



# International Journal of Research in Agronomy

E-ISSN: 2618-0618  
P-ISSN: 2618-060X  
© Agronomy  
NAAS Rating (2026): 5.20  
[www.agronomyjournals.com](http://www.agronomyjournals.com)  
2026; 9(6): 1260-1263  
Received: 20-04-2026  
Accepted: 25-05-2026

**Vaishali Singh**  
M.Sc. Student, Department of  
Vegetable Science, ANDUA&T,  
Kumarganj, Ayodhya, Uttar  
Pradesh, India

**CN Ram**  
Professor, Department of  
Vegetable Science, ANDUA&T,  
Kumarganj, Ayodhya, Uttar  
Pradesh, India

**Aastik Jha**  
Associate Professor, Department of  
Vegetable Science, ANDUA&T,  
Kumarganj, Ayodhya, Uttar  
Pradesh, India

**Anil Kumar**  
Assistant Professor, Department of  
Vegetable Science, ANDUA&T,  
Kumarganj, Ayodhya, Uttar  
Pradesh, India

**Santosh Kumar**  
Research Scholar, Department of  
Vegetable Science, ANDUA&T,  
Kumarganj, Ayodhya, Uttar  
Pradesh, India

**Vishal Singh**  
Research Scholar, Department of  
Horticulture, BBAU, Lucknow,  
Uttar Pradesh, India

**Tontim Zimik**  
M.Sc. Student, Department of  
Vegetable Science, ANDUA&T,  
Kumarganj, Ayodhya, Uttar  
Pradesh, India

**Shivangi Kamal**  
M.Sc. Student, Department of  
Vegetable Science, ANDUA&T,  
Kumarganj, Ayodhya, Uttar  
Pradesh, India

**Corresponding Author:**  
**CN Ram**  
Professor, Department of  
Vegetable Science, ANDUA&T,  
Kumarganj, Ayodhya, Uttar  
Pradesh, India

## Genetic variability, heritability and genetic advance in Sponge Gourd [*Luffa cylindrica* (Roem.) L.] Genotypes

**Vaishali Singh, CN Ram, Aastik Jha, Anil Kumar, Santosh Kumar, Vishal Singh, Tontim Zimik and Shivangi Kamal**

**DOI:** <https://www.doi.org/10.33545/2618060X.2026.v9.i6p.5861>

### Abstract

The present investigation entitled, "Studies on Genetic Variability and Trait Association in Sponge Gourd [*Luffa cylindrica* (Roem.) L.]" was conducted during the *zaid* season of 2025 at the Main Experimental Station, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh. A Completely Randomized Block Design with three replications was used to test twenty-five sponge gourd genotypes with sixteen quantitative and bio-chemical traits. All sixteen variables evaluated showed significant changes across genotypes, showing high level of genetic diversity. Dry matter content, vine length, fruit length, and number of main branches all yielded high GCV and PCV values. These qualities also had high heritability and genetic progress, indicating the importance of additive gene action and their appropriateness for successful selection. The genotype with the highest fruit yield per plant (2.72 kg) and per hectare (162.34 q/ha) was NDSG-6-23, followed by VRSG-78 and VRSG-68-1. Overall, the study determined that dry matter content, vine length, fruit length, number of primary branches, total soluble solids and ascorbic acid is key selection variables for sponge gourd genetic improvement.

**Keywords:** Sponge gourd, genetic variability, GCV, PCV, heritability, genetic advance, yield

### Introduction

Sponge gourd [*Luffa cylindrica* (Roem.) L.] is a well-known cucurbitaceous vegetable crop grown in tropical and subtropical areas. The sponge gourd, also known as the loofah, bath sponge, or dishcloth gourd, is a member of the Cucurbitaceae family with a chromosomal number of  $2n=26$ . The crop is appreciated for its soft, immature fruits, which are consumed as healthy vegetable, but it also has significant economic value in local and regional markets.

Sponge gourd fruits are high in dietary fibre, vitamins, and minerals, making them an essential component of a well-balanced diet. Sponge gourd is a robust climbing vine that thrives in warm, humid climates. It grows best on well-drained, rich loamy soils with enough of organic matter and prefers a temperature range of 25-35°C for optimal growth and fruit production. Proper nutrition management, watering, and the use of appropriate support systems like as trellises or bowers all benefit plant growth, fruit quality, and overall production.

Effective breeding requires analysing variability and categorizing it into heritable and non-heritable components. GCV, PCV, heritability percentage, and genetic advance percentage can be used for this purpose. Similar findings can be observed in Gantayat *et al.* (2025).

### Materials and Methods

The present investigation was conducted during the *zaid* of 2025 at the Main Experimental Station, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh. The experimental location is located in the Gangetic alluvial plains of eastern Uttar Pradesh and has humid subtropical climate and in between 24.470 and 26.560 N latitude and 82.120 and 83.980 E longitude at an altitude of 113 m above mean sea level. The experimental field featured well-drained sandy loam soil, which was ideal for growing sponge gourds.

**Table 1:** Source of sponge gourd genotypes

| Sl. No. | Genotypes             | Source of origin |
|---------|-----------------------|------------------|
| 1.      | NDSG-1-23             | ANDUAT, Ayodhya  |
| 2.      | NDSG-2-23             | ANDUAT, Ayodhya  |
| 3.      | VRSG-24-17            | IIVR, Varanasi   |
| 4.      | VRSG-1-15             | IIVR, Varanasi   |
| 5.      | VRSG-21-17            | IIVR, Varanasi   |
| 6.      | VRSG-186              | IIVR, Varanasi   |
| 7.      | VRSG-140              | IIVR, Varanasi   |
| 8.      | VRSG-214              | IIVR, Varanasi   |
| 9.      | VRSG-51               | IIVR, Varanasi   |
| 10.     | VRSG-1-14             | IIVR, Varanasi   |
| 11.     | VRSG-15               | IIVR, Varanasi   |
| 12.     | NDSG-3-23             | ANDUAT, Ayodhya  |
| 13.     | NDSG-4-23             | ANDUAT, Ayodhya  |
| 14.     | NDSG-5-23             | ANDUAT, Ayodhya  |
| 15.     | NDSG-6-23             | ANDUAT, Ayodhya  |
| 16.     | NDSG-7-23             | ANDUAT, Ayodhya  |
| 17.     | NDSG-8-23             | ANDUAT, Ayodhya  |
| 18.     | Kashi Jyoti           | IIVR, Varanasi   |
| 19.     | VRSG-154              | IIVR, Varanasi   |
| 20.     | VRSG-68-1             | IIVR, Varanasi   |
| 21.     | VRSG-26               | IIVR, Varanasi   |
| 22.     | VRSG-17-2017          | IIVR, Varanasi   |
| 23.     | VRSG-3-14             | IIVR, Varanasi   |
| 24.     | VRSG-78               | IIVR, Varanasi   |
| 25.     | Kashi Kalyani (Check) | IIVR, Varanasi   |

The experiment was carried out in a Completely Randomized Block Design (CRBD) with three replications. Each genotype was sown in three rows of 3 m length. A spacing of 3.0 m between rows and 0.6 m between plants was maintained. Prescribed agronomic practices and plant protection measures were followed uniformly for all treatments. Similar agronomic measures were observed by Mashilo *et al.* (2025) [7].

**Table 2:** Analysis of variance (mean squares) for sixteen characters in Sponge gourd

| S. No. | Traits<br>d.f.                                    | Source of variation |           |        |
|--------|---------------------------------------------------|---------------------|-----------|--------|
|        |                                                   | Replication         | Genotypes | Error  |
|        |                                                   | 2                   | 24        | 48     |
| 1.     | Days to first staminate flower anthesis           | 2.08                | 35.72**   | 6.19   |
| 2.     | Days to first pistillate flower anthesis          | 1.45                | 34.06**   | 6.79   |
| 3.     | Node number to first staminate flower appearance  | 0.26                | 1.43**    | 0.15   |
| 4.     | Node number to first pistillate flower appearance | 0.243               | 0.524**   | 0.083  |
| 5.     | Number of primary branches                        | 0.45                | 1.02**    | 0.07   |
| 6.     | Internodal length (cm)                            | 5.24                | 6.52**    | 0.72   |
| 7.     | Vine length (cm)                                  | 1.76                | 2.29**    | 0.12   |
| 8.     | Fruit length (cm)                                 | 1.16                | 60.10**   | 2.57   |
| 9.     | Fruit width (cm)                                  | 0.116               | 0.164**   | 0.07   |
| 10.    | Number of fruits per plant                        | 1.41                | 10.02**   | 1.6    |
| 11.    | Average fruit weight (g)                          | 52.14               | 349.43**  | 83.75  |
| 12.    | Total soluble solid (°Brix)                       | 0.027               | 0.994**   | 0.02   |
| 13.    | Ascorbic acid (mg/100g)                           | 0.2                 | 4.06**    | 0.12   |
| 14.    | Dry matter content (%)                            | 0.57                | 6.22**    | 0.04   |
| 15.    | Fruit yield per plant (kg)                        | 0.019               | 0.210**   | 0.04   |
| 16.    | Fruit yield (q/ha)                                | 68.95               | 711.66**  | 130.35 |

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

### Genetic variability

The estimations of GCV and PCV revealed that for all characteristics, the phenotypic coefficient of variation was greater than the genotypic coefficient of variation, showing that environmental factors impact trait expression. However, the differences between PCV and GCV were small for most features, indicating that the environmental influence was minimal and that much of the variation was genetic in nature.

Observations were recorded on five randomly selected plants from each genotype in each replication for sixteen quantitative characters, namely: days to first staminate flower anthesis, days to first pistillate flower anthesis, node number to first staminate flower appearance, node number to first pistillate flower appearance, number of primary branches, internodal length (cm), vine length (m), fruit length (cm), fruit width (cm), number of fruits per plant, average fruit weight (g), total soluble solids (°Brix), ascorbic acid (mg/100 g), dry matter content (%), fruit yield per plant (kg), and fruit yield (q/ha).

The data were subjected to analysis of variance following Panse and Sukhatme (2000) [8]. Genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were determined to measure variability. Broad-sense heritability was calculated according to Allard (1960) [1], and genetic advance as percent of mean was worked out following Hanson *et al.* (1956) [3].

### Results and Discussion

#### Analysis of variance

The analysis of variance, performed following the procedure suggested by Panse and Sukhatme (2000) [8]. It indicated extremely significant variations between genotypes for all the traits, suggesting that the experimental material included significant genetic diversity. This vast range of variability showed that sponge gourds may be effectively selected and improved.

Among the traits studied, fruit yield (q/ha) recorded the highest treatment mean square (711.66), followed by average fruit weight (349.43), fruit length (60.10), days to first staminate flower anthesis (35.72) and days to first pistillate flower anthesis (34.06). Significant variations across genotypes in quality indicators such as ascorbic acid and dry matter content demonstrated the germplasm's utility for both yield and quality enhancement.

The highest GCV and PCV were recorded for dry matter content (19.71 and 19.91%), followed by vine length (18.64 and 20.15%), fruit length (17.87 and 19.03%), number of primary branches (16.33 and 18.08%), node number to first staminate flower appearance (12.88 and 14.98%), ascorbic acid (12.63 and 13.19%), and total soluble solids (12.40 and 12.77%). These findings indicated the presence of moderate to high variability and therefore good scope for selection in these traits.

On the other hand, the lowest GCV and PCV were recorded for fruit width (4.57 and 8.21%), followed by node number to first pistillate flower appearance (5.10 and 6.39%), days to first pistillate flower anthesis (6.36 and 8.40%), average fruit weight (6.55 and 9.14%), and days to first staminate flower anthesis (7.56

and 9.64%), which suggested relatively lower variability in these traits. Likewise, Kousthubha *et al.* (2023)<sup>[5]</sup>, observed substantial genetic variability among Sponge gourd genotypes for fruit-related characters, including fruit width, indicating good scope for selection in breeding programmes.

**Table 3:** Estimates of range, grand mean, phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability in broad sense and GA in per cent of mean for sixteen characters in Sponge gourd germplasm.

| Characters                                        | Mean   | Range  |        | GCV (%) | PCV (%) | Heritability (%) | GA% mean |
|---------------------------------------------------|--------|--------|--------|---------|---------|------------------|----------|
|                                                   |        | Min    | Max    |         |         |                  |          |
| Days to first staminate flower anthesis           | 41.52  | 35.67  | 47     | 7.56    | 9.64    | 61.39            | 12.2     |
| Days to first pistillate flower anthesis          | 47.41  | 41.67  | 52.67  | 6.36    | 8.4     | 57.26            | 9.91     |
| Node number to first staminate flower appearance  | 5.07   | 3.75   | 6.16   | 12.88   | 14.98   | 73.96            | 22.82    |
| Node number to first pistillate flower appearance | 7.51   | 6.6    | 8.3    | 5.1     | 6.39    | 63.75            | 8.39     |
| Number of primary branches                        | 3.45   | 2.61   | 4.8    | 16.33   | 18.08   | 81.62            | 30.39    |
| Internodal length (cm)                            | 12.38  | 8.79   | 13.93  | 11.23   | 13.16   | 72.82            | 19.74    |
| Vine length (cm)                                  | 4.56   | 3.18   | 5.91   | 18.64   | 20.15   | 85.54            | 35.5     |
| Fruit length (cm)                                 | 24.51  | 16.17  | 31.38  | 17.87   | 19.03   | 88.18            | 34.56    |
| Fruit width (cm)                                  | 3.88   | 3.4    | 4.17   | 4.57    | 8.21    | 31.03            | 5.25     |
| Number of fruit per plant                         | 15.43  | 12.77  | 19.27  | 10.86   | 13.6    | 63.73            | 17.86    |
| Average fruit weight (g)                          | 143.59 | 126.62 | 169.33 | 6.55    | 9.14    | 51.4             | 9.68     |
| Total soluble solid (°Brix)                       | 4.6    | 3.6    | 5.5    | 12.4    | 12.77   | 94.25            | 24.8     |
| Ascorbic acid (mg/100g)                           | 9.08   | 5.33   | 11.62  | 12.63   | 13.19   | 91.81            | 24.94    |
| Dry matter content (%)                            | 7.28   | 4.47   | 9.9    | 19.71   | 19.91   | 97.97            | 40.18    |
| Fruit yield per plant (kg)                        | 2.21   | 1.7    | 2.72   | 10.73   | 14.06   | 58.25            | 16.87    |
| Fruit yield (q/ha)                                | 132.74 | 102.33 | 162.34 | 10.49   | 13.56   | 59.78            | 16.7     |

### Heritability and genetic advance

The broad-sense heritability estimates varied from 31.03% for fruit width to 97.97% for dry matter content. Dry matter content (97.97%), TSS (94.25%), ascorbic acid (91.81%), fruit length (88.18%), vine length (85.54%), and the number of main branches (81.62%) all showed a high heritability. This indicates that the variance seen for these traits was mostly genetic in nature and less influenced by the environment.

Moderate heritability was observed for node number to first staminate flower appearance (73.96%), internodal length (72.82%), node number to first pistillate flower appearance (63.75%), days to first staminate flower anthesis (61.39%), fruit yield per hectare (59.78%), fruit yield per plant (58.25%), and days to first pistillate flower anthesis (57.26%). The lowest heritability was observed for fruit width (31.03%), indicating a comparatively greater environmental influence on this character. Genetic advance as percent of mean ranged from 5.25% in fruit width to 40.18% in dry matter content. High GA% was observed for dry matter content (40.18%), vine length (35.50%), fruit length (34.56%), number of primary branches (30.39%), ascorbic acid (24.94%), TSS (24.80%), and node number to first staminate flower appearance (22.82%). High heritability together with high GA% indicated the predominance of additive gene action for these characters, suggesting that direct selection would be effective.

Moderate GA% was observed for internodal length (19.74%), number of fruits per plant (17.86%), fruit yield per plant (16.87%), and fruit yield per hectare (16.70%), indicating that selection may still be useful, though these traits may also involve non-additive gene effects.

Low GA% was recorded for fruit width (5.25%), node number to first pistillate flower appearance (8.39%), average fruit weight (9.68%), and days to first pistillate flower anthesis (9.91%), suggesting greater environmental influence and/or non-additive gene action. Likewise, Billur *et al.* (2025) reported high heritability coupled with high genetic advance was recorded in for fruit length, fruit diameter, number of fruits per vine, and average fruit weight, indicating predominance of additive gene action.

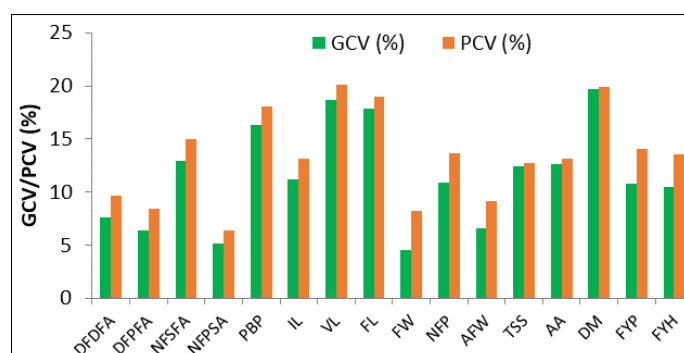


**Fig 1:** GCV and PCV for sixteen characters in Sponge gourd.

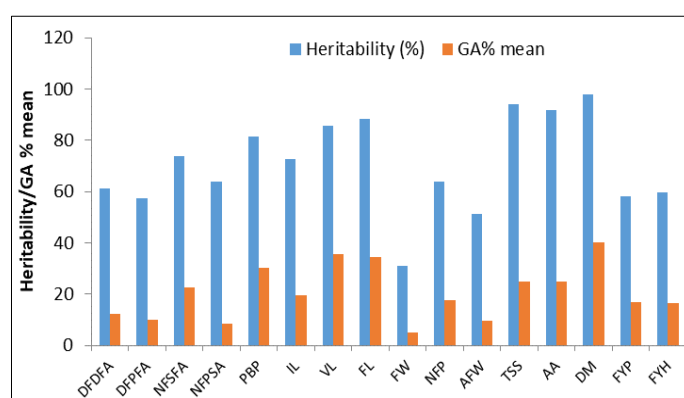


**Fig 2:** Heritability and GA% mean of sixteen characters in Sponge gourd

DFSFA:- Days to first staminate flower anthesis, DFPFA:- Days to first pistillate flower anthesis, NFSFA:- Node number to first staminate flower appearance, NFPFA:- Node number to first pistillate flower appearance, NPB:- Number of primary branches, INL:-Internodal length, VL:-Vine length, FL:- Fruit length, FW:- Fruit width, NFP:-Number of fruits per plant , AFW:-Average fruit weight, T.S.S. :- Total soluble solid, DM:-Dry matter, AA:- Ascorbic acid, YPP:- Yield per plant (kg), YQH:-Yield (q/ha)

## Conclusion

The present research clearly indicated the presence of significant genetic variability among the 25 sponge gourd genotypes examined under Ayodhya conditions. The genotypes NDSG-6-23, VRSG-78, VRSG-68-1, and Kashi Kalyani emerged as possible high-yielding entry, whereas VRSG-214, VRSG-68-1, NDSG-5-23, and VRSG-24-17 were found as comparably early flowering genotypes. Among the parameters tested, dry matter content, vine length, fruit length, number of main branches, total soluble solids, and ascorbic acid had high GCV, heritability, and genetic advance as percent of mean, showing that additive gene action predominated. These qualities can thus be significantly enhanced by direct phenotypic selection. Modest heritability, along with modest genetic progress for fruit output per plant and fruit yield per hectare, showed that yield may be improved by selection in later generations following the fixation of beneficial genes. Overall, the study suggests that NDSG-6-23, VRSG-78, and VRSG-68-1 may be useful genotypes for increasing yield, whereas traits such as dry matter content, fruit length, vine length, number of primary branches, TSS, and ascorbic acid can be used as reliable selection criteria in sponge gourd breeding programs.

## References

1. Allard RW. Principles of plant breeding. New York: John Wiley and Sons; 1960. 485 p.
2. Dewey DR, Lu KH. A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agronomy Journal*. 1959;51:515-518.
3. Hanson CH, Robinson HF, Comstock RE. Biometrical studies of yield in segregating populations of Korean lespedeza. *Agronomy Journal*. 1956;48:268-272.
4. Johnson HW, Robinson HF, Comstock RE. Estimates of genetic and environmental variability in soybean. *Agronomy Journal*. 1955;47:314-318.
5. Kousthubha VP, Anitha P, Kumar P, Xavier F, Beena VI. Genetic diversity analysis in sponge gourd. *Indian Journal of Agricultural Sciences*. 2023;93(4):447-451.
6. Mahalanobis PC. On the generalized distance in statistics. *Proceedings of the National Institute of Sciences of India*. 1936;2:49-55.
7. Mashilo J, Shimelis H, Ngwepe MR. Genetic improvement and innovations of sponge gourd (*Luffa cylindrica* L.): An opportunity crop. *Industrial Crops and Products*. 2025;225:120430.
8. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. New Delhi: Indian Council of Agricultural Research; 2000. p. 359.