# Plant Archives

# CORRELATION STUDIES FOR GROWTH AND YIELD ATTRIBUTING TRAITS IN SPONGE GOURD (*LUFFA CYLINDRICA* L. ROEM)

**S. Reddy Veera Nagaveni[1], B.P. Bisen[2]\*, Rajani Bisen[3], Swati Barche[1] and Anil Chauhan[2]**

[1]Department of Vegetable Science, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur-482004, Madhya Pradesh, India

[2]Department of Fruit Science, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur-482004, Madhya Pradesh, India

[3]Department of Genetics and Plant Breeding, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur-482004, Madhya Pradesh, India

\*Corresponding author E-mail: drbrijbisen@jnkvv.org

**ABSTRACT**

The present investigation was conducted at the New Nursery, Adhartal, Department of Horticulture, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (Madhya Pradesh) to study the nature and magnitude of genotypic and phenotypic correlations among growth, yield and its component characters in sponge gourd using 9 parents and their derived 36 $F_1$ hybrids. Correlation coefficients were estimated to determine the association between fruit yield per vine and various growth, flowering and fruit traits. Fruit yield per vine exhibited significant and positive association with number of fruits per vine, fruit set percentage, average fruit weight, fruit diameter, fruit length, vine length, internodal length and number of primary branches at both genotypic and phenotypic levels, indicating their importance in determining yield. In contrast, traits related to earliness and sex ratio showed significant negative association with fruit yield. The analysis reveals that genotypic correlation coefficients were higher in magnitude than their corresponding phenotypic correlations, suggesting the predominance of genetic factors and relatively lower environmental influence on trait associations.

*Keywords* : Sponge gourd, correlation, yield attributes, character association

## Introduction

Sponge gourd (*Luffa cylindrica* L. Roem.) is an important cucurbitaceous vegetable crop cultivated widely in tropical and subtropical regions for its tender fruits and diverse domestic and industrial uses. The crop belongs to the family Cucurbitaceae with a diploid chromosome number of 2n=26 and is predominantly cross-pollinated in nature, which results in considerable variability for growth, flowering and fruit characters (Kalloo, 1993; Som *et al*., 2020). India is considered one of the centers of diversity for sponge gourd, where it is extensively grown for vegetable purposes as well as for fibre obtained from mature fruits (Yawalkar, 2004). It is commonly called as sponge gourd, smooth gourd, loofah, vegetable sponge, dish cloth and it is known by several vernacular names including kali tori, ghia tori, dundul, bhol, tarada and ghiraula in different parts of India, reflecting its wide cultivation and cultural importance (Nath and Swamy, 2016).

Fruit yield in sponge gourd is a complex quantitative character governed by several interrelated growth, flowering and yield component traits. Direct selection for yield alone may not be effective, as yield is the cumulative expression of many component characters that may exhibit positive or negative inter-relationships among themselves (Angadi *et al*., 2018). Therefore, understanding the association among yield and its contributing traits is essential for improving selection efficiency in breeding programmes.

Correlation analysis is an important biometrical tool used to study the degree and direction of association among quantitative traits, particularly in crop improvement programmes where yield is a

complex character. Estimation of genotypic and phenotypic correlation coefficients provides insight into the inherent genetic relationships among traits and aids in separating genetic associations from environmental effects (Al-Jibouri *et al*., 1958). Genotypic correlations generally represent the true genetic association, while phenotypic correlations reflect the combined influence of genetic and environmental factors (Wright, 1921). In many crop species, including cucurbits, genotypic correlations are often higher than phenotypic correlations, indicating stronger genetic control over trait associations (Gantayat *et al*., 2025; Srinivasulu *et al*., 2025). Such information is valuable for identifying yield-contributing traits and formulating effective selection strategies in breeding programmes. Therefore, correlation analysis plays a crucial role in formulating efficient selection strategies by providing a clear understanding of interrelationships among yield and its component characters.

In view of the above, the present investigation was undertaken to study the genotypic and phenotypic correlations among growth, fruit yield and its component traits in sponge gourd with the objective of identifying key characters that could be effectively utilized as selection criteria for yield improvement.

## Material and Methods

The present investigation was carried out at the New Nursery, Adhartal, Department of Horticulture, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh. The experimental material consisted of 9 parental lines of sponge gourd viz., Pusa Chikni ($P_1$), Kashi Shreya ($P_2$), Kashi Jyothi ($P_3$), Pusa Sneha ($P_4$), Kashi Kalyani ($P_5$), Kashi Vandana ($P_6$), VRSG-2/13 ($P_7$), VRSG-8 ($P_8$), Local Variety ($P_9$) and their derived 36 $F_1$ hybrids developed through a diallele crossing programme. The parents and $F_1$ hybrids were evaluated together as a breeding population in *kharif* -2025 to study the association among yield and its component traits. Standard agronomic and plant protection practices recommended for sponge gourd cultivation were followed uniformly throughout the cropping period to raise a healthy crop. The data were analyzed as per Randomized Block Design (Panse and Sukhatme., 1969) with 3 replications.

The correlation analysis was carried out using OPSTAT statistical software developed by Chaudhary Charan Singh Haryana Agricultural University, Hisar, India. The correlation coefficients among all possible character combinations at phenotypic ($r_p$) and genotypic ($r_g$) level was estimated employing formula by Johnson *et al*. (1955). The significance of correlation coefficients was tested at 5 and 1 per cent probability levels.

## Results

Observations were recorded on fourteen characters, namely vine length, number of primary branches, internodal length, node number of first female flower, days to first female flower appearance, number of female flowers, sex ratio, number of fruits, fruit set percentage, days to first harvest harvest sowing, fruit length, fruit diameter, average fruit weight and yield per vine.The recorded data were subjected to analysis of variance to test the significance of differences among the genotypes. Since correlation coefficients indicate the degree of association between pairs of traits, genotypic and phenotypic correlations were estimated for all possible trait combinations and the results are presented in Table 1 and Table 2.

### Association of fruit yield per vine with other traits

Fruit yield per vine exhibited significant association with all major growth, flowering and fruit characters at both genotypic and phenotypic levels. It showed strong and positive correlation with vine length ($r_g = 0.770$, $r_p = 0.711$), number of primary branches per plant ($r_g = 0.824$, $r_p = 0.739$), internodal length ($r_g = 0.532$, $r_p = 0.464$), number of female flowers ($r_g = 0.921$, $r_p = 0.787$), number of fruits per vine ($r_g = 0.884$, $r_p = 0.876$) and fruit set percentage ($r_g = 0.858$, $r_p = 0.725$), indicating that both vegetative vigour and reproductive efficiency play a major role in yield determination. Fruit yield per vine also recorded significant positive association with fruit length ($r_g = 0.526$, $r_p = 0.477$), fruit diameter ($r_g = 0.598$, $r_p = 0.550$) and average fruit weight ($r_g = 0.766$, $r_p = 0.754$), suggesting that improvement in fruit size and weight directly contributes to higher yield.

In contrast, fruit yield per vine showed significant and negative association with node number of first female flower, days to first female flower appearance ($r_g = -0.608$, $r_p = -0.544$), days to first harvest after sowing ($r_g = -0.566$, $r_p = -0.484$) and sex ratio ($r_g = -0.861$, $r_p = -0.787$), indicating that earliness in flowering and harvesting along with female flower predominance contributes positively to fruit yield (Tables 1 and 2).

### Association of vegetative traits with other characters

Vine length exhibited significant positive association with number of primary branches per plant ($r_g = 0.755$, $r_p = 0.676$), number of female flowers ($r_g = 0.624$, $r_p = 0.534$), number of fruits per vine ($r_g = $

0.604, $r_p$ = 0.557) and fruit set percentage ($r_g$ = 0.535, $r_p$ = 0.448), along with internodal length, fruit length and fruit diameter. However, it showed negative association with earliness traits, suggesting that excessive vegetative growth may delay flowering and harvesting. Number of primary branches per plant showed significant positive association with number of female flowers ($r_g$ = 0.860, $r_p$ = 0.675), number of fruits per vine ($r_g$ = 0.831, $r_p$ = 0.733), fruit set percentage ($r_g$ = 0.811, $r_p$ = 0.679) and fruit yield per vine ($r_g$ = 0.824, $r_p$ = 0.739). At the same time, it exhibited negative association with sex ratio, node number of first female flower appearance and days to first female flower appearance (Tables 1 and 2).

Internodal length showed significant positive association with fruit length ($r_g$ = 0.852, $r_p$ = 0.748), fruit diameter ($r_g$ = 0.488, $r_p$ = 0.432), average fruit weight ($r_g$ = 0.806, $r_p$ = 0.670) and fruit yield per vine ($r_g$ = 0.532, $r_p$ = 0.464), while its association with certain flowering traits was weak or negative, suggesting an indirect influence on yield through fruit size attributes. Node number of first female flower exhibited a strong negative association with vine length ($r_g$ = -0.667), number of primary branches per plant ($r_g$ = -0.861), internodal length ($r_g$ = -0.209) and number of female flowers ($r_g$ = -0.821). It also showed a significant negative association with number of fruits per vine ($r_g$ = -0.780), fruit set percentage ($r_g$ = -0.760) and fruit yield per vine ($r_g$ = -0.740), suggesting that early node bearing of female flowers is favourable for higher yield.

**Table 1 :** Estimates of genotypic correlation coefficient among 14 characters for yield and yield traits in sponge gourd

|  | VL | NPBPP | IL | NNFFF | DTFFF | NFF | SR | NF | FS% | DTFHAS | FL | FD | FW | Y/VINE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **VL** | 1 | 0.755** | 0.636** | -0.667** | -0.484** | 0.624** | -0.603** | 0.604** | 0.535** | -0.341** | 0.578** | 0.687** | 0.700** | **0.770**** |
| **NPBPP** |  | 1 | 0.280** | -0.861** | -0.751** | 0.860** | -0.886** | 0.831** | 0.811** | -0.680** | 0.283** | 0.619** | 0.525** | **0.824**** |
| **IL** |  |  | 1 | -0.209* | 0.135 | 0.201* | -0.122 | 0.165 | 0.077 | 0.211* | 0.852** | 0.488** | 0.806** | **0.532**** |
| **NNFFF** |  |  |  | 1 | 0.807** | -0.821** | 0.840** | -0.780** | -0.760** | 0.729** | -0.154 | -0.632** | -0.429** | **-0.740**** |
| **DTFFF** |  |  |  |  | 1 | -0.820** | 0.840** | -0.814** | -0.833** | 0.961** | 0.086 | -0.277** | -0.116 | **-0.608**** |
| **NFF** |  |  |  |  |  | 1 | -0.953** | 0.986** | 0.952** | -0.767** | 0.170 | 0.464** | 0.399** | **0.921**** |
| **SR** |  |  |  |  |  |  | 1 | -0.964** | -0.948** | 0.806** | -0.136 | -0.497** | -0.411** | **-0.861**** |
| **NF** |  |  |  |  |  |  |  | 1 | 0.991** | -0.797** | 0.168 | 0.429** | 0.385** | **0.884**** |
| **FS%** |  |  |  |  |  |  |  |  | 1 | -0.818** | 0.125 | 0.386** | 0.371** | **0.858**** |
| **DTFHAS** |  |  |  |  |  |  |  |  |  | 1 | 0.190* | -0.247** | -0.046 | **-0.566**** |
| **FL** |  |  |  |  |  |  |  |  |  |  | 1 | 0.448** | 0.816** | **0.526**** |
| **FD** |  |  |  |  |  |  |  |  |  |  |  | 1 | 0.601** | **0.598**** |
| **FW** |  |  |  |  |  |  |  |  |  |  |  |  | 1 | **0.766**** |
| **Y/VINE** |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 |

\* Significant at 5% level, \*\* Significant at 1% level

VL - Vine Length (m), NPBPP - number of primary branches, IL- internodal length (cm), NNFFF-node number of first female flower, DTFFF -days to first female flower appearance, NFF - number of female flowers, SR - sex ratio (%), NF - number of fruits per vine, FS% - fruit set percentage, DTFHAS - days to first harvest sowing, FL - fruit length (cm), FD - fruit diameter (cm), FW-average fruit weight (g) and Y/VINE - yield per vine (kg)

**Table 2 :** Estimates of phenotypic correlation coefficient among 14 characters for yield and yield traits in sponge gourd

|  | VL | NPBPP | IL | NNFFF | DTFFF | NFF | SR | NF | FS% | DTFHAS | FL | FD | FW | Y/VINE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **VL** | 1 | 0.676** | 0.564** | -0.608** | -0.435** | 0.534** | -0.564** | 0.557** | 0.448** | -0.314** | 0.526** | 0.633** | 0.636** | **0.711**** |
| **NPBPP** |  | 1 | 0.225** | -0.762** | -0.651** | 0.675** | -0.774** | 0.733** | 0.679** | -0.564** | 0.233** | 0.528** | 0.482** | **0.739**** |
| **IL** |  |  | 1 | -0.203* | 0.098 | 0.120 | -0.041 | 0.150 | 0.067 | 0.185* | 0.748** | 0.432** | 0.670** | **0.464**** |
| **NNFFF** |  |  |  | 1 | 0.775** | -0.654** | 0.729** | -0.710** | -0.610** | 0.632** | -0.138 | -0.577** | -0.393** | **-0.678**** |
| **DTFFF** |  |  |  |  | 1 | -0.654** | 0.728** | -0.720** | -0.672** | 0.808** | 0.090 | -0.228** | -0.112 | **-0.544**** |
| **NFF** |  |  |  |  |  | 1 | -0.899** | 0.906** | 0.755** | -0.658** | 0.135 | 0.373** | 0.312** | **0.787**** |
| **SR** |  |  |  |  |  |  | 1 | -0.887** | -0.800** | 0.709** | -0.101 | -0.440** | -0.367** | **-0.787**** |
| **NF** |  |  |  |  |  |  |  | 1 | 0.838** | -0.675** | 0.155 | 0.401** | 0.358** | **0.876**** |
| **FS%** |  |  |  |  |  |  |  |  | 1 | -0.664** | 0.107 | 0.323** | 0.304** | **0.725**** |
| **DTFHAS** |  |  |  |  |  |  |  |  |  | 1 | 0.156 | -0.179* | -0.059 | **-0.484**** |
| **FL** |  |  |  |  |  |  |  |  |  |  | 1 | 0.405** | 0.718** | **0.477**** |
| **FD** |  |  |  |  |  |  |  |  |  |  |  | 1 | 0.532** | **0.550**** |
| **FW** |  |  |  |  |  |  |  |  |  |  |  |  | 1 | **0.754**** |
| **Y/VINE** |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 |

\* Significant at 5% level, \*\* Significant at 1% level

VL - Vine Length (m), NPBPP - number of primary branches, IL- internodal length (cm), NNFFF-node number of first female flower, DTFFF -days to first female flower appearance, NFF - number of female flowers, SR - sex ratio (%), NF - number of fruits per vine, FS% - fruit set percentage, DTFHAS - days to first harvest harvest sowing, FL - fruit length (cm), FD - fruit diameter (cm), FW-average fruit weight (g) and Y/VINE - yield per vine (kg)

**Association of flowering traits with other characters**

Number of female flowers showed strong positive association with number of fruits per vine ($r_g = 0.986$), fruit set percentage ($r_g = 0.952$) and fruit yield per vine ($r_g = 0.921$), whereas it exhibited a strong negative association with sex ratio ($r_g = -0.953$, $r_p = -0.899$). Days to first female flower appearance exhibited a significant negative association with fruit yield per vine ($r_g = -0.608$, $r_p = -0.544$), suggesting that early flowering and early harvesting genotypes are desirable for achieving higher productivity. Sex ratio exhibited a strong and significant negative association with number of fruits per vine ($r_g = -0.964$, $r_p = -0.948$), fruit set percentage ($r_g = -0.948$, $r_p = -0.818$), fruit length, fruit diameter and average fruit weight. In contrast, it showed a positive association with days to first harvest after sowing ($r_g = 0.806$, $r_p = 0.729$) (Tables 1 and 2).

**Association of fruiting parameters with other characters**

Fruiting and yield related traits exhibited clear associations among themselves at both genotypic and phenotypic levels. Number of fruits per vine showed positive association with fruit set percentage ($r_g = 0.991$), fruit diameter ($r_g = 0.429$), average fruit weight ($r_g = 0.385$) and fruit yield per vine ($r_g = 0.884$), while it was negatively associated with days to first harvest after sowing ($r_g = -0.797$). Fruit set percentage also exhibited positive association with fruit diameter ($r_g = 0.386$), average fruit weight ($r_g = 0.371$) and fruit yield per vine ($r_g = 0.858$), but showed a negative association with days to first harvest ($r_g = -0.818$).

Days to first harvest after sowing exhibited negative association with fruit diameter ($r_g = -0.247$) and fruit yield per vine ($r_g = -0.566$), whereas its association with fruit length was positive ($r_g = 0.190$). Fruit length showed positive association with fruit diameter ($r_g = 0.448$), average fruit weight ($r_g = 0.816$) and fruit yield per vine ($r_g = 0.526$). Fruit diameter was positively associated with average fruit weight ($r_g = 0.601$) and fruit yield per vine ($r_g = 0.598$), while average fruit weight exhibited a strong positive association with fruit yield per vine ($r_g = 0.766$).

**Discussion**

The correlation analysis revealed that fruit yield per vine in sponge gourd was strongly influenced by a few key yield-contributing traits. Among these, number of female flowers, number of fruits per vine and fruit set percentage showed the highest positive association with yield at both genotypic and phenotypic levels, indicating that reproductive efficiency plays a major role in determining yield.

Similar findings have been reported by Bhagyasree *et al*. (2024) and Singh *et al*. (2018) in sponge gourd, Ahmed *et al*. (2024) in snake gourd, Chakraborty and Chaurasiya (2025) in bottle gourd, Panda *et al*. (2022) in ridge gourd.

Fruit yield per vine also exhibited strong positive association with vine length and average fruit weight, suggesting that vigorous vegetative growth coupled with better fruit development contributes to higher yield. The positive association of yield with fruit size traits such as fruit length and fruit diameter further indicates that improvement in fruit growth parameters can enhance overall productivity. These results are in agreement with earlier reports in sponge gourd by Chitra *et al*. (2024), Gantayat *et al*. (2025) and Kumar *et al*. (2013)

In contrast, fruit yield per vine showed strong negative association with sex ratio, days to first female flower appearance and days to first harvest after sowing, indicating that delayed flowering, delayed harvesting and an unfavourable male-to-female flower ratio adversely affect yield. Similar negative relationships between yield and earliness traits as well as sex ratio in sponge gourd, have been reported by Som *et al*. (2020), Krishnamoorthy *et al*. (2020) and in bittergourd by Srinivasulu *et al*. (2025).

The consistency in the direction of association at both genotypic and phenotypic levels for most traits suggests that these relationships are stable and can be effectively exploited in selection programmes aimed at improving fruit yield in sponge gourd.

**Conclusion**

Fruit yield per vine in sponge gourd was strongly influenced by number of female flowers, number of fruits per vine, fruit set percentage, vine length and average fruit weight, which showed positive association with yield. In contrast, sex ratio and earliness traits exhibited negative association with yield. The predominance of genotypic correlations indicates that these associations are largely genetic, suggesting that selection for positively associated traits would be effective for yield improvement.

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