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Effect of different spacing on growth parameters of Okra

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Abstract
A field experiment titled *"*Effect of different Spacing on Growth Parameters of Okra *(Abelmoschus esculentus (L.) Moench)* Variety Phule Utkarsha*"* was carried out during the summer season of 2013 at the Research Farm, Horticulture Section, College of Agriculture, Kolhapur. The study evaluated four spacing treatments: 30 × 15 cm, 30 × 30 cm, 45 × 30 cm, and 60 × 30 cm. Data were collected on various growth and yield parameters, including plant height, number of branches per plant, internodal length, number of internodes per plant, fruit length, fruit diameter, fruit weight.
The results indicated that wider spacing, particularly 60 × 30 cm, significantly enhanced the number of branches (2.60), number of internodes (7.53), fruit diameter (1.97 cm), and fruit weight (13.78 g). In contrast, the closest spacing (30 × 15 cm) produced the tallest plants (170.41 cm). These findings emphasize the important role of plant spacing in optimizing growth and yield characteristics of okra.

Keywords: Growth parameters, Plant spacing, Phule Utkarsha

Introduction
Okra (Abelmoschus esculentus (L.) Moench), also known as Lady's Finger, is a widely grown vegetable in India, particularly during the summer and monsoon seasons. Native to tropical and subtropical areas such as Africa, South America, and India, okra holds significant agricultural importance in the country. It is cultivated extensively in states like Maharashtra, Uttar Pradesh, Bihar, and Karnataka. In Maharashtra alone, okra is grown on over 22,000 hectares, producing 3.28 lakh metric tons (Anon, 2013) [1], with major producing districts including Nasik, Pune, and Solapur.
Highly nutritious and commercially valuable, okra is important both for domestic consumption and export, especially to the Middle East. However, its productivity is often affected by agronomic practices, such as plant spacing. Improper spacing can result in poor fruit quality and reduced yields. Hence, optimizing plant population through proper spacing is critical for enhancing growth and maximizing yield.
This study, titled "Effect of Different Spacing on Growth Parameters of Okra (Abelmoschus esculentus (L.) Moench) Cv. Phule Utkarsha," aims to assess the effect of various spacing techniques on the growth performance of okra.

Materials and Methods
The experiment was conducted during the 2012-13 growing season at the Horticulture Sectional Farm, College of Agriculture, Kolhapur. The study evaluated four different plant spacing treatments: T1 (30 × 15 cm), T2 (30 × 30 cm), T3 (45 × 30 cm), and T4 (60 × 30 cm). The selected site was uniformly levelled, with medium black soil characterized by good texture, fertility, and drainage.
Land preparation involved conventional practices, including ploughing, harrowing, clod crushing, and leveling to achieve a fine tilth. Farmyard manure was applied at the rate of 20 tonnes per hectare during land preparation. Ridges and furrows were formed according to the specified spacing's for each treatment.
A basal dose of fertilizers was applied at 100:50:50 kg NPK per hectare. This included the full recommended dose of phosphorus and potassium, and half of the nitrogen dose, applied prior to sowing. The remaining half of the nitrogen was administered as a top dressing in two equal split doses during the crop growth period.

Seeds were soaked in water for 24 hours before sowing to promote better germination. Sowing was done by dibbling method on the ridges prepared as per the respective spacing treatments (30 × 15 cm, 30 × 30 cm, 45 × 30 cm, and 60 × 30 cm), placing seeds at a depth of 1.5-2.0 cm.

Standard cultural practices such as gap filling, thinning, rouging, insecticide spraying, and other necessary intercultural operations were carried out as needed to maintain healthy crop growth. The field was kept free of weeds, and irrigation was provided at intervals of 5-6 days.

Observations were recorded on various parameters from 10 randomly selected plants in each plot. The data collected were analyzed statistically for interpretation.

Table 1: Effect of spacing on growth Character

Treatments	Plant height (cm)	No. of branches per plant	Length of internodes cm	No. of internodes per plant
T_1	170.41	1.87	7.53	22.60
T_2	164.07	2.20	7.43	21.53
T_3	160.07	2.53	7.15	22.13
T_4	154.28	2.60	7.07	22.80
S.E. ±	2.274	o.185	0.123	0.328
C.D.at 5%	6.509	0.529	0.351	0.939

Table 2: Effect of spacing on growth and yield

Treatments	Length of fruit (cm	Diameter of fruit (cm)	Weight of green fruit (g)
T_1	11.48	1.77	12.08
T_2	11.77	1.88	12.35
T_3	12.69	1.90	13.38
T_4	13.25	1.97	13.78
S.E. ±	0.494	0.037	0.379
C.D.at 5%	1.414	0.105	1.085

Results and Discussion

Plant Height (cm)

The tallest plants were observed under the closest spacing of 30 × 15 cm (T1), with a maximum height of (170.41 cm), whereas the shortest plants (154.28 cm) were recorded under the widest spacing (T4: 60 × 30 cm). This increase in height under denser spacing may be attributed to increased competition for light and other growth resources, causing the plants to grow taller in search of light. In contrast, plants grown at wider spacing were generally shorter but had more foliage. These results are consistent with the findings of Ashtaputre (1987), Pandita and Randhawa (1994), Patil *et al*. (1995), Randhawa and Pannum (2000), Amjad *et al*. (2002), Moniruzzaman *et al*. (2007), Ijoyah *et al*. (2010), Kumar *et al*. (2011), and Maurya *et al*. (2013) [2, 9, 12, 7, 4, 5].

Number of Branches per Plant

The highest number of branches per plant **(**2.60**)** was recorded under the widest spacing (T4: 60 × 30 cm), while the lowest **(**1.87) was observed in the closest spacing (T1: 30 × 15 cm). The increased branching at wider spacing may be due to reduced competition for light, nutrients, and space, allowing plants to allocate more resources toward vegetative growth. These observations are supported by previous studies including those of Saha *et al*. (1989), Bilekudari *et al*. (2005), Ibeawuchi *et al*. (2005), Shrikanth (2007), Ijoyah *et al*. (2010), and Maurya *et al*. (2013) [3, 14, 4].

Internodal Length and Number of Internodes

Treatment T4 (60 × 30 cm) also resulted in the shortest internodal length (7.07 cm) and the highest number of internodes (22.80) per plant. These findings are in line with the results reported by Kumar *et al*. (2011) [5], who also observed similar trends in okra.

Fruit Characteristics

Plant spacing had a significant influence on fruit traits such as fruit length, diameter, and both fresh and dry fruit weights. The maximum green fruit length (13.25 cm) and diameter (1.97 cm) were recorded under the widest spacing (T4: 60 × 30 cm). This improvement in fruit size under wider spacing is likely due to better access to nutrients, moisture, and space, which collectively enhance overall plant growth and fruit development. Ashtaputre (1987) [2] also reported similar results, attributing increased fruit size to the abundance of growth resources in wider spacing conditions. Supporting studies include, Ijoyah *et al*. (2010) [4].

Conclusion

The findings from the present study suggest that closer spacing (30 × 15 cm) promotes greater plant height (170.41 cm), likely due to inter-plant competition for light. On the other hand, wider spacing (60 × 30 cm) results in increased number of branches per plant (2.60) and enhanced fruit traits, including maximum length and diameter of green fruits. Therefore, plant spacing has a significant impact on both vegetative growth and yield components in okra.

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