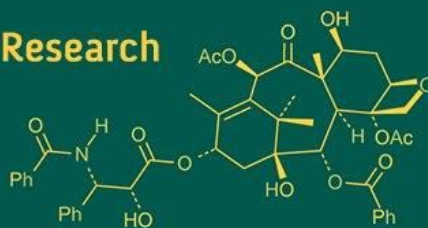
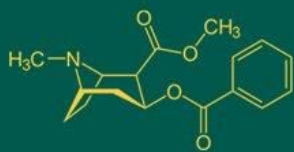


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Studies on relationship among yield and its components through correlation in mango germplasm

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Abstract

The investigation entitled “studies on relationship among yield and its components through correlation in mango (*Mangifera indica* L.) germplasm” was carried out during the period 2021-22 and 2022-2023 at Mango Research Station, Nuzvid, Eluru District, Andhra Pradesh. In the study, positive association of fruit yield per tree (kg) was observed with the height of mature tree (m) (0.091), inflorescence width (cm) (0.069), no. of hermaphrodite flowers in the inflorescence (0.264), fruit length (cm) (0.158), fruit diameter (cm) (0.339), fruit weight (g) (0.369), pulp weight (g) (0.434), peel weight (g) (0.476), number of fruits/tree (0.721), stone length (cm) (0.202), stone width (cm) (0.276) and stone weight (g) (0.386) at genotypic level. As a result, these traits emerged as the most important predictors of fruit yield per tree in mango. Therefore, the above-mentioned characters must be included in the selection criteria for improving of the fruit yield in mango.

Keywords: *Mangifera indica*, Crop improvement, Fruit yield per tree, Genotypes, Positive association

1. Introduction

Mango (*Mangifera indica* L.) is the most nutritive and delicious fruit crop belonging to the Anacardiaceae family and originated in Indo-Burma region. Due to its popularity and importance, mango is often named ‘King of fruits’ for its luscious flavour and taste. It is recognized as the pride fruit of India, being the richest source of vitamin A (4800 I.U.), vitamin C, minerals and other nutrients (Bhamini *et al.*, 2018) [3]. In India, mango is cultivated in an area of 2325 thousand hectares with production of 208.99 lakh tonnes and 9.0 MT/ha productivity. The major mango-growing states in India encompass Uttar Pradesh, Karnataka, Andhra Pradesh, Telangana, Bihar, West Bengal and Gujarat *etc.* Notably, in Andhra Pradesh it is cultivated in an area of 378.94 thousand ha, yielding a production of 4926.22 MT and productivity of 13 MT/ha (NHB Data base, 2020-21). Correlation analysis is an important genetic attribute in crop improvement programme. This analysis measures the mutual relationship between different characters and determines component characters on which selection for genetic improvement can be done.

2. Material and Methods

The experiment was conducted to study the relationship among yield and its components through correlation. The experiment was laid out in an Augmented Block Design consisting of 36 genotypes and 4 checks. The details of genotypes are furnished in Table 1. Genotypes are named as per the names of the blocks *i.e.* B, C, D, E, F, G, H and I.

Table 1: List of 36 genotypes and 4 checks used in the study.

S. No.	Genotype	S.No.	Genotype
1	B-6	21	F-16
2	B-9	22	G-7
3	B-10	23	G-19
4	B-17	24	G-28
5	B-20	25	G-30
6	C-1	26	H-5
7	C-6	27	H-7
8	C-13	28	H-16
9	C-24	29	H-17
10	D-7	30	H-32
11	D-12	31	H-49
12	D-13	32	H-58
13	E-2	33	I-1
14	E-3	34	I-2
15	E-6	35	I-3
16	E-8	36	I-4
17	E-11	37	Banaganapalle (Table variety)
18	F-4	38	Chinnarasam (Juicy variety)
19	F-10	39	Jalal (Pickle variety)
20	F-12	40	Suvarnarekha (Coloured variety)

To determine the degree of association of characters with yield and also among the yield components, the correlation coefficient was calculated.

The genotypic coefficient of correlation between two characters were determined by using the variance and covariance components as suggested by Jibouri *et al.* (1958) [6].

$$rg(xy) = \frac{Cov_g(x, y)}{\sqrt{\sigma_g^2(x) \cdot \sigma_g^2(y)}}$$

Where,

$r_g(xy)$ is the genotypic correlation coefficient.

$Cov_g(xy)$ is the genotypic covariance of xy .

$\sigma_g^2(x)$ is the genotypic variance of x .

$\sigma_g^2(y)$ is the genotypic variance of y .

The calculated value of 'r' was compared with table 'r' value with $n-2$ degrees of freedom at 5% and 1% level of significance, where, n refers to number of pairs of observation.

3. Results and Discussion

3.1 Height of mature tree (m)

Height of mature tree had significant positive correlation with stone width (0.346*). It also recorded positive association with inflorescence length (0.063), no. of hermaphrodite flowers in the inflorescence (0.259), fruit diameter (0.239), fruit weight (0.170), pulp weight (0.286), peel weight (0.171), pulp to stone ratio (0.150), stone length (0.002), stone weight (0.058) and fruit yield per tree (0.091). Whereas, negative correlation was recorded with inflorescence width (-0.065), fruit length (-0.054), number of fruits/tree (-0.026) and total soluble solids (-0.256) (Table 2 and Figure 1). Similar observations with regard to positive correlation of height of mature tree with fruit yield per tree was earlier reported by Barhate *et al.* (2012) [2] and Majumder *et al.* (2012) [9] in mango.

3.2 Inflorescence length (cm)

Inflorescence length showed significant positive correlation with inflorescence width (0.552**). It exhibited positive association with fruit length (0.259), fruit weight (0.097), pulp weight (0.108), peel weight (0.020), pulp to stone ratio

(0.033), stone length (0.251) and stone weight (0.006). Significant negative correlation was recorded with no. of hermaphrodite flowers in the inflorescence (-0.331*). Whereas, negative correlation was recorded with fruit diameter (-0.076), number of fruits/tree (-0.099), stone width (-0.045), total soluble solids (-0.075) and fruit yield per tree (-0.076) (Table 2 and Figure 1). Similar results was earlier reported by Sridhar *et al.* (2022) [11] who revealed positive association of inflorescence length with inflorescence width and fruit weight in mango.

3.3 Inflorescence width (cm)

Inflorescence width exhibited positive correlation with fruit length (0.259), fruit diameter (0.119), fruit weight (0.149), pulp weight (0.085), peel weight (0.103), pulp to stone ratio (0.076), stone length (0.118) and fruit yield per tree (0.069). While, negative correlation was recorded with no. of hermaphrodite flowers in the inflorescence (-0.190), number of fruits/tree (-0.0004), stone width (-0.089), stone weight (-0.040) and total soluble solids (-0.154) (Table 2 and Figure 1). Similar findings with respect to positive correlation of inflorescence width with fruit yield per tree was earlier reported by Elaiyaraja *et al.* (2021) [4] in mango.

3.4 No. of hermaphrodite flowers in the inflorescence

No. of hermaphrodite flowers in the inflorescence showed significant positive correlation with fruit length (0.331*), fruit weight (0.387*), pulp weight (0.349*), stone width (0.317*) and stone weight (0.349*). A positive association was recorded with fruit diameter (0.270), peel weight (0.274), number of fruits/tree (0.035), stone length (0.247) and fruit yield per tree (0.264). Whereas, negative correlation was recorded with pulp to stone ratio (-0.107) and total soluble solids (-0.108) (Table 2 and Figure 1).

3.5 Fruit length (cm)

Fruit length had significant positive correlation with fruit diameter (0.338*), fruit weight (0.717**), pulp weight (0.710**), peel weight (0.720**), stone length (0.831**), stone width (0.495**) and stone weight (0.540**). It also recorded positive association with pulp to stone ratio (0.148) and fruit yield per tree (0.158). While, negative correlation was recorded with number of fruits/tree (-0.252) and total soluble solids (-0.142) (Table 2 and Figure 1). Similarly positive correlation of fruit length with fruit yield per tree was earlier reported by Lal *et al.* (2017) [8] and Elaiyaraja *et al.* (2021) [4] in mango.

3.6 Fruit diameter (cm)

Fruit diameter exhibited significant positive correlation with fruit weight (0.826**), pulp weight (0.741**), peel weight (0.569**), pulp to stone ratio (0.376*), stone width (0.346*), stone weight (0.429**) and fruit yield per tree (0.339*). A positive correlation was recorded with stone length (0.106). Whereas, negative correlation was recorded with number of fruits/tree (-0.233) and total soluble solids (-0.200) (Table 2 and Figure 1). The results were in conformity with findings of Lal *et al.* (2017) [8] who reported positive association of fruit diameter with fruit yield per tree in mango.

3.7 Fruit weight (g)

Fruit weight showed significant positive correlation with pulp weight (0.888**), peel weight (0.755**), stone length

(0.539**), stone width (0.565**), stone weight (0.660**) and fruit yield per tree (0.369*). It also recorded positive correlation with pulp to stone ratio (0.249). Whereas, negative correlation was recorded with number of fruits/tree (-0.240) and total soluble solids (-0.252) (Table 2 and Figure 1). Similar observations with regard to positive correlation of fruit weight with fruit yield per tree was earlier reported by Gill and Navprem (2015) [5] and Lal *et al.* (2017) [8] in mango.

3.8 Pulp weight (g)

Pulp weight exhibited significant positive correlation with peel weight (0.795**), pulp to stone ratio (0.348*), stone length (0.642**), stone width (0.496**), stone weight (0.677**) and fruit yield per tree (0.434**). While, negative correlation was recorded with number of fruits/tree (-0.148) and total soluble solids (-0.256) (Table 2 and Figure 1). Similar results were earlier reported by Karuna *et al.* (2018) [7] and Elaiyaraja *et al.* (2021) [4] they revealed positive association of pulp weight with fruit yield per tree in mango.

3.9 Peel weight (g)

Peel weight had showed a positive and significant correlation with stone length (0.601**), stone width (0.569**), stone weight (0.530**) and fruit yield per tree (0.476**). A positive correlation was observed with pulp to stone ratio (0.298). Whereas, negative correlation was recorded with number of fruits/tree (-0.030) and total soluble solids (-0.227) (Table 2 and Figure 1). Similar observations with regard to positive correlation of peel weight with fruit yield per tree were earlier reported by Lal *et al.* (2017) [8] in mango.

3.10 Pulp to stone ratio

Pulp to stone ratio exhibited positive correlation with stone length (0.042) and stone width (0.042). Whereas, negative and significant correlation was observed with stone weight (-0.393*). It also recorded negative correlation with number of fruits/tree (-0.228), total soluble solids (-0.150) and fruit yield per tree (-0.026) (Table 2 and Figure 1).

3.11 Number of fruits/tree

Number of fruits/tree showed significant positive association with fruit yield per tree (0.721**). A positive correlation was observed with total soluble solids (0.128). Whereas, negative correlation was observed with stone length (-0.112), stone width (-0.063) and stone weight (-0.023) (Table 2 and Figure 1). The results were in line with Barhate *et al.* (2012) [2] and Abdul *et al.* (2022) [1] who

reported positive association of number of fruits/tree with fruit yield per tree in mango.

3.12 Stone length (cm)

Stone length showed significant and positive correlation with stone width (0.413**) and stone weight (0.576**). A positive correlation was associated with fruit yield per tree (0.202). Whereas, negative correlation was observed with total soluble solids (-0.066) (Table 2 and Figure 1). Similar observations with regard to positive correlation of stone length with fruit yield per tree was earlier reported by Lal *et al.* (2017) [8] and Karuna *et al.* (2018) [7] in mango.

3.13. Stone width (cm)

Stone width exhibited significant positive correlation with stone weight (0.445**). It also recorded positive correlation with fruit yield per tree (0.276). Whereas, negative correlation was observed with total soluble solids (-0.294) (Table 2 and Figure 1). Similar results were earlier reported by Lal *et al.* (2017) [8] they revealed positive association of stone width with fruit yield per tree in mango.

3.14 Stone weight (g)

Stone weight showed significant positive association with fruit yield per tree (0.386*) and negative correlation was observed with total soluble solids (-0.121) (Table 2 and Figure 1). The results were in conformity with findings of Lal *et al.* (2017) [8] and Karuna *et al.* (2018) [7] they reported positive association of stone weight with fruit yield per tree in mango.

3.15 Total soluble solids (°Brix)

Total soluble solids exhibited negative correlation with fruit yield per tree (-0.019) (Table 2 and Figure 1). Similar findings with respect to negative correlation of total soluble solids with fruit yield per tree were earlier reported by Sridhar *et al.* (2022) [11] in mango.

4. Conclusion

In the present findings, positive association of fruit yield per tree (kg) was observed with the height of mature tree (m), inflorescence width (cm), no. of hermaphrodite flowers in the inflorescence, fruit length (cm), fruit diameter (cm), fruit weight (g), pulp weight (g), peel weight (g), number of fruits/tree, stone length (cm), stone width (cm) and stone weight (g) at genotypic level. As a result, these traits emerged as the most important predictors of fruit yield per tree in mango. Therefore, the above-mentioned characters must be included in the selection criteria for improving of the fruit yield in mango.

Table 2: Genotypic correlation coefficient between fruit yield and its component characters in mango genotypes.

Characters	HMT	IL	IW	NHFI	FL	FD	FW	PW	PEW	PSR	NFT	SL	SW	SWT	TSS	FYPT
HMT	1.00	0.063	-0.065	0.259	-0.054	0.239	0.170	0.286	0.171	0.150	-0.026	0.002	0.346*	0.058	-0.256	0.091
IL		1.00	0.552**	-0.331*	0.259	-0.076	0.097	0.108	0.020	0.033	-0.099	0.251	-0.045	0.006	-0.075	-0.076
IW			1.00	-0.190	0.259	0.119	0.149	0.085	0.103	0.076	-0.0004	0.118	-0.089	-0.040	-0.154	0.069
NHFI				1.00	0.331*	0.270	0.387*	0.349*	0.274	-0.107	0.035	0.247	0.317*	0.349*	-0.108	0.264
FL					1.00	0.338*	0.717**	0.710**	0.720**	0.148	-0.252	0.831**	0.495**	0.540**	-0.142	0.158
FD						1.00	0.826**	0.741**	0.569**	0.376*	-0.233	0.106	0.346*	0.429**	-0.200	0.339*
FW							1.00	0.888**	0.755**	0.249	-0.240	0.539**	0.565**	0.660**	-0.252	0.369*
PW								1.00	0.795**	0.348*	-0.148	0.642**	0.496**	0.677**	-0.256	0.434**
PEW									1.00	0.298	-0.030	0.601**	0.569**	0.530**	-0.227	0.476**
PSR										1.00	-0.228	0.042	0.042	-0.393*	-0.150	-0.026

NFT											1.00	-0.112	-0.063	-0.023	0.128	0.721**
SL												1.00	0.413**	0.576**	-0.066	0.202
SW													1.00	0.445**	-0.294	0.276
SWT														1.00	-0.121	0.386*
TSS															1.00	-0.019

Note: r =0.311 and 0.40 at 5% and 1% level, respectively
* and ** = significant at 5% and 1% level, respectively.
HMT-Height of mature tree (m), **IL**- Inflorescence length (cm), **IW**-Inflorescence width (cm), **NHFI**- No. of hermaphrodite flowers in the inflorescence, **FL**- Fruit length (cm), **FD**-Fruit diameter (cm), **FW**- Fruit weight (g), **PW**-Pulp weight (g), **PEW**- Peel weight (g), **PSR**- Pulp to stone ratio, **NFT**- Number of fruits/tree, **SL**-Stone length(cm), **SW**-Stone width (cm), **SWT** - Stone weight (g), **TSS**-Total soluble solids (°Brix), **FYPT**- Fruit yield (kg/tree).

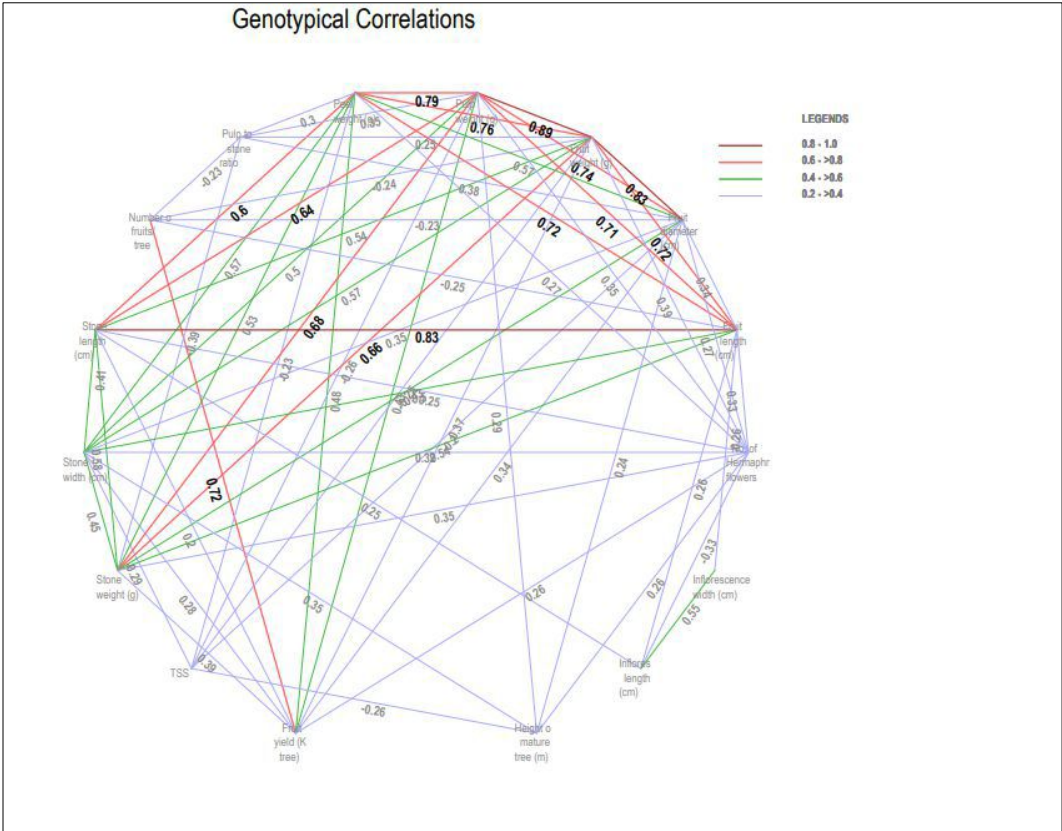


Fig 1: Diagrammatic representation of genotypic correlation among yield and its component characters in mango genotypes.

5. Authors’ Contribution

Conceptualization of research (RL,PR); Designing of the experiments (RL,PR); Contribution of experimental materials (RL,KL,M); Analysis of data and interpretation (S); Preparation of the manuscript (SR, RL, PR); Review and editing (RL,PR).

6. Funding Declaration

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

7. Conflict of Interest

The authors declare that they do not have any conflict of interest.

8. Data Availability

The data that support the findings of this study are available from the corresponding author, [MS], upon reasonable request.

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