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# Mean Performance Analysis for different characters in Okra (*Abelmoschus esculantus* L. Moench)

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**ABSTRACT: The field experiment was conducted at the Horticulture Research Centre, Department of Horticulture, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, during the summer season of 2020–2021. The experiment used 95 genotypes (20 parents and 75 hybrids) in a randomized block design with three replications. Five plants were selected randomly from each replication and data was recorded following characters: plant height (cm), days to 50% flowering, days to first flowering, inter-node length (cm), number of nodes per plant, number of fruits per plant, fruit length (cm), fruit diameter (cm), number of seeds per fruit, weight of 100 seeds per plant (g), and fruit yield per plant (g). The mean of the parents and the mean of the hybrids were compared, which revealed that the overall performance of the hybrids was superior to their parents. The cross-combination Azad Bhindi-2 × Hisar Unnat and Pusa Mukhmali × VRO-6 showed better results in yield per plant. Thus, it is implied that there ample variability in the genotypes of okra. Yields of present cultivars of okra per unit area are very low, because they have been grown continuously for many years. Therefore, there is a need to improve those varieties and develop new varieties.**

**Keywords:** Mean performance, Okra, Characters, Growth, Yield.

## INTRODUCTION

Okra [*Abelmoschus esculentus* (L.) Moench.] is the most important vegetable grown in tropical and sub-tropical parts in the India. It is members of the family Malvaceae and having somatic chromosome number 2n = 130. It is called lady's finger in England, Gumbo in U.S.A. and Bhindi in India. Okra is an African word and is native to northern Africa. India has first rank in area and production of okra, followed by Nigeria in the world. Okra is commercially grown in Gujarat, Maharashtra, Andhra Pradesh, Uttar Pradesh, Madhya Pradesh and West Bengal in India. During 2019-20, vegetables occupied 10.31 million hectare, producing 188.28 million tonne with an average productivity of 18.26 t $ha^{-1}$. In Uttar Pradesh, the area under vegetable production was 1.31 million hectare in 2019-20, with a production of 29.16 million tonne and a productivity of 22.25 t $ha^{-1}$. In India, okra cover 0.52 million hectare out of a total of 10.31 million hectare, yielding 6.35 million tonne (Anonymous, 2021). The immature pod pods are consumed as a vegetable, while the extract from the harvested fruit is used in soups and sauces, as well as in various recipes (Sengkhamparn *et al.*, 2010). Green fruits are also rich source of iron and vitamin A, B and C (Kumar *et al.*, 2021c). Fruits of okra are useful for the control of goiter disease due to high iodine content (Okoli, 2021). The main issues with okra are that it is a high-yielding variety with good quality output and a low incidence of pests and illnesses. The understanding of mean performance of characters is of prime importance in selection of effective hybrid.

## MATERIALS AND METHODS

This experiment was conducted at the Horticulture Research Centre, Department of horticulture, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, during summer season of 2020-2021. The Horticulture Research Centre, Meerut is located at 29.01°N′ latitude and 77.45°E′ by having a distance of around 70 K.M from the national capital, New Delhi, at an altitude of 297 m.a.s.l. The experiment used 95 genotypes (20 parents and 75 hybrids) in a Randomized Block Design with three

replications. Each plot had a size of 2.40 × 1.50 meter, consisting of four rows and a total of five plants per row. The spacing between rows, plants, and adjacent replications was 0.60, 0.30, and 1 meter, respectively. Twenty genotypes were collected from ICAR-IIVR, Varanasi and seventy-five hybrids were developed from the cross of genotypes in a Line × Tester design. Five plants were selected randomly from each replication and data was recorded for the characters viz. Plant height (cm), days to 50% flowering, days to first flowering, inter-node length (cm), number of nodes per plant, number of fruits per plant, fruit length (cm), fruit diameter (cm), number of seeds per fruit, weight of 100 seeds per plant (g), and fruit yield per plant (g). The statistical analysis for experimental design was given by Panse and Sukhatme (1967).

## RESULT AND DISCUSSION

The estimate of mean performance is presented in Table 1. The analysis of variance, the mean sum of squares due to parents and hybrids were highly significant for all the characters under the study. The plant height ranged from 81.82 cm to 129.50 cm with an average of 106.37 cm in parent and crosses. Among the parents, VRO-5 (85.09 cm) recorded minimum plant height and Kashi Lila (128.11 cm) recorded maximum plant height. The average performance of parents was recorded (103.51 cm). Among the crosses, plant height minimum was observed in VRO-5 × Hisar Unnat (81.82 cm). Whereas the maximum plant height of Kashi Satdhari × VRO-6 (119.50 cm) was observed. The overall mean performance of crosses was recorded (107.17 cm). Plant height is a major concern for plant breeders as plant height has a positive relationship with yield.

Days to 50 per cent flowering ranged from 34.00 days to 51.67 days with an average of 42.79 days. Among the parents, the minimum days to 50 per cent flowering were observed in Punjab Padmini (35.33 days) and maximum days to 50 per cent flowering in Parbhani Kranti (51.67 days). The grand mean value of parents for days to 50 per cent flowering was (44.15 days). In the case of crosses, the minimum days to 50 per cent flowering were observed in Punjab Padmini × Kashi Lila (34.00 days) and maximum days to 50 per cent flowering in Pusa Swani × Hisar Unnat (50.67 days). The grand mean value for days to 50 per cent flowering was (42.42 days) in the crosses. Days to 50% flowering are one of the earliest characteristics. Negative value for this character is desirable in okra improvement.

The mean values for days to first flowering ranged from 30.67 days to 47.53 days with an average of 39.28 days. Among the parents, Punjab Padmini (31.47 days) was recorded as the minimum days to first flowering and Parbhani Kranti (47.53 days) was recorded as the maximum days to first flowering. The overall mean of parents was (40.07 days). Among the crosses, minimum days to first flowering were observed in Punjab Padmini × Kashi Lila (30.67 days) and maximum days to first flowering were recorded in Pusa swani × Hisar unnat (47.13 days). The overall mean of crosses was (39.05 days). Days to first flowering are also an early characteristic. It increases the number of fruits per plant and helps in getting early yields. Negative values are desirable for this trait. Among the parents, first flowering was observed in Punjab Padmini, Kashi Lila and in crosses Punjab Padmini × Kashi Lila, Punjab Padmini × Hisar Unnat.

In case of number of primary branches per plant varies from 1.60 to 5.07 with the grand mean value of 3.07. Among the parents, the lowest number of primary branches per plant was recorded in VRO-3 (1.67) and highest in Azad Bhindi-2 (3.87). The mean value for the number of primary branches per plant was (3.03) in parents. In the crosses, the lowest number of primary branches per plant was recorded in Pusa Swani × Pusa A-4 (1.60) and the highest in Kashi Satdhari × VRO-6 (5.07). The mean value for the number of primary branches per plant was (3.08) in crosses. Increasing the number of branches results in an increase in the number of fruiting nodes, and thus increasing the number of fruits per plant increases the yield per plant, as this trait determines the fruit bearing surface. Highest number of branches were recorded in parent Azad Bhind-2, Kashi Kranti and in cross Kashi Satdhari × VRO-6, Azad Bhindi-2 × VRO-6.

The data show that inter-node length varies among the genotypes and the range for internode length was 3.12 cm to 7.19 cm with an average of 5.03 cm. In the case of parents, the minimum internode length was observed in Pusa Mukhmali (3.15 cm) and the maximum inter-node length was observed in Kashi satdhari (7.17 cm). The overall mean of parents was (5.18 cm). In the case of hybrids, the minimum inter-node length was observed in VRO-5 × Pusa A-4 (3.12 cm) and the maximum inter-node length was observed in Kashi satdhari × Kashi Lila (7.19 cm). The overall mean of hybrids was (5.03 cm). Negative value is beneficial for inter-node length because shorter internodes allow for more blooms and, eventually, a greater number of fruits on even plants of smaller stature. Short internode length was observed in parent Pusa Mukhmali, Pusa A-4 and in crosses VRO-5 × Pusa A-4, VRO-5 × Hisar Unnat.

In case of number of fruits per plant was range from 11.20 to 28.87 and the grand mean was 18.70 for the number of fruits per plant. Among the parents, the lowest number of fruits per plant was recorded in DOV-91-4 (11.20) and the highest in Kashi Lila (21.87). The mean value for the number of fruits per plant was (16.64) for parents. In the crosses, the lowest number of fruits per plant was recorded in KS-410 × Kashi Lila (13.47) and the highest in Azad Bhindi-2 × Hisar Unnat (28.87). The mean value for the number of fruits per plant was (19.29) in crosses. The number of fruits per plant directly affects the fruit yield per plant, so this characteristic is very important for fruit yield.

Mean values for fruit length ranged from 8.62 cm to 22.17 cm with an average of 15.86 cm. Among the parents, KS-410 (9.99 cm) was recorded as the minimum fruit length and Pusa Swani (19.54 cm) was recorded as the maximum fruit length. The overall mean of parents was (15.44 cm). Among the crosses, minimum fruit length was observed in Pusa Mukhmali × Pusa A-4 (8.62 cm) and maximum fruit length was recorded in Azad Bhindi-2 × Kashi Lila (22.17 cm).

**Table 1: Mean performance of parents and hybrids for twelve quantitative characters in okra.**

| Sr. No. | Character<br>Treatments ($F_1$ + Parents) | Plant height (cm) | Days to 50 % flowering | Days to first flowering | Number of primary branches per plant | Internode length (cm) | Number of nodes per plant | Number of fruits per plant | Fruit length (cm) | Fruit diameter (cm) | Number of seeds per fruit | Weight of 100 seed (g) | Fruit yield per plant (g) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Larm-1 x Hisar Unnat | 106.10 | 41.00 | 38.53 | 2.73 | 5.93 | 18.47 | 15.60 | 14.47 | 1.62 | 61.87 | 5.64 | 162.07 |
| 2 | Larm-1 x Arka Abhay | 116.76 | 43.33 | 39.67 | 2.33 | 5.79 | 20.73 | 17.60 | 16.27 | 1.77 | 60.33 | 6.51 | 182.80 |
| 3 | Larm-1 x Pusa A-4 | 101.02 | 39.67 | 36.40 | 3.20 | 4.89 | 20.33 | 18.00 | 11.75 | 1.51 | 53.00 | 5.16 | 186.07 |
| 4 | Larm-1 x Kashi Lila | 120.32 | 38.00 | 34.20 | 3.07 | 6.01 | 20.87 | 18.00 | 14.43 | 1.44 | 64.07 | 5.13 | 190.67 |
| 5 | Larm-1 x VRO-6 | 113.86 | 42.67 | 36.07 | 2.60 | 5.57 | 21.07 | 18.20 | 16.42 | 1.62 | 60.33 | 6.58 | 193.80 |
| 6 | VRO-3 x Hisar Unnat | 108.18 | 43.33 | 40.53 | 1.80 | 5.23 | 21.13 | 17.53 | 14.25 | 1.57 | 63.53 | 5.35 | 187.07 |
| 7 | VRO-3 x Arka Abhay | 98.40 | 43.00 | 39.60 | 1.73 | 5.03 | 19.60 | 15.87 | 17.15 | 1.41 | 71.33 | 6.58 | 170.93 |
| 8 | VRO-3 x Pusa A-4 | 106.57 | 39.33 | 36.53 | 2.07 | 4.81 | 22.27 | 19.13 | 14.31 | 1.63 | 62.93 | 6.69 | 207.20 |
| 9 | VRO-3 x Kashi lila | 118.67 | 41.00 | 37.67 | 1.80 | 6.47 | 18.67 | 15.53 | 17.75 | 1.76 | 54.47 | 7.14 | 166.27 |
| 10 | VRO-3 x VRO-6 | 116.36 | 42.00 | 39.33 | 1.93 | 5.31 | 21.87 | 18.47 | 16.77 | 1.61 | 64.47 | 5.18 | 197.20 |
| 11 | VRO-4 x Hisar Unnat | 111.20 | 43.33 | 40.07 | 3.53 | 4.47 | 25.20 | 22.80 | 16.98 | 1.78 | 75.93 | 7.23 | 244.27 |
| 12 | VRO-4 x Arka Abhay | 96.23 | 44.67 | 41.60 | 2.93 | 4.30 | 21.40 | 18.60 | 15.77 | 1.72 | 66.07 | 7.66 | 197.07 |
| 13 | VRO-4 x Pusa A-4 | 107.37 | 41.00 | 37.47 | 2.80 | 4.27 | 25.27 | 22.67 | 14.80 | 1.79 | 56.73 | 6.57 | 241.93 |
| 14 | VRO-4 x Kashi lila | 114.07 | 42.33 | 39.00 | 3.00 | 5.34 | 21.80 | 19.47 | 17.87 | 1.55 | 74.87 | 6.68 | 209.73 |
| 15 | VRO-4 x VRO-6 | 111.49 | 42.33 | 39.13 | 3.27 | 4.83 | 22.80 | 20.07 | 17.91 | 1.58 | 58.73 | 6.94 | 214.27 |
| 16 | P. Kranti x H. Unnat | 100.03 | 45.67 | 42.33 | 2.73 | 5.49 | 18.67 | 15.87 | 16.75 | 1.76 | 69.40 | 6.35 | 175.13 |
| 17 | P. Kranti x A. Abhay | 110.87 | 46.00 | 42.60 | 2.93 | 4.67 | 24.20 | 21.20 | 17.63 | 1.70 | 57.33 | 6.16 | 236.07 |
| 18 | P. Kranti x Pusa A-4 | 94.01 | 43.33 | 40.07 | 2.93 | 4.16 | 22.87 | 19.80 | 15.81 | 1.52 | 66.40 | 7.13 | 216.67 |
| 19 | P. Kranti x Kashi lila | 116.26 | 42.00 | 38.87 | 2.60 | 5.79 | 20.33 | 17.20 | 18.96 | 1.72 | 72.13 | 5.83 | 189.47 |
| 20 | P. Kranti x VRO-6 | 120.25 | 44.33 | 41.13 | 3.20 | 5.55 | 21.00 | 18.67 | 17.72 | 1.53 | 63.13 | 6.23 | 203.53 |
| 21 | BCO-1 x Hisar Unnat | 106.95 | 39.00 | 35.87 | 3.47 | 4.64 | 23.27 | 21.20 | 12.67 | 1.46 | 64.47 | 6.25 | 237.80 |
| 22 | BCO-1 x Arka Abhay | 112.59 | 41.33 | 37.80 | 2.93 | 5.83 | 19.40 | 16.73 | 13.04 | 1.59 | 61.07 | 7.20 | 178.73 |
| 23 | BCO-1 x Pusa A-4 | 108.57 | 36.33 | 32.87 | 3.60 | 4.48 | 24.20 | 22.00 | 11.48 | 1.41 | 71.13 | 6.63 | 225.13 |
| 24 | BCO-1 x Kashi lila | 110.03 | 40.00 | 36.73 | 3.27 | 6.76 | 16.13 | 13.80 | 17.53 | 1.60 | 58.67 | 7.11 | 151.20 |
| 25 | BCO-1 x VRO-6 | 111.97 | 40.33 | 37.13 | 3.80 | 5.84 | 19.07 | 17.47 | 17.53 | 1.58 | 65.47 | 7.31 | 190.33 |
| 26 | P. Padmini x H. Unnat | 106.29 | 35.33 | 31.80 | 2.60 | 5.49 | 19.47 | 16.33 | 17.99 | 1.63 | 55.87 | 7.70 | 179.33 |
| 27 | P. Padmini x A. Abhay | 109.19 | 38.67 | 35.13 | 3.33 | 5.85 | 18.60 | 16.20 | 16.76 | 1.81 | 65.67 | 7.30 | 178.67 |
| 28 | P. Padmini x Pusa A-4 | 97.83 | 36.67 | 32.93 | 3.67 | 5.15 | 19.13 | 17.13 | 17.15 | 1.54 | 64.00 | 7.73 | 177.93 |
| 29 | P. Padmini x Kashi lila | 116.12 | 34.00 | 30.67 | 2.60 | 5.18 | 22.40 | 19.73 | 19.09 | 1.73 | 73.33 | 7.35 | 216.20 |
| 30 | P. Padmini x VRO-6 | 115.17 | 40.00 | 36.40 | 3.07 | 5.50 | 21.13 | 19.40 | 18.51 | 1.95 | 74.60 | 7.82 | 207.60 |
| 31 | DOV-91-4 x H. Unnat | 120.57 | 42.33 | 39.13 | 3.27 | 6.21 | 19.13 | 16.33 | 14.86 | 1.70 | 64.73 | 6.71 | 181.13 |
| 32 | DOV-91-4 x A. Abhay | 124.69 | 42.33 | 39.00 | 4.00 | 6.31 | 20.00 | 18.60 | 16.07 | 1.61 | 58.67 | 7.10 | 202.93 |
| 33 | DOV-91-4 x Pusa A-4 | 110.67 | 39.67 | 36.53 | 3.67 | 5.47 | 20.27 | 17.93 | 16.01 | 1.71 | 44.80 | 6.93 | 197.40 |
| 34 | DOV-91-4 x Kashi lila | 128.31 | 37.67 | 34.27 | 2.87 | 6.54 | 19.47 | 16.67 | 16.73 | 1.82 | 65.00 | 6.41 | 173.67 |
| 35 | DOV-91-4 x VRO-6 | 120.83 | 41.67 | 38.27 | 2.27 | 6.03 | 20.53 | 17.07 | 16.96 | 1.60 | 70.87 | 6.83 | 186.73 |
| 36 | KS-410 x Hisar Unnat | 88.80 | 46.33 | 43.20 | 1.73 | 4.66 | 19.13 | 13.93 | 13.43 | 1.49 | 50.27 | 4.64 | 146.07 |
| 37 | KS-410 x Arka Abhay | 91.97 | 43.67 | 40.47 | 2.53 | 4.83 | 19.33 | 15.73 | 13.25 | 1.70 | 39.00 | 5.15 | 172.73 |
| 38 | KS-410 x Pusa A-4 | 95.62 | 41.67 | 38.47 | 3.27 | 4.26 | 22.53 | 19.73 | 9.16 | 1.62 | 56.33 | 4.11 | 218.80 |
| 39 | KS-410 x Kashi lila | 99.37 | 42.67 | 39.33 | 2.67 | 5.61 | 17.87 | 13.47 | 12.81 | 1.70 | 65.33 | 5.43 | 129.00 |
| 40 | KS-410 x VRO-6 | 100.28 | 43.67 | 40.60 | 3.40 | 4.37 | 22.93 | 21.60 | 12.87 | 1.70 | 64.27 | 4.14 | 239.73 |
| 41 | Azad B.-2 x H. Unnat | 120.45 | 46.00 | 42.20 | 4.53 | 3.88 | 30.47 | 28.87 | 19.33 | 2.04 | 56.93 | 6.64 | 318.80 |
| 42 | Azad B.-2 x A.Abhay | 123.71 | 44.67 | 41.33 | 3.47 | 4.02 | 30.80 | 27.73 | 17.57 | 1.71 | 84.53 | 7.68 | 310.60 |
| 43 | Azad B.-2 x Pusa A-4 | 115.46 | 43.00 | 39.67 | 3.40 | 4.18 | 26.47 | 24.93 | 16.62 | 1.53 | 71.87 | 6.84 | 281.00 |
| 44 | Azad B.-2 x Kashi lila | 128.39 | 42.33 | 39.13 | 4.33 | 4.66 | 27.07 | 25.40 | 22.17 | 1.81 | 74.60 | 7.07 | 287.40 |
| 45 | Azad Bhindi-2 x VRO-6 | 120.33 | 44.67 | 41.07 | 4.87 | 4.69 | 25.33 | 24.87 | 20.37 | 1.69 | 73.60 | 6.07 | 280.00 |
| 46 | IC-341190 x H. Unnat | 91.34 | 44.00 | 40.73 | 2.80 | 5.07 | 18.27 | 15.40 | 16.09 | 1.46 | 58.33 | 5.39 | 180.33 |
| 47 | IC-341190 x A. Abhay | 96.61 | 42.00 | 38.53 | 2.87 | 5.21 | 18.60 | 15.47 | 15.63 | 1.70 | 63.93 | 6.93 | 170.40 |
| 48 | IC-341190 x Pusa A-4 | 86.93 | 39.67 | 36.47 | 2.07 | 4.51 | 19.73 | 16.13 | 15.15 | 1.81 | 50.33 | 6.08 | 168.07 |
| 49 | IC-341190 x Kashi lila | 103.66 | 39.33 | 36.00 | 3.87 | 5.73 | 18.20 | 17.13 | 16.95 | 1.60 | 64.53 | 5.38 | 193.40 |
| 50 | IC-341190 x VRO-6 | 103.83 | 42.00 | 38.47 | 3.13 | 4.41 | 23.40 | 21.27 | 17.15 | 1.71 | 63.80 | 6.55 | 236.87 |
| 51 | VRO-5 x Hisar Unnat | 81.82 | 50.33 | 47.07 | 2.47 | 3.34 | 24.47 | 22.47 | 17.09 | 1.39 | 66.07 | 7.91 | 245.93 |
| 52 | VRO-5 x Arka Abhay | 91.80 | 47.00 | 43.80 | 2.60 | 3.78 | 24.07 | 21.93 | 13.49 | 1.68 | 69.33 | 8.11 | 242.20 |

*Cont…….*

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **53** | **VRO-5 x Pusa A-4** | 87.27 | 43.33 | 40.07 | 2.87 | 3.12 | 27.80 | 25.33 | 15.49 | 1.77 | 50.00 | 7.42 | 259.53 |
| **54** | **VRO-5 x Kashi lila** | 92.47 | 42.67 | 39.33 | 3.53 | 4.73 | 19.53 | 17.60 | 17.51 | 1.81 | 63.00 | 6.74 | 183.40 |
| **55** | **VRO-5 x VRO-6** | 94.05 | 47.00 | 43.73 | 3.67 | 4.51 | 20.73 | 18.73 | 18.03 | 1.70 | 71.53 | 8.24 | 205.20 |
| **56** | **Kashi Kranti x H. Unnat** | 103.19 | 42.00 | 38.87 | 4.67 | 5.86 | 17.73 | 16.60 | 9.44 | 1.69 | 58.73 | 7.78 | 181.53 |
| **57** | **Kashi Kranti x A Abhay** | 110.72 | 43.33 | 39.27 | 3.67 | 5.32 | 20.80 | 18.93 | 15.75 | 1.71 | 58.53 | 6.81 | 209.80 |
| **58** | **Kashi Kranti x Pusa A-4** | 103.29 | 39.67 | 35.80 | 3.20 | 4.51 | 22.80 | 19.93 | 14.23 | 1.52 | 61.27 | 8.07 | 221.07 |
| **59** | **Kashi Kranti x K. lila** | 116.71 | 38.67 | 39.27 | 3.93 | 6.45 | 18.00 | 16.00 | 15.96 | 1.72 | 64.80 | 7.20 | 163.20 |
| **60** | **Kashi Kranti x VRO-6** | 108.40 | 43.33 | 43.87 | 3.80 | 5.59 | 19.20 | 17.00 | 14.83 | 1.90 | 56.67 | 8.24 | 184.67 |
| **61** | **K. Satdhari x H.Unnat** | 116.90 | 47.33 | 42.80 | 4.40 | 6.41 | 18.07 | 17.07 | 16.42 | 1.70 | 63.73 | 6.20 | 188.27 |
| **62** | **K. Satdhari x A. Abhay** | 120.22 | 46.67 | 40.07 | 3.60 | 6.53 | 18.60 | 16.27 | 16.61 | 1.78 | 64.53 | 6.13 | 182.00 |
| **63** | **K. Satdhari x Pusa A-4** | 113.95 | 43.67 | 39.00 | 3.87 | 5.09 | 22.33 | 20.33 | 14.77 | 1.81 | 50.93 | 6.82 | 236.40 |
| **64** | **K. Satdhari x Kashi lila** | 129.50 | 42.67 | 39.00 | 2.93 | 7.19 | 17.80 | 15.13 | 15.79 | 1.61 | 63.80 | 6.44 | 167.13 |
| **65** | **Kashi Satdhari x VRO-6** | 123.25 | 45.00 | 41.07 | 5.07 | 6.49 | 19.00 | 18.20 | 17.67 | 1.96 | 63.13 | 7.14 | 201.00 |
| **66** | **Pusa Swani x H. Unnat** | 96.38 | 50.67 | 47.13 | 2.20 | 4.07 | 23.53 | 19.73 | 20.16 | 1.90 | 64.93 | 5.85 | 220.13 |
| **67** | **Pusa Swani x A. Abhay** | 103.83 | 49.33 | 45.67 | 2.80 | 4.17 | 24.80 | 21.67 | 18.38 | 1.99 | 73.67 | 7.78 | 237.47 |
| **68** | **Pusa Swani x Pusa A-4** | 100.49 | 46.67 | 43.13 | 1.60 | 3.60 | 27.60 | 23.07 | 17.29 | 1.73 | 65.13 | 6.96 | 255.20 |
| **69** | **Pusa Swani x Kashi lila** | 107.03 | 45.00 | 41.40 | 2.13 | 4.52 | 23.60 | 19.93 | 18.85 | 1.85 | 67.00 | 7.12 | 224.80 |
| **70** | **Pusa Swani x VRO-6** | 107.87 | 43.33 | 40.20 | 3.27 | 4.31 | 24.93 | 22.20 | 13.93 | 1.98 | 62.93 | 7.90 | 244.87 |
| **71** | **P. Mukhmali x H. Unnat** | 87.17 | 40.00 | 36.73 | 2.33 | 3.43 | 25.33 | 21.87 | 13.65 | 1.72 | 64.07 | 6.52 | 242.87 |
| **72** | **P. Mukhmali x A.Abhay** | 92.11 | 41.33 | 37.93 | 1.73 | 3.41 | 26.80 | 22.60 | 15.64 | 1.61 | 59.53 | 6.15 | 247.20 |
| **73** | **Pusa Mukhmali x P. A-4** | 87.37 | 40.33 | 36.93 | 3.60 | 3.53 | 24.67 | 21.33 | 8.62 | 1.72 | 51.20 | 7.19 | 239.80 |
| **74** | **P. Mukhmali x K. lila** | 103.71 | 41.00 | 37.47 | 3.00 | 4.19 | 24.80 | 22.20 | 14.17 | 1.65 | 63.80 | 8.13 | 243.73 |
| **75** | **P.Mukhmali x VRO-6** | 107.04 | 42.00 | 38.20 | 3.40 | 3.43 | 30.80 | 28.40 | 18.01 | 1.71 | 71.00 | 7.71 | 315.73 |
| **76** | **Larm-1** | 105.97 | 46.00 | 41.40 | 2.40 | 5.87 | 18.47 | 16.13 | 13.17 | 1.49 | 54.33 | 5.25 | 175.73 |
| **77** | **VRO-3** | 110.28 | 47.67 | 43.80 | 1.67 | 5.80 | 19.13 | 15.13 | 16.60 | 1.46 | 66.47 | 5.26 | 174.27 |
| **78** | **VRO-4** | 105.83 | 47.67 | 43.60 | 3.27 | 4.91 | 21.73 | 18.13 | 17.55 | 1.58 | 69.53 | 6.82 | 202.00 |
| **79** | **Parbhani Kranti** | 102.08 | 51.67 | 47.53 | 3.47 | 5.16 | 20.20 | 15.33 | 18.36 | 1.67 | 72.33 | 5.94 | 154.53 |
| **80** | **BCO-1** | 106.60 | 39.67 | 36.13 | 3.07 | 5.84 | 18.53 | 12.40 | 15.36 | 1.41 | 60.33 | 6.99 | 132.60 |
| **81** | **Punjab Padmini** | 101.66 | 35.33 | 31.47 | 3.13 | 6.18 | 16.87 | 13.40 | 17.51 | 1.87 | 68.40 | 7.21 | 162.47 |
| **82** | **DOV-91-4** | 110.46 | 44.00 | 39.80 | 2.93 | 6.81 | 16.80 | 11.20 | 13.06 | 1.69 | 53.00 | 6.62 | 132.33 |
| **83** | **KS-410** | 96.61 | 45.67 | 41.67 | 2.07 | 5.69 | 17.33 | 11.47 | 9.99 | 1.67 | 43.00 | 4.17 | 129.47 |
| **84** | **Azad Bhindi-2** | 113.85 | 46.33 | 42.40 | 3.87 | 4.67 | 24.87 | 20.20 | 19.21 | 1.84 | 75.00 | 6.18 | 243.47 |
| **85** | **IC-341190** | 86.96 | 47.00 | 42.87 | 3.13 | 5.65 | 15.47 | 11.73 | 14.03 | 1.69 | 57.33 | 5.46 | 144.07 |
| **86** | **VRO-5** | 85.09 | 47.67 | 43.53 | 3.33 | 3.91 | 21.87 | 18.80 | 16.83 | 1.69 | 66.20 | 7.71 | 203.93 |
| **87** | **Kashi Kranti** | 93.77 | 44.67 | 40.20 | 3.80 | 5.95 | 16.13 | 15.93 | 10.18 | 1.65 | 60.60 | 7.18 | 175.73 |
| **88** | **Kashi Satdhari** | 116.15 | 47.00 | 42.80 | 3.67 | 7.17 | 16.67 | 12.60 | 15.71 | 1.87 | 62.80 | 6.18 | 155.53 |
| **89** | **Pusa Swani** | 92.42 | 45.67 | 41.47 | 3.47 | 3.69 | 25.40 | 19.60 | 19.54 | 1.79 | 75.53 | 6.96 | 200.53 |
| **90** | **Pusa Mukhmali** | 93.69 | 44.33 | 40.53 | 1.93 | 3.15 | 30.27 | 19.80 | 13.03 | 1.68 | 51.07 | 6.46 | 199.73 |
| **91** | **Hisar Unnat** | 104.91 | 43.33 | 39.67 | 2.53 | 4.38 | 23.80 | 20.07 | 15.50 | 1.68 | 61.07 | 6.03 | 205.73 |
| **92** | **Arka abhay** | 96.57 | 43.00 | 39.53 | 3.07 | 4.61 | 20.93 | 18.20 | 15.31 | 1.70 | 60.87 | 7.47 | 189.47 |
| **93** | **Pusa A-4** | 92.86 | 37.67 | 33.33 | 2.87 | 3.67 | 23.60 | 19.67 | 13.77 | 1.64 | 56.47 | 6.89 | 200.07 |
| **94** | **Kashi Lila** | 128.11 | 36.00 | 32.13 | 3.80 | 5.60 | 22.87 | 21.87 | 18.32 | 1.77 | 69.27 | 7.05 | 236.80 |
| **95** | **VRO-6 (Check Variety)** | 120.16 | 42.67 | 38.60 | 3.60 | 4.91 | 23.27 | 21.40 | 17.04 | 1.76 | 68.27 | 7.64 | 235.47 |
| | **Mean** | 106.37 | 42.79 | 39.28 | 3.07 | 5.06 | 21.61 | 18.70 | 15.86 | 1.68 | 63.10 | 6.65 | 204.08 |
| | **Min** | 81.82 | 34.00 | 30.67 | 1.60 | 3.12 | 15.47 | 11.20 | 8.62 | 1.39 | 39.00 | 4.11 | 129.00 |
| | **Max** | 129.50 | 51.67 | 47.53 | 5.07 | 7.19 | 30.80 | 28.87 | 22.17 | 2.04 | 84.53 | 8.24 | 318.80 |
| | **SE(d)** | 1.18 | 0.90 | 0.57 | 0.18 | 0.08 | 0.41 | 0.41 | 0.29 | 0.02 | 1.18 | 0.03 | 4.29 |
| | **C.V. (%)** | 1.36 | 2.58 | 1.76 | 7.09 | 2.04 | 2.30 | 2.68 | 2.21 | 1.18 | 2.29 | 0.52 | 2.58 |
| | **C.D. (5%)** | 2.34 | 1.78 | 1.12 | 0.35 | 0.17 | 0.80 | 0.81 | 0.56 | 0.03 | 2.33 | 0.06 | 8.47 |

The overall mean of crosses was (15.94 cm). Fruit length is an important fruit quality characteristic, which is preferable both for consumption and processing purposes. Positive parental value are desirable for this trait.

In fruit diameter was range from 1.39 cm to 2.04 cm. whereas, the grand mean of fruit diameter was 1.68 cm. In the parents, the minimum fruit diameter was observed in BCO-1 (1.41 cm); whereas the maximum fruit diameter was observed in Kashi Satdhari (1.87 cm). The overall mean performance of the parent was (1.68 cm). In the hybrids, the minimum fruit diameter was observed in VRO-5 × Hisar Unnat (1.39 cm); whereas the maximum fruit diameter was observed in Azad Bhindi-2 × Hisar Unnat (1.87 cm). The overall mean performance of the parent was (1.68 cm). Fruit diameter is an important fruit quality parameter, which is desirable in positive direction.

Considering number of seeds per fruit, the parents with hybrid had ranged from 39.00 to 84.53 with an average of 63.10. Among the parents, the minimum numbers of seeds per fruit were observed in KS-410 (43.00) and the maximum number of seeds per fruit in Pusa Swani (75.53). The grand mean value of parents for number of seeds per fruit was (62.29). In the case of crosses, the minimum numbers of seeds per fruit were observed in Punjab KS-410 × Arka Abhay (39.00) and the maximum number of seeds per fruit in Azad Bhindi-2 × Arka Abhay (84.53). The grand mean value for the number of seeds per fruit was (63.19) in the crosses. The data presented revealed that all genotypes showed a wide range of variation with respect to the weight of 100 seeds. It varies from 4.11 g to 8.24 g. The grand mean performance for the weight of 100 seeds was (6.65 g). Among the parents, the minimum weight of 100 seeds was in the KS-410 (4.17 g) and the maximum weight was in the VRO-5 (7.71 g). The overall mean performance of parents (6.43 g) was recorded. Among the hybrids, the minimum weight of 100 seeds was in the KS-410 × Pusa A-4 (4.11 g) and the maximum weight was in the Kashi Kranti × VRO-6 (8.24 g). The overall mean performance of hybrids (6.68 g) was recorded. The number of seeds per fruit and 100 seed weight is a seed quality parameter, which is desirable in a positive direction. The highest number of seed was observed in the parent Pusa Swani, Azad Bhindi-2 and in the hybrids Azad Bhindi-2 × Arka Abhay, VRO-4 × Hisar Unnat.

Fruit yield per plant ranged from 129.00 g to 318.80 g with an average of 204.08 g. Among the parents, the minimum fruit yield per plant was observed in KS-410 (129.47 g) and maximum fruit yield per plant was observed in Azad Bhindi-2 (243.47 g). The grand mean value of parents for fruit yield per plant was (183.04 g). In the case of crosses, the minimum fruit yield per plant was observed in KS-410 × Kashi Lila (129.00) and maximum fruit yield per plant was observed in Azad Bhindi-2 × Hisar Unnat (318.80 g). The grand mean value for fruit yield per plant was (210.14 g) in the crosses. Fruit yield per plant is an important trait and should be given prime importance in okra breeding for hybrid development. All the finding are in parity with Singh *et al.* (2007); Vani *et al.* (2015); Kumar *et al.* (2019); Vani *et al.* (2021); Saryam *et al*. (2017); Kumar *et al.* (2019); Xavier *et al.* (2016).

## CONCLUSIONS

In conclusion, it is evidently clear from the analysis of variance that the okra genotypes used in this study possessed a considerable mean performance as all the characters revealed considerable variation in the observed traits. The mean of the parents and the mean of the hybrids were compared, which revealed that the overall performance of the hybrids was superior to their parents. The mean of the parents and the mean of the hybrids were compared, which revealed that the overall performance of the hybrids was superior to their parents. The cross-combination Azad Bhindi-2 × Hisar Unnat and Pusa Mukhmali × VRO-6 showed better results in yield per plant. Thus, it is implied that there ample variability in the genotypes of okra.

## FUTURE SCOPE

A comparison of the means of parents and means of hybrids revealed that the overall performance of the hybrids were significantly superior over the parents for all the characters under study. Thus, it is implied that there ample variability in the genotypes of okra. This indicates that a significant difference suggests the existence of variability for different characters, which give good opportunity for improvement of yield in okra.

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**Conflict of Interest.** None.

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