International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; SP-9(8): 1739-1741
www.biochemjournal.com
Received: 17-05-2025
Accepted: 20-06-2025

K Rajendar Sagar
Ph.D Scholar, Department of Vegetable Science, College of Horticulture, Dr. YSR Horticultural University, Venkataramannagudem, Andhra Pradesh, India

Epadma
Associate Professor, Department of Vegetable Science, College of Horticulture, Dr. YSR Horticultural University, Venkataramannagudem, Andhra Pradesh, India

M Ravindra Babu
Senior Scientist, Department of Vegetable Science, HRS, Dr. YSR Horticultural University, Darsi, Andhra Pradesh, India

K Usha Kumari
Associate Professor, Department of Vegetable Science, College of Horticulture, Dr. YSR Horticultural University, Venkataramannagudem, Andhra Pradesh, India

S Narasimha Rao
Associate Professor, Department of Plant Pathology, College of Horticulture, Dr. YSR Horticultural University, Venkataramannagudem, Andhra Pradesh, India

K Umakrishna
Professor, Department of Statistics, College of Horticulture, Dr. YSR Horticultural University, Venkataramannagudem, Andhra Pradesh, India

Corresponding Author:
K Rajendar Sagar
Ph.D Scholar, Department of Vegetable Science, College of Horticulture, Dr. YSR Horticultural University, Venkataramannagudem, Andhra Pradesh, India

Mean performance of parents their crosses and two check varieties in F_4 segregating generations for qualitative traits of okra (*Abelmoschus esculentus* L. Moench)

K Rajendar Sagar, Epadma, M Ravindra Babu, K Usha Kumari, S Narasimha Rao and K Umakrishna

DOI: https://www.doi.org/10.33545/26174693.2025.v9.i8Sx.5441

Abstract
The present investigation was carried out to evaluate the performance of okra F_4 Crosses there four parents and two check Varieties for quality parameters in Randomized Block Design (RBD) with three replications. Okra is often cross-pollinated and is grown primarily for its fruits, which have various culinary uses. Tender fruits are commonly boiled or used in sliced and fried dishes. Okra fruits are also dried in the sun, canned, or dehydrated for preservation during the offseason. The study was carried out at college of horticulture, Venkataramannagudem, during summer 2023-24. The analysis of variance revealed significant differences (p<0.05) among genotypes for all traits studied. Among the three crosses Cross-1 (ACC-19XACC-1) showed high fibre content, Vitamin-C and Shelf life when compare to remaining two crosses (ACC-1XACC-29) and (AACC-1XACC-39) and there parents (ACC-1, ACC-19, ACC-29 and ACC-39) and two check varieties Arka Nikitha and Salkeerthi for quality traits and they can be used in future breeding and crop improvement program.

Keywords: Okra, summer, fibre content, vitamin-C and shelf life

Introduction
Okra (*Abelmoschus esculentus* L. Moench), also referred to as lady's finger and bhendi, is a significant vegetable crop grown in tropical and subtropical regions during the spring-summer and rainy seasons. It can also be cultivated year round in areas with mild winters. India, the largest producer of okra globally, yields an annual production of 6.35 million tonnes from 521 thousand hectares, achieving a productivity of 12.19 tonnes per hectare [1]. Major okra cultivating states include Uttar Pradesh, Bihar, Orissa, West Bengal, Andhra Pradesh, Karnataka, and Assam. Okra is an annual plant that belongs to the Malvaceae family and the Malvales order. It has a chromosome number of 2n = 130 and is considered an amphidiploid. Okra is often crosspollinated and is grown primarily for its fruits, which have various culinary uses. Tender fruits are commonly boiled or used in sliced and fried dishes. Okra fruits are also dried in the sun, canned, or dehydrated for preservation during the off-season. The ripe seeds are roasted, ground, and used as a coffee substitute. Okra fruits contain protein (2.10%), fat (0.2%), carbohydrate (8.2%), fiber (1.70%), ash (0.8%), vitamin C (30 mg/100 g), calcium (84.00 mg/100 g), and iron (1.20 mg/100 g). The seeds contain 13-22% edible oil and 20-24% protein, which are used to produce refined edible oil [2]. Additionally, okra is an excellent natural source of iodine (2.33-6.33 µg/100 g). YVMV resistant wild species had maximum phenolics, peroxidase, polyphenol oxidase activity and seed soluble protein content and ascorbic acid content, while cultivated okra had minimum of these whereas interspecific hybrids recorded in between their parents.

Materials and Methods
During *kharif*, 2023-24, four parents ACC-1 (T_1), ACC-19 (T_2), ACC-29 (T_3), ACC-39 (T_4) along with three crosses ACC-19XACC-1 (T_5), ACC-1XACC-29 (T_6) and ACC-1XACC-39 (T_7) were raised in Randamized block design with three replications (Table.1). Each cross consisted of 50 progenies derived from 50 selected plants of F_2 generation.

Each progeny/family consisted of 15 individual plants spread over three replications *i.e.* 5 plants/replication. Thus there are 250 plants per cross in each replication totalling to 750 plants. Selection was excercised based on mean performance of the important yield contributing characters like earliness, average length and diameter of the fruit (cm), average weight of fruit (g), yield per plant (g) and and quality parameters and 50 best performing plants were selected from each cross across the three replication. This selected plants were selfed and seeds was obtained to raise the futher generation. Fibre was estimated according to the methods described by Sadasivam and Manikam (2008) [5]. Ascorbic acid content of mature green fruits was estimated by volumetric method described by Sadasivam and Balasubramanian (1987) [6]. The shelf-life in days was counted from the day of harvest to 50 per cent of fruits in each sample showing the symptoms of shrivelling.

Details of the parents their crosses two checks used in the present study.

Treatment	Parents/Crosses	Source
T_1	ACC-1	Horticultural Research station, V.R. Gudem
T_2	ACC-19	Horticultural Research station, V.R. Gudem
T_3	ACC-29	Horticultural Research station, V.R. Gudem
T_4	ACC-39	Horticultural Research station, V.R .Gudem
T_5	ACC-19 X ACC-1	Horticultural Research station, V.R. Gudem
T_6	ACC-1 X ACC-29	Horticultural Research station, V.R. Gudem
T_7	ACC-1 X ACC-39	Horticultural Research station, V.R. Gudem
T_8	Arka NIkitha	IIHR Bengalore
T_9	Salkeerthi	Kau, Kerala

Results and Discussion

The results on the mean performance and various genetic parameters for three quality traits of three crosses their four parents and two check varieties in F_4 segregating populations are explained here under and tabulated in table 2

Fibre content (mg 100 g^{-1})

For the trait fibre, a lower mean value is preferred. Among the four parental lines, it it ranged from 1.96 to 2.54 and the lowest value was noticed in ACC-19 (1.96) followed by ACC-29 (2.30), ACC-39 (2.54) and ACC-1 (2.10) in F_4 generation. However, among the three crosses, in F_4 generation, it ranged from 1.89 to 2.45 and the lowest value was observed in ACC-19XACC-1 (1.89) followed by ACC-1XACC-29 (2.26) and ACC-1XACC-39 (2.45). Between the two check varieties, Arka Nikita in F_4 (2.21) generations showed the lowest fibre compared to Salkeerthi in F_4 (2.56) generations.

Ascorbic acid content (mg 100 g^{-1})

For the trait ascorbic acid, a higher mean value is preferred. Among the four parental lines, it ranged from 11.10 to 13.57 and the highest value was noticed in ACC-1(13.57) followed by ACC-29 (12.57), ACC-39 (11.25), and ACC-19 (11.10) In F_4 generation.However, among the three crosses in F_4 generation, it ranged from 12.76 to 14.28 and the highest value was observed in ACC-19XACC-1 (14.28) followed by ACC-1XACC-29 (13.96) and ACC-1XACC-39 (12.76).The check variety, Arka Nikita F_4 (14.25) generations showed the highest ascorbic acid compared to Salkeerthi in F_4 (13.78) and generations.

Shelf-life (Days)

For the trait shelf life, a higher mean value is preferred. Among the four parental lines, it ranged from 2.47 to 3.01 and the highest value was noticed in ACC-1(3.01) followed by ACC-29 (2.84), ACC-39 (2.54), and ACC-19 (2.47) in F_4 generation. However, among the three crosses, in F_4 generation, it ranged from 2.95 to 3.29 and the highest value was observed in ACC-19XACC-1 (4.21) followed by ACC-1XACC-39 (3.06) and ACC-1XACC-29 (2.95).Between the two check varieties, Arka Nikita in F_4 (3.78) generations showed the highest shelf life compared to Salkeerthi in F_4 (3.68) generations. The results are in agreement with the findings of Kokare *et al.* (2006) [4], Biswas *et al.* (2016) [1], Rajesh *et al.* (2018) [3] and Rajani (2021) [2] presented in Fig. 1 and Table.2.

Table 2: Mean performance of parents their crosses and two check varieties in F_4 population for quality characters of okra

Sl. No.	Treatments	Fiber Content	Ascorbic Acid (mg/100 g)	Shelf Life
1	ACC-1	2.10	12.57	3.01
2	ACC-19	1.96	11.10	2.47
3	ACC-29	2.30	13.57	2.84
4	ACC-39	2.54	11.25	2.54
5	ACC-19XACC-1	1.89	14.28	4.21
6	ACC-1XACC-29	2.26	13.96	2.95
7	ACC-1XACC-39	2.45	12.76	3.06
8	ARKA NIKITHA	2.21	14.25	3.78
9	SALKEERTHI	2.56	13.78	3.68
	G. mean	2.25	13.06	3.12
	S. Em	0.004	0.019	0.008
	C.D @ 5%	0.011	0.056	0.025

*significant 5 percent level

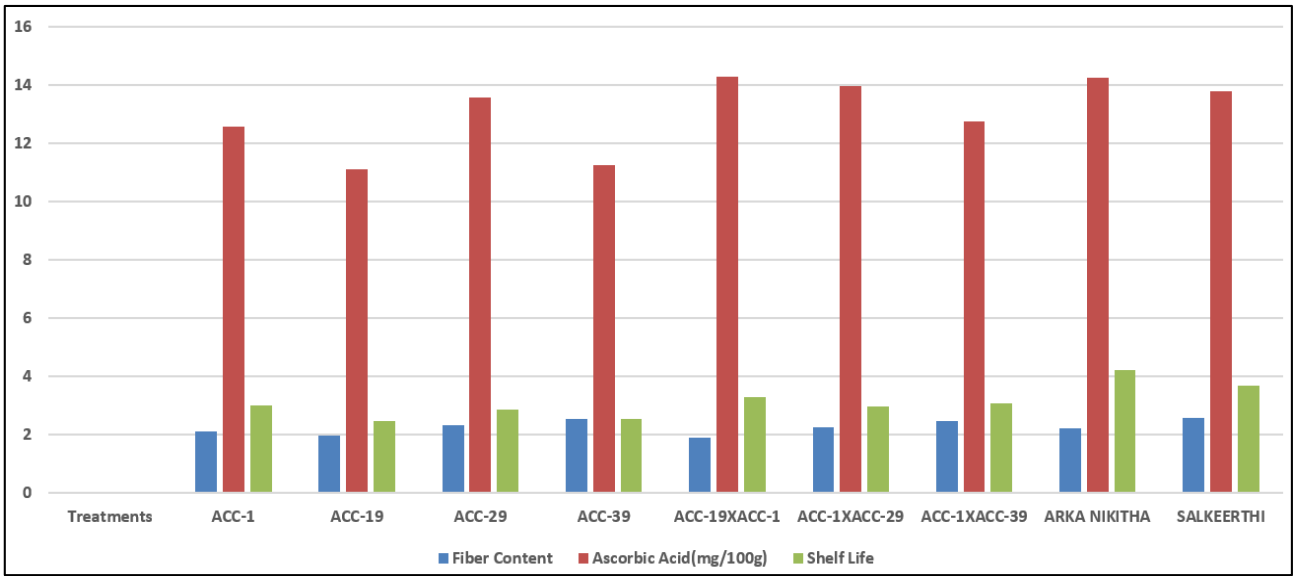

Fig 1: Mean performance of okra genotypes for Fibre, Vitamin-C and Shelf life

Conclusion

The results concluded that the Cross-1 (ACC-19XACC-1) performed better over the remaining two crosses (ACC-1 X ACC-29, ACC-1 X ACC-39) and four parents (ACC-1, ACC-19, ACC-29 and ACC-39) and two check varieties (Arka Nikitha and Salkeerthi) with respect to yield, quality and YVMV incidence in $F_{3,}$ generations.

Acknowledgement

We would like to express our gratitude to the Department of Vegetable Science, Dr. YSR horticulture university Venkataramannagudem, Andhra Pradesh for providing the research facilities.

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