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**Effect of different spacing on growth and fruit quality
of okra (*Abelmoschus esculentus*)**

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Abstract

An investigation was conducted in the farm of Sh. Jagdish Parshad at village Rampura, Teh. Abohar, Dist. Fazilka during the academic year 2018 to study the effect of different spacing on growth, fruit quality and yield of okra. The three different spacing were 30 cm, 45 cm, 60 cm were kept for experimentation. The effect of different spacing on plant height, number of leaves per plant, number of flower per plant, number of pod per plant and pod length. The different treatments showed variation in vegetative and pod characters. The obtained results indicated that the average maximum plant height, number of pod per plant and pod length were recorded in spacing (60 × 15 cm) and average minimum plant height and number of pod per plant were observed in spacing (45 × 15 cm). But average minimum pod length was observed in spacing (30 × 15 cm). Average maximum number of leaves per plant and number of flower per plant were observed in spacing (45 × 15 cm) and average minimum number of leaves per plant and number of flower per plant were observed in spacing (60 × 15 cm).

Keywords: Okra, spacing, growth, pod characters, quality

Introduction

Okra (*Abelmoschus esculentus* (L.) Moench) also known as Lady Finger is an economically important summer vegetable crop that belongs to the family Malvaceae. The crop is quite popular due to its easy cultivation, dependable yield and adaptability to varying moisture conditions (resistant to drought and waterlogging) and soil types (Maurya *et al.*)^[1]. Bhindi fruits are used as a vegetable. The root and stem of bhindi are used for cleaning the Gur or Khand or raw sugar. Its fruits with fibrous stalks are used in paper making industry. Bhindi leaves are used in Turkey for preparing a medicament to soothe or reduce inflammation, while ripe seeds are sometimes roasted and ground as a substitute for coffee. It is also used in soups and stews. Bhindi plant produce fibre by 20.2 to 7.2 percent. Dried fruits yield 2 to 2.4 percent nitrogen. Mucilage of bruised seeds contain phosphoric acid, while fruits contain salts of potash, lime and magnesia (Chauhan)^[2]. Appropriate in relatively low yields and quality. With increasing plant population, yield per unit area increases upto a certain limit, beyond which it decreases as resources for plant growth become limited (Paththinige *et al.*)^[3]. Further, it was reported that optimum plant population is the key element for higher yields, as plant growth and yield are affected by intra and inter row spacing.

Materials and Methods

The study was carried out on okra which was conducted in the farm of Sh. Jagdish Parshad at village Rampura, Teh. Abohar, Dist. Fazilka in three plot with each plot having dimension of 16.5 x 16.5 feet or 25.293 square meters. The field was properly prepared with disc harrow followed by one ploughings with cultivator and one planking to make fine tilth. The Okra variety Juhi was sown at seed rate 10 kg/acre on 1st March 2018. The objective of the study was to calculate the vegetative characters such as plant height, number of leaves per plant and number of flower per plant and pod characters such as number of pod per plant and pod length. Five plants were selected randomly from each plot. Plant height was measured with the help of measuring tape from ground level to the tip of the main stem. Number of leaves per plant,

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number of flower per plant and number of pod per plant were counted manually at 15 days interval. Pod length was measured using measuring tape from tip of the fruit to the plant of attachment to the pedicel.

Treatments

Treatment	Spacing
T1	30cm
T2	45cm
T3	60cm

Results and Discussions

Vegetative Characters

Plant height

From the experiment, it has been observed that average maximum plant height (47.85 cm) was observed in T₃ (60 × 15 cm) followed by average intermediate plant height (46.97 cm) was observed in T₁ (30 × 15 cm) and average minimum plant height (42.36 cm) was observed in T₂ (45 × 15 cm). The findings of this research are similar with that of Hassan *et al.* [4] who concluded that mean plant height was maximum in 50 cm followed by 40 cm and minimum plant height was recorded in 30 cm. The findings of Ijoyah *et al.* [5] also showed that plant height observed was maximum in 25 cm followed by 20 cm and minimum plant height was recorded in 30 cm.

Number of leaves per plant

From the experiment, it has been observed that average maximum number of leaves per plant (15.77) was observed in T₂ (45 × 15 cm) followed by average intermediate number of leaves per plant (15.16) was observed in T₁ (30 × 15 cm) and average minimum number of leaves per plant (13.32) was observed in T₃ (60 × 15 cm). The findings of Brar and Singh [6] concluded that the average leaves per plant were found to be maximum in the spacing S₂₀ and average minimum leaves per plant were recorded in the spacing S₁₀.

Number of flower per plant

From the experiment, it has been observed that average maximum number of flower per plant (0.55) was observed in T₂ (45 × 15 cm) followed by average intermediate number of flower per plant (0.47) was observed in T₁ (30 × 15 cm) and average minimum number of flower per plant (0.42) was observed in T₃ (60 × 15 cm). Similarly, Guade [7] studied the effect of intra-row spacing on tomato in which maximum number of flower per plant were obtained from T₂ (50 × 25 cm) and T₁ (50 × 20 cm) and minimum number of flower per plant were obtained from T₄ (50 × 35 cm). The findings of Madisa *et al.* [8] concluded that no of flowers were maximum in R60 and R75 and minimum no of flowers were recorded in R30 and R45.

Pod Characters

Number of pod per plant

From the experiment, it has been observed that average maximum number of pod per plant (1.35) was observed in T₃ (60 × 15 cm) followed by average intermediate number of pod per plant (1.12) was observed in T₁ (30 × 15 cm) and average minimum number of pod per plant (1.10) was observed in T₂ (45 × 15 cm). Similarly, Gbaraneh [9] studied the effect of plant spacing on okra in which number of pods per plant was found highest in PS₃ and minimum number of pods per plant was recorded in PS₁. The findings of Firoz *et al.* [10] concluded that the highest number of fruits per plant was obtained with the spacing of 60 × 50 cm while the lowest number of fruits per plant was produced by 60 × 30 cm.

Pod length

From the experiment, it has been observed that average maximum pod length (6.9 cm) was observed in T₃ (60 × 15 cm) followed by average intermediate pod length (6.4 cm) was observed in T₂ (45 × 15 cm) and average minimum pod length (6.3cm) was observed in T₁ (30 × 15 cm). Similarly, Muhammad and Singh [11] studied the intra-row spacing on tomato in which mean pod length was observed maximum in T₃ and minimum pod length was observed in T₁. The findings of Parmar *et al.* [12] showed that the maximum pod length was observed in S₃) and minimum pod length was observed in S₁.

Observations and Tables

Table 1: Effect of different spacing on growth and fruit quality on Plant height (cm)

Days of interval	15	30	45	60	75	90	105	120	Average
T ₁	3.8	11.4	19	33	55.4	77	85.6	90.6	46.97
T ₂	4.3	12.4	18.2	31.6	53.2	67	73.2	79	42.36
T ₃	3.4	9.8	19.4	34.2	58.6	78.2	87.2	92	47.85

Table 2: Effect of different spacing on growth and fruit quality on Number of leaves per plant

Days of interval	15	30	45	60	75	90	105	120	Average
T ₁	2.2	3.8	5.8	8	13.3	25.3	29.6	33.3	15.16
T ₂	2	4	6.4	8.6	17.2	26.2	29.9	31.9	15.77
T ₃	2.1	4.2	5.8	8.8	12.9	18	22.7	27.1	13.32

Table 3: Effect of different spacing on growth and fruit quality on Number of flower per plant

Days of interval	15	30	45	60	75	90	105	120	Average
T ₁	-	-	0.4	0.4	0.6	1.4	0.8	0.2	0.47
T ₂	-	-	0.6	0.6	0.4	0.6	1.4	0.8	0.55
T ₃	-	-	0.8	0.2	0.2	0.4	1.4	0.6	0.42

Table 4: Effect of different spacing on growth and fruit quality on Number of pod per plant

Days of interval	15	30	45	60	75	90	105	120	Average
T ₁	-	-	1.2	1.8	2.4	1.2	1.6	0.8	1.12
T ₂	-	-	1.6	1.2	2.6	1.6	1.2	0.6	1.10
T ₃	-	-	2.0	1.8	2.2	1.4	2.4	1.0	1.35

Table 5: Effect of different spacing on growth and fruit quality on Pod length (cm)

Days of interval	15	30	45	60	75	90	105	120	Average
T ₁	-	-	5.8	5.6	13.2	6.2	11.2	8.6	6.3
T ₂	-	-	4.8	4	18.2	7.8	8	9	6.4
T ₃	-	-	2.6	13.7	9	4	17	9.6	6.9

Conclusion

The results concluded from the present investigation are that when okra sown with different spacing showed significant effect on vegetative and pod characters. All the treatments also showed significant differences among each other. Increase in growth and no of pods was observed as the time proceeds.

So, we concluded from the research that the average maximum plant height, number of pod per plant and pod length were recorded in spacing (60 × 15 cm) whereas average maximum number of leaves per plant and number of flower per plant were observed in spacing (45 × 15 cm). This research being done on different spacing which would help the farmer to increase the growth and fruit quality of okra. Further, it was reported that optimum plant population is the key element for higher yields, as plant growth and fruit quality are affected by inter row spacing.

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