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Pruning intensity, bio-enhancers and biofertilizer induced effect on yield, physico-chemical traits of mango cv. Dashehari-51

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ABSTRACT

An experiment was conducted with varying intensities of pruning, bio-enhancers, and biofertilizers. Significant improvements were observed across all yield, physical, and chemical traits in the integrated treatments, when data were pooled for both years, T_9-Retention of 20 cm + 30% Fruit Thinning + Panchgavya (3%) + *Azotobacter* (100 g/tree) consistently outperforming then others. In yield traits, T_9 produced the highest number of fruits per panicle (5.37), number of fruits per tree (210.33) and fruit yield (5.12 tons/ha), whereas in physical and chemical traits T_9 also resulted an increased fruit length (11.78 cm), fruit width (7.18 cm), fruit weight (244.18 g), fruit volume (237.87 cc), specific gravity (1.027 g/cm^3), pulp weight (193.59 g), peel weight (19.51 g), stone weight (31.09 g), stone length (5.95 cm), stone width (3.06cm), stone thickness (1.40 cm), kernel length (3.28 cm), kernel width (1.76 cm), kernel thickness (1.06 cm), pulp: peel ratio (9.97), pulp: stone ratio (6.23), total soluble solids (20.20 ºBrix), total sugars (21.08%), titratable acidity (0.398%), sugar: acid ratio (53.03) and TSS: acid ratio (50.81).

Key words: Pruning intensities, bio-enhancers, biofertilizer, specific gravity, yield.

INTRODUCTION

Mango (*Mangifera indica* L.), a member of the family Anacardiaceae, is considered the most popular and delicious fruit cultivated mainly in the tropical and sub-tropical parts of the world. Mango trees are evergreen in nature which bears fruit up to 300 years with spreading canopy. The leaves are oblong in shape, thick and leathery in nature, alternate, and 14-35 cm long, with short petioles. Young leaves are pinkish and mature ones are dark green in colour. Flowers develop at the terminal ends, which are 10-40 cm long, white in colour with a sweet smell (Lauricella *et al*., 7).

Dashehari is one of the most popular varity of mango in North India; which is a mid-season in maturity, fruits are small to medium in size, elongated in shape with light yellow in colour at maturity, flesh is fibreless; good in keeping quality; mainly used for table purposes but susceptible to mango malformation. Dashehari-51 is an important clone of Dashehari, which is regular in bearing, high-yielding in nature, known for its attractive appearance, excellent taste, and pleasing flavour. Now-a-days, it is being cultivated on a commercial level and has been established through vegetative propagation to ensure the multiplication of true-to-type plants.

In India, it is being cultivated on 2,396.00 thousand hectares of land, yielding 22,398.00 MT of production. Uttar Pradesh is leading producer of mango, followed by Andhra Pradesh (Anonymous, 4).

Pruning is regarded as a tool not only to control size but also to maximize yields; however, practices such as severe pruning and drastic orchard thinning seriously affect the bearing surface, reducing productivity for at least the following year (Sauco, 10).

Bio-enhancers are a relatively new concept in organic agriculture. Essentially, these are prepared by fermenting various cow products over a specific duration. To enhance its quality and attributes, a few other ingredients are also incorporated into this. In fact, bio-enhancers are used for all crop activities, such as seed/seedings treatment, to enhance the quick decomposition of biomass, improve the nutritive value of compost, and thereby improve soil fertility, crop productivity, and quality. Biofertilizers are living cells of various types of microorganisms that can mobilize nutritionally essential elements from insoluble forms.

MATERIALS AND METHODS

The experiment described was conducted at the Horticulture Garden, Department of Fruit Science, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.) over two subsequent years: 2023-24 and 2024-25 and pooled data of both years is presented here. The Kanpur district is located at an elevation of 135 meters above sea level. It is situated in a subtropical zone with coordinates

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between 25.26° & 26.58° North latitude and 79.31° & 80.34° Eastern longitude. A total of ten treatment combinations (Table 1) were evaluated using a randomized block design with three replications, involving pruning intensities, bio-enhancers, and biofertilizer application. The pruning was done in the month of June.

Foliar sprays of bio-enhancers and bio-fertilizers were applied before and after flowering in 2023 and 2024. For the foliar application, 10 litres of solution was used to adequately drench the entire foliage. Spraying was done using a pneumatic foot sprayer fitted with a nozzle in the afternoon from 4:00 pm to 6:00 pm. For spraying on top of the plant, a high-legged stool was used to ensure that all sides of the plant were completely drenched. To prevent the spread of surplus spray under the plants, polythene sheets were placed on the soil, ensuring that spray drops did not reach the soil.

The observations were recorded for different traits related to yield, including number of fruits per panicle, number of fruits per tree, and fruit yield (tons/ha). In physical traits *viz.,* fruit length (cm), width (cm), weight (g), volume(cc), specific gravity (g/cm^3), pulp weight (g), peel weight (g), stone weight (g), stone length (cm), stone width (cm), stone thickness (cm), kernel length (cm), kernel width (cm), kernel thickness (cm), pulp: peel ratio and pulp: stone ratio and in chemical traits *viz.,* total soluble solids (ºBrix), total sugars (%), titratable acidity (%), sugar: acid ratio and TSS: acid ratio were recorded. All chemical parameters were analysed using methodologies as recommended by AOAC (1). The data obtained were statistically analyzed using a Randomised Block Design (RBD) as per Fisher's method (5). The significance of treatment effects was tested using an F-test, and critical differences (CD) at a 5% probability level were calculated for comparison among treatment means. Multivariate relationships among treatments and traits were evaluated using Principal Component Analysis (PCA) performed with SPSS software (Version 25.0).

RESULTS AND DISCUSSION

The perusal of data related to number of fruits per panicle and number of fruits per tree (Table 2), clearly revealed that the maximum number of fruits per panicle 5.37 and number of fruits per tree 210.33 was recorded in mango plants with T_9-Retention of 20 cm + 30 % Fruit Thinning + Panchgavya (3%) + *Azotobacter* (100 g/tree). The minimum number of fruits per panicle (1.42) and the number of fruits per

Table 2: Impact of different pruning intensities, bio-enhancers and biofertilizer application on yield traits of mango.

Treatment	Number of fruits per panicle	Number of fruits per tree	Fruit yield (tons/ha)
T_0	1.42	124.00	2.43
T_1	1.84	132.50	2.73
T_2	2.05	137.33	2.87
T_3	2.56	150.67	3.36
T_4	2.37	144.17	3.10
T_5	2.93	163.00	3.70
T_6	3.84	183.33	4.30
T_7	3.36	175.67	4.08
T_8	4.57	204.00	4.91
T_9	5.37	210.33	5.15
F test	S	S	S
S.E.(m)±	0.031	1.69	0.04
C.D. (P=0.05)	0.094	5.07	0.14

Table 1: Details of the experimental treatments.

Symbols	Treatment per plant
T_0	Control (no pruning only water spray)
T_1	Retention of 10 cm + 10 % Fruit Thinning + Amritpani (25%) + + *Azotobacter* (100 g/tree)
T_2	Retention of 10 cm + 10 % Fruit Thinning + Jivamrit (25%) + *Azotobacter* (100 g/tree)
T_3	Retention of 10 cm +10 % Fruit Thinning + Panchgavya (3%) + + *Azotobacter* (100 g/tree)
T_4	Retention of 15 cm + 20 % Fruit Thinning + Amritpani (25%) + *Azotobacter* (100 g/tree)
T_5	Retention of 15 cm + 20 % Fruit Thinning + Jivamrit (25%) + *Azotobacter* (100 g/tree)
T_6	Retention of 15 cm +20 % Fruit Thinning + Panchgavya (3%) + *Azotobacter* (100 g/tree)
T_7	Retention of 20 cm + 30 % Fruit Thinning + Amritpani (25%) + *Azotobacter* (100 g/tree)
T_8	Retention of 20 cm + 30 % Fruit Thinning + Jivamrit (25%) + *Azotobacter* (100 g/tree)
T_9	Retention of 20 cm + 30 % Fruit Thinning + Panchgavya (3%) + *Azotobacter* (100 g/tree)

tree (124.00) were recorded in T_0-control (no pruning, only water spray). Additionally, it was reported that the panchagavya spray was more effective in increasing growth and production. The use of bio-fertilizers provides balanced nourishment to the plants where *Azotobacter* is present. These outcomes are in consistent with the findings of Sharma *et al.* (12), Devi *et al.* (5) and Singh *et al.* (14). The maximum fruit yield (5.15 tons/ha) was recorded in mango plants which were treated with the application of T_9-Retention of 20 cm + 30 % Fruit Thinning + Panchgavya (3%) + *Azotobacter* (100 g/tree), whereas, the minimum fruit yield of 2.43 tons/ha was recorded in T_0-control, where no pruning was done and only water was sprayed (Table 2). It was also recorded that the panchagavya spray and use of bio-fertilizer (*Azotobacter)*was more effective in increasing production by providing balanced nourishment to the plants, by increase in biologically fixing of nitrogen, dissolving insoluble phosphate, secreting a number of hormones, and providing vitamins such as thiamine, riboflavin, pyridoxine, and nicotinic acid, among other essential growth elements necessary for plant growth, which ultimately increased the production . These outcomes are consistent with the findings of Devi *et al.* (5) and Singh *et al.* (14).

Increased fruit length (11.78 cm) and width (7.18 cm) was recorded in plants which were treated with T_9-Retention of 20 cm + 30 % Fruit Thinning + Panchgavya (3%) + *Azotobacter* (100 g/tree), whereas the minimum fruit length (8.50 cm) and width (5.18 cm) was recorded in T_0-control, where no pruning was done and only water was sprayed (Table 3). This is attributed to the fact that panchagavya contains various microorganisms, especially bacteria, along with a high concentration of different plant hormones, especially auxins, gibberellins, and cytokinins, which improves the fruit plant growth. These outcomes are consistent with the findings of Shukla *et al*. (13) and Bhadauria and Tripathi (3). In addition, Panchagavya also contains numerous vitamins, amino acids and growth regulators like auxins and gibberellins, leading to better physiology in terms of physical growth (Devi *et al*., 5). Maximum fruit weight (244.18 g) and pulp weight (193.59 g) was recorded in plants which were treated with the application of T_9-Retention of 20 cm + 30 % Fruit Thinning + Panchgavya (3%) + *Azotobacter* (100 g/tree). However, minimum fruit weight (195.49 g) and pulp weight (134.73 g) was recorded in plants kept under T_0-control, where no pruning was done and only water was sprayed (Table 3). This is consistent with the fact that increase in the photosynthetic area is much favourable for physiological activities which may increase the production and translocation of

Table 3: Impact of different pruning intensities, bio-enhancers and biofertilizer application on physical traits of mango.

Treatment	Fruit length (cm)	Fruit width (cm)	Fruit weight (g)	Fruit volume (cc)	Specific gravity (g/cm^3)	Pulp weight (g)	Peel weight (g)	Stone weight (g)	Stone length (cm)	Stone width (cm)	Stone thickness (cm)	Kernel length (cm)	Kernel width (cm)	Kernel thickness (cm)	Pulp: peel ratio	Pulp: stone ratio
T_0	8.50	5.18	195.49	194.90	1.003	134.73	25.60	35.17	6.96	4.19	1.84	4.20	2.41	1.40	5.27	3.83
T_1	9.30	5.45	205.15	203.92	1.006	145.94	24.19	35.03	6.87	4.08	1.80	4.15	2.33	1.34	6.03	4.17
T_2	9.72	5.70	207.93	205.97	1.010	148.29	23.76	34.89	6.76	3.88	1.77	4.11	2.27	1.31	6.24	4.25
T_3	10.21	6.25	222.48	219.30	1.015	165.39	22.89	34.20	6.28	3.70	1.66	3.89	2.15	1.24	7.23	4.84
T_4	9.99	6.12	214.74	212.09	1.013	156.59	23.34	34.82	6.47	3.83	1.73	4.03	2.22	1.27	6.71	4.50
T_5	10.53	6.49	226.58	222.68	1.018	170.18	22.75	33.65	6.21	3.52	1.59	3.84	2.10	1.22	7.49	5.06
T_6	11.50	6.91	233.90	228.74	1.023	180.07	21.43	32.41	6.06	3.23	1.50	3.55	1.94	1.13	8.42	5.56
T_7	11.23	6.76	231.60	226.94	1.021	176.40	22.17	33.03	6.13	3.35	1.56	3.72	2.03	1.19	7.97	5.34
T_8	11.65	7.07	240.12	234.37	1.025	187.45	20.79	31.88	5.97	3.14	1.45	3.40	1.83	1.10	9.06	5.88
T_9	11.78	7.18	244.18	237.87	1.027	193.59	19.51	31.09	5.95	3.06	1.40	3.28	1.76	1.06	9.97	6.23
F test	S	S	S	S	NS	S	S	S	S	S	S	S	S	S	S	S
S.E. (m)±	0.11	0.07	2.21	2.30	0.016	1.44	0.21	0.48	0.05	0.03	0.015	0.035	0.019	0.012	0.09	0.09
C.D. (P= 0.05)	0.33	0.23	6.63	6.91	NS	4.33	0.63	1.44	0.17	0.11	0.044	0.106	0.058	0.037	0.28	0.26

photosynthates, and accelerated the development of fruits with larger weights. These outcomes are in consistent with the findings of Devi *et al.* (5), Shukla *et al*. (13) and Bhadauria and Tripathi (3).

The perusal of data related in Table 3 revealed that the maximum fruit volume (237.87 cc) and specific gravity (1.027 g/cm^3) was recorded in plants which were treated with T_9-Retention of 20 cm + 30 % Fruit Thinning + Panchgavya (3%) + *Azotobacter* (100 g/tree). The minimum fruit volume (194.90 cc) and specific gravity (1.003 g/cm^3) were recorded from the plants kept under T_0-control (no pruning, only water spray). The use of Panchagavya, coupled with bio-fertilizers, resulted in the accumulation of additional food material and its effective in utilization for the growth of fruits, leading to an increase in fruit volume. These outcomes are in consistent with the findings of Sharma *et al.* (12), Shukla *et al*. (13), Bhadauria and Tripathi (3) and Singh *et al.* (14). Minimum peel weight (19.51 g) and stone weight (31.09 g) was recorded in fruits which were harvested from the plants (Table 3) which were treated with the application of T_9-Retention of 20 cm + 30 % Fruit Thinning + Panchgavya (3%) + *Azotobacter* (100 g/tree). The maximum peel weight 25.60 g pooled and stone weight 35.17 g pooled was recorded with the control (no pruning, only water spray). These outcomes are consistent with the findings of Devi *et al.* (5), Rawat *et al*. (9) and Singh *et al.* (17). The perusal of data related to stone length, width and stone thickness given in Table 3, clearly revealed that the minimum stone length (5.95 cm), stone width (3.06 cm) and stone thickness (1.40 cm) was recorded in fruits which were harvested from the plants treated with the application of T_9-Retention of 20 cm + 30 % Fruit Thinning + Panchgavya (3%) + *Azotobacter* (100 g/tree). The maximum stone length (6.96 cm), stone width (4.19 cm), and stone thickness (1.84 cm) were recorded in fruits harvested from T_0-control (no pruning only water spray) plants. These outcomes are in consistent with the findings of Sharma *et al.* (12), Singh *et al.* (16) and Devi *et al.* (5). Minimum kernel length (3.28 cm), kernel width (1.76 cm) and kernel thickness (1.06 cm) was recorded in fruits produced from the plants which were treated with the application of T_9-Retention of 20 cm + 30 % Fruit Thinning + Panchgavya (3%) + *Azotobacter* (100 g/tree). The maximum kernel length (4.20 cm), kernel width (2.41 cm) and kernel thickness (1.40 cm) were recorded in the T_0-control (no pruning, only water spray). These outcomes are consistent with the findings of Sharma *et al.* (12), Rathod *et al.* (8) and Devi *et al.* (5). Maximum pulp: peel ratio (9.97) and pulp: stone ratio (6.23) was recorded in fruits (Table 3) produced from the plants which were treated with the application of T_9-Retention of 20 cm + 30 % Fruit Thinning + Panchgavya (3%) + *Azotobacter* (100 g/tree).

The minimum pulp: peel ratio (5.27) and pulp: stone ratio (3.83) were recorded in the control (no pruning, only water spray). These outcomes are in agrement with the findings of Devi *et al.* (5), Bhadauria and Tripathi (3), Singh *et al.* (16) and Singh *et al*. (15). The perusal of data in Table 4 revealed that the maximum total soluble solid (20.20 ºBrix) and total sugars (21.08 %) was recorded in fruits which were produced from the plants treated with T_9-Retention of 20 cm + 30 % Fruit Thinning + Panchgavya (3%) + *Azotobacter* (100 g/tree). The minimum total soluble solids (18.68 ºBrix) and total sugars (19.52 %) were recorded in fruits produced from the plants kept under T_0-control, where no pruning was done and only water was sprayed. These outcomes are in accordance with the findings of Shukla *et al*. (13) and Bhadauria and Tripathi (2). This increase might be due to the reason that Panchagavya contains numerous vitamins, amino acids and tree growth regulators like auxins and gibberellins lead to better physiology in term of TSS and total sugars (Devi *et al*., 5). The minimum titratable acidity (0.398 %) was recorded in fruits which were produced from the plants which were treated with T_9-Retention of 20 cm + 30 % Fruit Thinning + Panchgavya (3%) + *Azotobacter* (100 g/tree), whereas the maximum titratable acidity of 0.578 % was recorded for the plants kept under T_0-control

Table 4: Impact of different pruning intensities, bio-enhancers and biofertilizer application on chemical traits of mango.

Treatment	Total soluble solids (°Brix)	Total sugars (%)	Titratable acidity (%)	Sugar: acid ratio	TSS: acid ratio
T_0	18.68	19.52	0.578	33.79	32.34
T_1	18.87	19.64	0.538	36.54	35.10
T_2	19.04	19.85	0.506	39.22	37.63
T_3	19.56	20.13	0.459	43.90	42.65
T_4	19.26	19.97	0.487	41.05	39.58
T_5	19.68	20.35	0.449	45.36	43.88
T_6	19.94	20.88	0.425	49.18	46.97
T_7	19.87	20.61	0.434	47.49	45.77
T_8	20.12	21.01	0.414	50.80	48.66
T_9	20.20	21.08	0.398	53.03	50.81
F test	S	S	S	S	S
S.E. (m)±	0.18	0.18	0.004	0.66	0.72
C.D. (P=0.05)	0.56	0.54	0.013	1.99	2.16

(no pruning, only water spray). These outcomes are consistent with the findings of Sharma *et al.* (12) and Shukla *et al*. (13). Sugar: acid and TSS: acid ratio were significantlyinfluenced by the pruning along with the application of bioenhancer and biofertilizer (Table 4). The maximum sugar: acid ratio (53.03) and TSS: acid ratio (50.81) was recorded in fruits of plants which were treated with T_9-Retention of 20 cm + 30 % Fruit Thinning + Panchgavya (3%) + *Azotobacter* (100 g/tree). The minimum sugar-to-acid ratio of 33.79, and TSS-to-acid ratio of 32.34, were recorded in the control (no pruning, only water spray). These outcomes are consistent with the findings reported by Bhadauria and Tripathi (2), Singh *et al*. (15), Sharma *et al*. (11), and Shukla *et al*. (13).

Principal Component Analysis (PCA) effectively reduced the dimensionality of 24 fruit traits (Table 5), identifying key patterns of variation among treatments. The first principal component (PC1) explained 97.83% of the total variance and was positively correlated with most fruit quality and yield attributes, such as fruit size, pulp weight, specific gravity, TSS, total sugars, sugar-to-acid ratio, and yield per hectare (Fig. 1, 2 & 3). Simultaneously, PC1 showed strong negative correlations with stone dimensions and titratable acidity, indicating an inverse relationship between desirable fruit traits and seed-related characteristics. The second component (PC2) accounted for an additional 1.44% of the variation, contributing minor differentiation related to stone weight, stone length, and acidity parameters. Together, PC1 and PC2 captured 99.27% of the cumulative variance, validating their use for treatment discrimination in the biplot. Treatments T_8 and

Table 5: PCA Loadings for physical, chemical and yield traits.

Trait	F1 Loading	F2 Loading	F3 Loading	F4 Loading	F5 Loading
Fruit length (cm)	0.986	0.095	-0.004	0.130	0.031
Fruit width (cm)	0.990	0.125	0.029	0.018	-0.031
Fruit weight (g)	0.995	0.085	-0.014	-0.034	0.036
Fruit volume(cc)	0.993	0.093	-0.020	-0.042	0.042
Specific gravity (g/cm^3)	0.995	0.085	0.015	0.039	-0.020
Pulp weight (g)	0.997	0.047	-0.017	-0.037	0.030
Peel weight (g)	-0.982	0.076	0.173	-0.022	0.010
Stone weight (g)	-0.972	0.217	-0.073	0.010	-0.021
Stone length (cm)	-0.970	-0.210	-0.063	0.086	0.050
Stone width (cm)	-0.994	-0.022	-0.067	-0.068	-0.008
Stone thickness (cm)	-0.996	0.038	-0.061	0.029	-0.010
Kernel length (cm)	-0.983	0.166	-0.036	0.030	0.036
Kernel width (cm)	-0.995	0.092	0.018	-0.005	0.021
Kernel thickness (cm)	-0.996	0.016	0.054	-0.025	0.047
Pulp: peel ratio	0.993	-0.085	-0.078	-0.033	0.002
Pulp: stone ratio	0.997	-0.058	-0.001	-0.033	0.023
Total soluble solids (^{0}Brix)	0.991	0.116	0.044	-0.038	0.012
Total sugars (%)	0.992	-0.033	0.091	0.068	-0.023
Titratable acidity (%)	-0.974	-0.210	0.073	-0.015	-0.005
Sugar: acid ratio	0.997	0.068	-0.014	0.004	-0.006
TSS: acid ratio	0.994	0.096	-0.021	-0.017	0.002
Number of fruits per panicle	0.976	-0.203	-0.058	-0.010	-0.019
Number of fruits per tree	0.987	-0.146	0.039	0.009	0.019
Fruit yield (ton/ha)	0.991	-0.125	0.026	-0.006	0.022
Eigenvalue	23.479	0.346	0.082	0.047	0.016
Variability (%)	97.827	1.443	0.340	0.196	0.066
Cumulative %	97.827	99.270	99.611	99.806	99.873

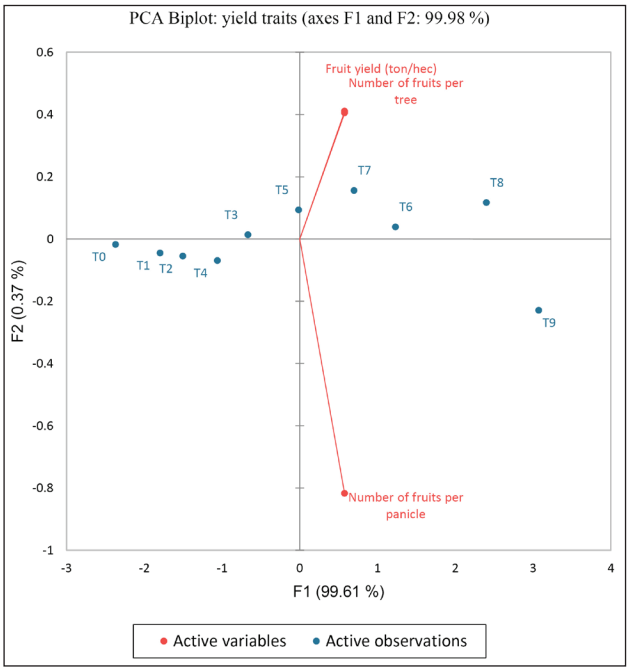

Fig. 1. Principal component biplot based on yield traits.

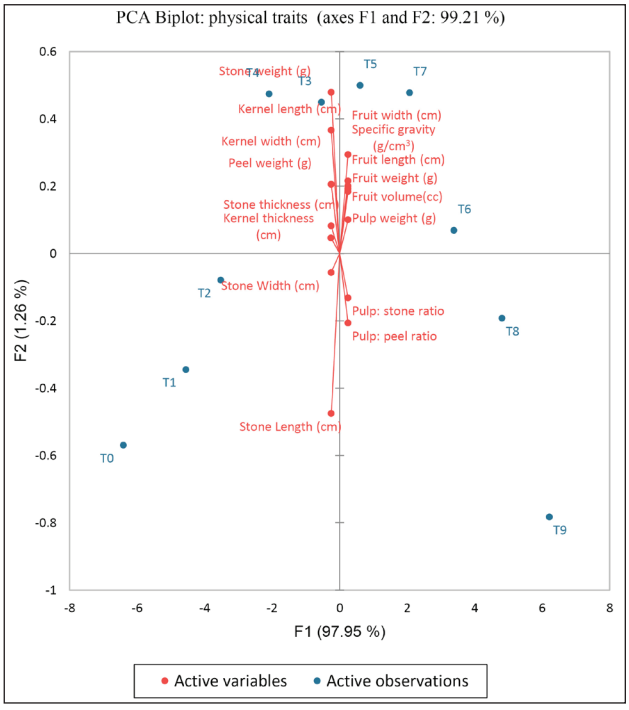

Fig. 2. Principal component biplot based on physical traits.

T_9 aligned strongly with the positive axis of PC1, reflecting their superior performance in terms of size, sweetness, and yield. In contrast, T_0 and T_1 were positioned on the negative side, associated with lower quality traits and higher acidity. These findings

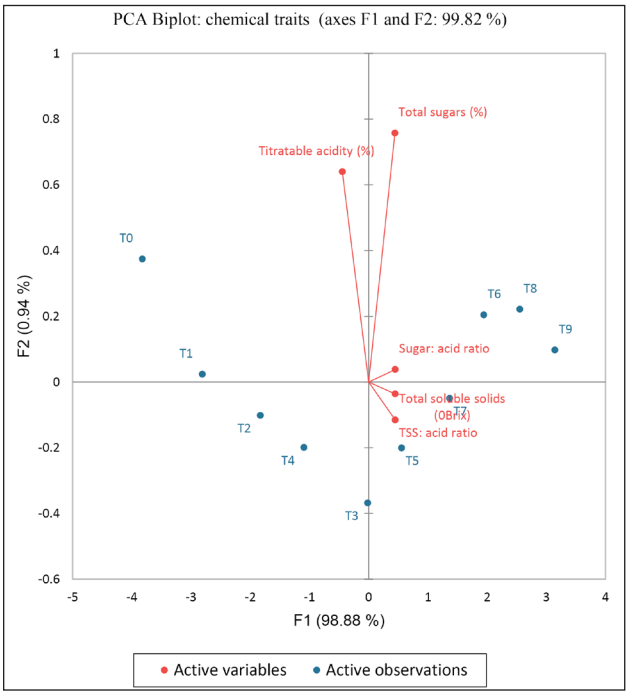

Fig. 3. Principal component biplot based on chemical traits.

highlight PC1 as a robust indicator for selecting high-performing fruit genotypes, thereby simplifying the evaluation of complex traits in breeding programs. The Pearson correlation matrix revealed several statistically significant interrelationships among the morphological and biochemical parameters measured across the fruit samples (Fig. 4). Strong positive correlations were observed among key fruit dimensional attributes. Notably, fruit length, fruit width, fruit weight, and fruit volume exhibited highly significant correlations ($r > 0.95$), suggesting that these size-related variables are tightly coordinated during fruit development and can be jointly selected in breeding programs targeting yield-enhancing traits. Specific gravity also demonstrated strong positive correlations with fruit weight ($r \approx 0.99$) and volume ($r \approx 0.99$), reinforcing its utility as a proxy indicator for fruit density and internal content. Pulp weight showed a similarly high correlation with total fruit weight ($r \approx 0.99$), reflecting its dominant contribution to overall fruit mass. Among compositional traits, total soluble solids (TSS) and total sugars were positively correlated with the sugar-to-acid ratio ($r > 0.98$), emphasizing their role in determining sweetness and palatability. Conversely, titratable acidity was negatively correlated with these parameters, indicating that as sweetness increases, acidity tends to decline-an inverse relationship that is well-documented in fruit ripening dynamics. The pulp-to-peel and pulp-to-stone ratios showed strong positive associations

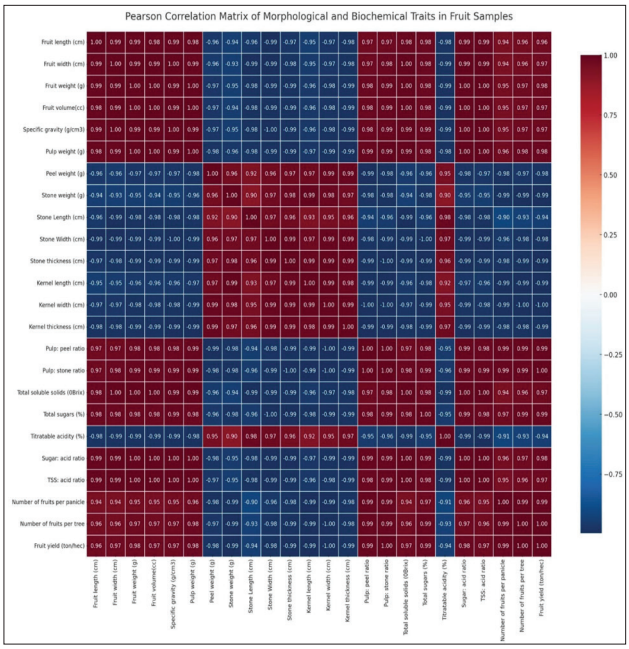

Fig. 4. Pearson correlation matrix morphological and biochemical traits in fruits.

with pulp weight and fruit size traits, highlighting their relevance as indicators of the edible portion. Meanwhile, fruit yield per hectare was positively correlated with number of fruits per tree ($r \approx 0.99$) and moderately with fruit size metrics, confirming that yield is a composite trait influenced by both fruit count and individual fruit weight. Interestingly, kernel and stone dimensions had negative or weak correlations with overall fruit size and yield traits, suggesting an independent developmental pattern and a lesser role in determining marketable quality.

Based on two years of field data and pooled statistical analysis, it is concluded that the treatment T_9, consisted of Retention of 20 cm + 30 % Fruit Thinning + Panchgavya (3%) + *Azotobacter* (100 g/tree) was the most effective in enhancing yield, physical and chemical parameters in mango cv. Dashehari-51. Pruning intensities, combined with the use of bioenhancers and biofertilizer, play a crucial role in mango production. Pruning is an unavoidable necessity for virtually all arboreal fruit crops and is adopted to maintain a proper physiological balance between growth and fruiting. Panchagavya contains various important microbes, including aerobic heterotrophic bacteria, lactic acid bacteria, yeast, fungi, and anaerobic bacteria, which boost growth and enhance yield. The study also highlighted that the integrated application of these components was superior to their individual use, suggesting a synergistic interaction that can be leveraged for sustainable and high-quality mango production in the plains of nort India.

AUTHORS' CONTRIBUTIONS

Conceptualisation of research (ST); Designing of the experiments (VKT); Contribution of experimental materials (ST); Execution of field/lab experiments and data collection (ST, VKT); Analysis of data and interpretation (ST, VKT); Preparation of the manuscript (ST); Review and editing (VKT).

DECLARATION

The authors declare no competing interests.

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