	-3.520	-0.140
Canopy area (m²)	-3.648	-6.224	**24.266**	0.625	0.272	-3.965	-0.981	-15.771	1.956
Leaf area (cm²)	1.460	-3.001	-9.214	**-1.645**	-0.569	6.049	-0.914	8.866	24.238
Number of leaves/ shoot	-4.337	-2.576	4.667	0.660	**1.417**	-1.514	0.286	12.667	-6.867
Flowering initiation (days)	3.026	-1.037	-13.034	-1.348	-0.291	**7.381**	-0.725	11.555	2.415
Flowering duration (days)	-1.347	-9.352	9.356	-0.591	-0.159	2.103	**-2.544**	9.684	0.162
Panicle length (cm)	0.630	1.390	14.325	0.546	-0.672	3.193	0.922	-26.715	4.743
Panicle width (cm)	2.902	-0.209	6.720	-0.987	-1.377	2.524	-0.058	-17.936	7.064
Number of panicle/m²	4.471	8.877	-13.194	0.396	-0.249	1.902	1.149	-3.395	-0.129
Number rachis/panicle	-0.301	0.177	0.261	-0.330	0.294	0.071	0.265	4.228	2.168
Number of perfect flowers/panicle	-3.301	0.177	0.261	-0.330	0.294	0.071	0.265	4.228	2.168
Sex ratio	-1.836	-1.264	14.642	1.162	0.070	-4.774	0.429	-16.704	-1.798
Fruit set/panicle	4.035	2.580	-18.774	-1.208	-0.555	7.397	0.450	6.823	2.173
Pulp%	3.637	4.642	-7.621	0.733	-0.987	1.056	1.898	-12.713	6.618
Fruit weight (g)	2.494	-2.888	39.792	0.939	-1.902	-8.271	1.157	38.924	4.374

Table 2. Continued.

Characters	Number of panicle /m²	Number rachi/ panicle	Number of perfect flowers/ panicle	Sex ratio	Fruit set/ panicle	Pulp (%)	Fruit weight (g)	Correlation with yield
Plant height (m)	4.092	-0.923	-0.281	1.719	2.594	-3.322	-0.002	-0.336
Number of laterals/m²	-4.178	0.561	-0.085	-0.608	-0.799	2.179	-0.001	-0.460
Canopy area (m²)	2.699	-0.719	-0.054	3.065	2.529	-1.556	-0.007	0.796
Leaf area (cm²)	1.194	-0.899	-1.016	-3.587	-2.401	2.207	-0.003	-0.671
Number of leaves/shoot	0.873	-0.063	-1.049	0.251	1.281	-3.451	-0.006	0.027
Flowering initiation (days)	1.280	0.122	-0.048	-3.285	-3.275	-0.709	-0.005	-0.794
Flowering duration (days)	2.424	-0.299	0.528	-0.857	0.578	-0.696	-0.002	0.339
Panicle length (cm)	-0.631	-0.516	0.801	3.176	0.798	2.357	0.006	0.056
Panicle width (cm)	0.091	-0.890	-1.533	-1.292	-1.006	4.641	0.003	0.889
Number of panicle/m²	**-4.965**	1.414	1.687	-0.540	-1.321	0.548	-0.002	-0.824
Number rachis/panicle	1.655	**1.311**	-5.061	-2.756	0.418	0.520	0.004	-0.535
Number of perfect flowers/panicle	1.655	-1.311	**-5.061**	-2.756	0.418	0.520	0.004	-0.116
Sex ratio	0.528	0.632	2.746	**5.079**	1.735	-0.537	0.005	0.248
Fruit set/panicle	-2.009	0.119	0.648	-2.696	**-3.269**	3.059	-0.002	-0.558
Pulp%	-0.549	-1.248	-0.532	-0.551	-2.019	**4.954**	0.001	-0.269
Fruit weight (g)	2.403	-1.353	-4.693	5.158	1.665	1.311	**0.004**	-0.697

sex ratio, pulp percent and fruit weight indicating the characters as important yield attributing features to be considered to achieve success in increasing yield of mango through selection.

Table 3. Path coefficient analysis of fruit yield per plant verses important quantitative characters in mango at phenotypic level. The bold letters indicate the direct path of the characters in correlation to yield.

Characters	Plant height (m)	Number of laterals/m^2	Canopy area (m^2)	Leaf area (cm^2)	Number of leaves/ shoot	Flowering initiation (days)	Flowering duration (days)	Panicle length (cm)	Panicle width (cm)
Plant height (m)	**-0.164**	-0.610	0.555	0.162	-0.169	-0.612	0.013	0.082	0.062
Number of laterals/m^2	0.096	**0.105**	-0.570	0.226	0.063	-0.130	0.054	-0.111	0.003
Canopy area (m^2)	-0.094	-0.061	**0.974**	0.301	-0.050	-0.707	-0.023	-0.496	-0.038
Leaf area (cm^2)	0.033	-0.029	-0.361	**-0.811**	0.104	1.061	-0.021	0.276	-0.081
Number of leaves/ shoot	-0.106	-0.025	0.188	0.323	**-0.261**	-0.266	0.007	0.396	0.132
Flowering initiation (days)	0.076	0.010	-0.521	-0.651	0.052	**1.322**	-0.017	0.366	-0.047
Flowering duration (days)	-0.034	-0.093	0.373	-0.285	0.029	0.375	**-0.061**	0.304	-0.003
Panicle length (cm)	0.016	0.014	0.572	0.265	0.122	-0.571	0.022	**-0.845**	-0.092
Panicle width (cm)	0.074	-0.002	0.268	-0.475	0.250	0.451	-0.001	-0.566	**-0.138**
Number of panicle/m^2	0.112	0.088	-0.526	0.198	0.045	0.339	0.027	-0.108	0.002
Number rachis/ panicle	-0.112	-0.047	0.561	-0.658	-0.008	-0.133	-0.015	-0.349	-0.098
Number of perfect flowers/panicle	-0.009	0.002	0.011	-0.173	-0.053	0.012	0.006	0.134	-0.042
Sex ratio	-0.046	0.013	0.585	0.564	-0.013	-0.853	0.010	-0.528	0.035
Fruit set panicle	0.108	0.025	-0.742	-0.577	0.099	1.313	0.011	0.204	-0.042
Pulp%	0.091	0.046	-0.304	-0.355	0.180	0.188	0.046	-0.401	-0.128
Fruit weight (g)	0.063	-0.029	1.590	0.455	0.347	-1.479	0.028	-1.231	-0.085

Table 3. Continued.

Characters	Number of panicle m^2	Number rachis/ panicle	Number of perfect flowers panicle	Sex ratio	Fruit set panicle	Pulp (%)	Fruit weight (g)	Correlation with yield
Plant height (m)	0.289	0.037	0.037	0.135	-0.352	-0.066	-0.058	-0.315
Number of laterals/m^2	-0.355	-0.024	0.012	0.057	-0.130	-0.053	0.041	-0.143
Canopy area (m^2)	0.229	0.031	0.008	0.287	-0.410	-0.038	0.247	-0.088
Leaf area (cm^2)	0.103	0.044	0.147	-0.332	0.382	0.053	-0.085	0.028
Number of leaves/shoot	0.073	0.002	0.140	0.024	-0.205	-0.083	-0.201	0.140
Flowering initiation (days)	-0.109	-0.005	0.006	-0.308	0.534	0.017	-0.169	0.426
Flowering duration (days)	0.190	0.013	-0.072	-0.080	-0.093	-0.090	-0.069	-0.064
Panicle length (cm)	-0.054	0.022	-0.110	0.298	-0.130	0.057	0.220	-0.167
Panicle width (cm)	-0.008	0.038	0.211	-0.121	0.164	0.113	0.093	0.172
Number of panicle/m^2	**-0.424**	-0.062	-0.232	-0.051	0.216	0.013	-0.073	-0.118
Number rachis/panicle	0.491	**0.054**	0.763	-0.245	-0.059	0.122	0.165	0.211
Number of perfect flowers/panicle	0.142	0.059	**0.693**	-0.258	-0.069	0.013	0.140	0.521
Sex ratio	0.045	-0.028	-0.375	**0.477**	-0.282	-0.013	0.153	-0.225
Fruit set panicle	-0.170	-0.006	0.089	0.250	**0.538**	0.074	-0.076	0.472
Pulp%	-0.047	0.054	0.073	-0.052	0.328	**0.121**	0.040	0.023
Fruit weight (g)	0.205	0.059	0.640	0.485	-0.272	0.032	**0.151**	0.599

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