

Effect of spacing and picking stage on yield characters of okra, *Abelmoschus esculentus* (L) Monech cv Phule Utkarsha

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ABSTRACT

A field experiment was conducted on okra cv Phule Utkarsha with four spacing (30 x 15, 30 x 30, 45 x 30 and 60 x 30 cm) and five levels of picking (no green, one green, two green, three green and four green fruit picking) for maximum seed yield. The study was carried out at College of Agriculture, Kolhapur, Maharashtra to find out the optimum spacing and seed yield during summer season of 2013. The plants were grown both for vegetable and seed production. The experiment was conducted by using factorial completely randomized block design using four treatments and five sub-treatments using three replications. The results indicated that the closest spacing of 30 x 15 cm and picking of green fruits two times (S_1P_2) gave the higher seed yield.

Keywords: Okra; plant spacing; picking interval; seed yield

INTRODUCTION

As per world scenario the total area and production of okra is reported to be 1148.0 thousand ha and 7896.3 thousand tonnes respectively. It is mainly grown in India, Nigeria, Sudan, Pakistan, Ghana, Egypt, Benin, Saudi Arabia, Mexico and Cameroon. Largest area and production is in India followed by Nigeria. Highest productivity is reported from Egypt (12.5 tonnes/ha) followed by Saudi Arabia (13.3 tonnes/ha). In India Andhra Pradesh is the leading okra producing state which has production of around 1184.2 thousand tonnes followed by West Bengal (862.1 thousand tonnes) (Anon 2013). All plant parts of okra are useful; immature pods are used as fresh fruit vegetables that can be consumed in many different forms viz raw, steamed, boiled or fried (Farinde et al 2007). Okra plants are mainly cultivated throughout the world for their tender pods. The tender fruits are popular as a vegetable amongst all classes of people around the world (Talukder et al 2003). It is nutritious vegetable which provides an important source of carbohydrates, protein, vitamins (A, B₁ and C), calcium, potassium, dietary fibre and mineral matter hence it plays an important role in the human diet (Rashwan 2011). In India mucilage from the roots, pods and stems of okra

are used for cleaning the cane juice from which jaggery or brown sugar is prepared (Chauhan 1972). Plant spacing is a vital factor in okra production both in summer and Kharif season crop (Palanisamy et al 1986, Saha et al 2005, Saimbhi et al 1997, Hossain et al 1999). Improper plant spacing may cause either too dense or too sparse population resulting in reduction of yield. Planting with proper spacing increases yield quality and size of fruit. To increase the seed yield of okra seed, research effort on planting, time and plant spacing of okra is inadequate. Considering this an experiment was conducted in summer season to determine the appropriate spacing and picking for okra to obtain maximum seed yield.

MATERIAL and METHODS

The experiment was conducted at horticulture farm of College of Agriculture, Kolhapur, Maharashtra during 2012-2013. The four main treatments viz S₁ (30 x 15 cm), S₂ (30 x 30 cm), S₃ (45 x 30 cm) and S₄ (60 x 30 cm) and five sub-treatments of green fruit pickings viz P₀ (no green fruit picking), P₁ (one green fruit picking), P₂ (two green fruit picking), P₃ (three green fruit picking) and P₄ (four green fruit picking). The experiment was laid out by using factorial

completely randomized block design using four treatments and five sub-treatments using three replications. The selected site was well leveled having uniform soil fertility. The soil was medium black having good texture and drainage. Land was prepared by ploughing, harrowing, clod crushing and was brought to fine tilth. Well decomposed farm yard manure @ 20 tonnes was applied at the time of preparation of land. Ridges and furrows were prepared for sowing of seed as per recommended spacing. The recommended dose of fertilizer NPK (100:50:50 kg/ha) was applied. Half dose of nitrogen and full of phosphorus and potash was applied as basal before sowing of seed and remaining nitrogen was applied in two split doses by top dressing method. Seeds were soaked in water for 24 hours, dried and sown for enhancing early germination; dibbled on ridges and furrows as per recommended spacing and sown at a depth of 1.5 to 2 cm in soil. The field was kept weed-free and cultural practices like gap filling, thinning, roughing and spraying of insecticides and pesticides were done as per need. Irrigation was given at an interval of 4-5 days. The data on yield parameters were recorded from 10 randomly selected plants in each plot and analyzed statistically.

RESULTS and DISCUSSION

The results on the effect of different spacing and picking stages on the yield characters of okra are given in Table 1.

Days to first green fruit harvesting (edible stage):

The maximum days to maturity (48.40) of green fruit were recorded in treatment S_4 (60 x 30 cm) whereas minimum (47.67) days to maturity (edible stage) were recorded in S_1 (30 x 15 cm). The minimum days to maturity of green fruit (edible stage) were observed in three green fruit picking (P_3 , 47.58) whereas the maximum in no green fruit picking (P_0 , 48.58).

Number of green fruits harvested per plant: The highest number (4.58) of green fruits harvested per plant was recorded in treatment S_4 (60 x 30 cm) followed by S_3 (43 x 30 cm, 4.50) while minimum (3.83) in S_1 (30 x 15 cm). The highest number of green fruits harvested per plant was recorded in four green fruit picking (P_4 , 7.08) which was significantly superior over rest of the treatments and minimum (1.50) in one green fruit picking (P_1). These results are in accordance with those of Pushpakumari and Saraswathy (1998) and Dattatraya (2013) in okra.

Days to dry fruit harvesting (seed maturity stage):

Maximum days to maturity (96.87) of fruit (seed maturity stage) were observed in treatment S_1 (30 x 15 cm) followed by treatment S_2 (30 x 30 cm, 96.73) and minimum (96.53) in S_4 (60 x 30 cm). The minimum days to maturity (91.25) of fruit (seed maturity stage) were recorded in no green fruit picking (P_0) followed by one green fruit picking (P_1 , 94.42) and maximum in four green fruit picking (P_4 , 102.77). Similar results were reported by Nikumbh (2001) in cucumber and Dattatraya (2013) in okra.

Number of dry fruits per plant at seed maturity:

The data show that number of dry fruits per plant was significantly increased (21.60) with treatment S_4 (60 x 30 cm) that was significant over rest of the treatments while lowest (18.47) was in S_1 (30 x 15 cm). The maximum number of dry fruits (21.42) per plant at seed maturity was recorded in two green fruit picking (P_2) and minimum (18.17) in four green fruit picking (P_4). These results are in agreement to that of Moniruzzarman and Quamruzzaman (2009) and Dattatraya (2013) in okra.

Number of seeds per fruit: The number of seeds per fruit was significantly influenced by different spacing. It was highest (44.80) in S_4 (60 x 30 cm) that was at par with S_3 (45 x 30 cm) (43.53) and S_2 (30 x 30 cm) (43.27) and lowest (41.87) in S_1 (30 x 15 cm). In case of picking the number of seeds per fruit was highest (45.50) in no green fruit picking (P_0) which was at par with treatment P_1 (43.92) and P_2 (43.50) with minimum (41.67) in P_4 . Similar results were reported by Sajjan et al (2002) in okra.

Seed yield per plant: The maximum seed yield per plant (43.20 g) was recorded in treatment S_4 which was at par with S_3 (40.81 g) whereas minimum was recorded in S_1 (34.98 g). The highest seed yield per plant was recorded in treatment P_2 (41.29 g) being at par with P_0 (40.39 g) and P_1 (40.27 g). It was lowest in P_4 (37.09 g). The highest seed yield was obtained in treatment combination S_3P_2 (46.15 g) and lowest (33.52) in S_1P_3 . Similar results were reported by Nikumbh (2001) in cucumber and Dattatraya (2013) in okra.

Seed yield per plot: The highest seed yield of okra per plot was recorded in treatment P_0 (1.28 kg) which was at par with P_1 (1.21 kg) and lowest in P_4 (1.01 kg). The maximum seed yield was recorded in

Table 1. Effect of spacing and picking on yield characters of okra

Treatment	Days to first green fruit harvesting (edible stage)	Number of green fruits harvested /plant	Days to dry fruit harvesting (seed maturity stage)	Number of dry fruits /plant at seed maturity	Number of seeds /fruit	Seed yield /plant (g)	Seed yield /plot (kg)	Seed yield /hectare (q)
Spacing								
S ₁	47.67	3.83	96.87	18.47	41.87	34.98	1.34	18.62
S ₂	48.33	4.25	96.73	19.53	43.27	38.24	1.18	16.45
S ₃	48.33	4.50	96.67	20.20	43.53	40.81	1.05	15.00
S ₄	48.40	4.58	96.53	21.60	44.80	43.20	1.00	14.14
SE±	0.422	0.167	0.411	0.333	0.630	0.972	0.032	0.495
CD _{0.05}	NS	NS	NS	0.954	1.803	2.783	0.091	1.417
Picking								
P ₀	48.58	-	91.25	20.25	45.50	40.39	1.28	17.76
P ₁	48.50	1.50	94.42	20.33	43.92	40.27	1.21	19.87
P ₂	48.42	3.33	96.83	21.42	43.50	41.29	1.16	16.34
P ₃	47.58	5.25	98.83	19.58	42.25	37.52	1.06	15.22
P ₄	47.83	7.08	102.17	18.17	41.67	37.09	1.01	14.08
SE±	0.472	0.187	0.459	0.373	0.704	1.087	0.036	0.553
CD _{0.05}	NS	0.536	1.315	1.067	2.016	3.111	0.102	1.584
Interaction (spacing x picking)								
S ₁ P ₀	47.33	-	91.00	18.67	43.00	34.67	1.49	20.64
S ₁ P ₁	46.67	1.33	95.00	19.33	43.00	36.46	1.38	19.50
S ₁ P ₂	50.00	3.33	96.33	19.67	40.67	35.83	1.34	18.65
S ₁ P ₃	47.00	4.67	99.67	18.00	41.67	33.52	1.25	17.31
S ₁ P ₄	47.33	6.00	102.33	16.67	41.00	34.44	1.22	16.99
S ₂ P ₀	48.33	-	91.67	19.67	44.67	40.88	1.34	18.61
S ₂ P ₁	48.67	1.67	94.33	20.00	44.67	38.05	1.28	17.90
S ₂ P ₂	48.33	3.00	97.67	21.00	42.00	40.06	1.25	17.34
S ₂ P ₃	48.00	5.33	98.33	19.33	43.00	34.67	1.09	15.09
S ₂ P ₄	48.33	7.00	101.67	17.67	42.00	37.57	0.96	13.33
S ₃ P ₀	49.33	-	91.33	20.33	45.67	41.00	1.18	16.50
S ₃ P ₁	48.67	1.67	94.33	21.00	44.00	40.69	1.11	15.50
S ₃ P ₂	47.33	3.33	96.67	22.00	44.67	46.15	1.06	15.23
S ₃ P ₃	48.33	5.67	99.00	19.67	42.00	38.23	0.97	14.72
S ₃ P ₄	48.00	7.33	102.00	18.00	41.33	38.00	0.94	13.05
S ₄ P ₀	49.33	-	91.00	22.33	48.67	45.00	1.10	15.27
S ₄ P ₁	50.00	1.33	94.00	21.00	44.00	45.91	1.05	14.58
S ₄ P ₂	48.00	3.67	96.67	23.00	46.67	43.11	0.99	14.12
S ₄ P ₃	47.00	5.33	98.33	21.33	42.33	43.67	0.92	13.75
S ₄ P ₄	47.67	8.00	102.67	20.33	42.33	38.33	1.00	12.96
SE±	0.945	0.374	0.919	0.745	1.408	2.173	0.71	1.107
CD _{0.05}	NS	NS	NS	NS	NS	NS	NS	NS

S= Spacing, P= Picking

treatment combination S₁P₀ (1.49 kg) followed by S₁P₁ (1.38 kg) and minimum in S₄P₄ (0.92 kg). These results are supported by the works of Sharma (2000), Baswana et al (1989) and Moniruzzaman et al (2007).

Seed yield per hectare: The treatment S₁ recorded significantly highest (18.62 q) and S₄ lowest (14.14 q) seed yield per hectare. It was the highest (17.76 q) in P₀ that was at par with P₁ (16.87 q) and P₂ (16.34 q)

while lowest was recorded in P₄ (14.08 q). The maximum seed yield per hectare was recorded in combination S₁P₀ (20.64 q) followed by S₁P₁ (19.50 q) and minimum in S₄P₄ (12.96 q). Similar results were reported by Sajjan et al (2002) in okra.

The interaction effects between spacing and number of green fruit picking for all yield characters were non-significant.

CONCLUSION

The maximum length and weight of dry fruits were recorded in widest plant spacing S_4 (60 x 30 cm). The yield attributing parameters like number of green fruits per plant, number of dry fruits per plant at seed maturity, number of seeds per fruit, seed yield per plant, seed yield per plot and seed yield per hectare were significantly affected by different spacing and number of green fruit pickings. The maximum values for all these yield parameters were recorded in widest spacing S_4 (60 x 30 cm) except seed yield per plot and seed yield per hectare. The maximum values for yield parameters like number of dry fruits at seed maturity and seed yield per plant were recorded in two green fruit picking.

REFERENCES

- Anonymous 2013. India ranks 1st in ladyfinger production: Indian Institute of Vegetable Research. The Times of India, 28 Sep 2013.
- Baswana KS, Pandita ML and Sharma SS 1989. Response of coriander to dates of planting and row spacing. Indian Journal of Agronomy **34(3)**: 355-357.
- Chauhan DVS 1972. Vegetable production in India. 3rd edn, Ram Prasad and Sons, Agra, Uttar Pradesh, India.
- Dattatraya UR 2013. Effect of plant growth regulators and fruit pickings on seed yield and seed quality of okra, *Abelmoschus esculentus* (L) Moench variety Phule Utkarsha. MSc (Agric) thesis, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India.
- Farinde AJ, Owolarafe OK and Ogungbemi OI 2007. Overview of production, processing, marketing and utilization of okra in Egbedore local government area of Osun state, Nigeria. Agricultural Engineering International: the CIGR Ejournal, Manuscript #MES 07 002, Vol IX.
- Hossain MD, Salam MA, Islam MS and Masud MAT 1999. Yield and quality of okra (BARI Dherosh-1) seed as influenced by time of sowing and plant spacing. Bangladesh Journal of Seed Science Technology **3(1-2)**: 83-87.
- Moniruzzaman M and Quamruzzaman KM 2009. Effect of nitrogen and picking of green fruits on the fruit and seed production of okra. Journal of Agriculture and Rural Development **7(1-2)**: 99-106.
- Moniruzzaman M, Uddin MZ and Choudhury AK 2007. Response of okra seed crop to sowing time and plant spacing in southeastern hilly region of Bangladesh. Bangladesh Journal of Agricultural Research **32(3)**: 393-402.
- Nikumbh MP 2001. Effect of ethrel and fruit pickings on seed yield and seed quality of cucumber (*Cucumis Sativus* L) var Himangi. MSc (Agric) thesis, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India.
- Palanisamy V, Vanangamudi K, Joyaroj T and Karivarattaraju TV 1986. Influence of date of sowing and spacing on seed quality in Bhindi. South Indian Horticulture **34(1)**: 23-25.
- Pushpakumari R and Saraswathy P 1998. Influence of green fruit picking and nutrient sources on fruit production of okra, *Abelmoschus esculentus* (L) Moench. Journal of Tropical Agriculture **36**: 50-52.
- Rashwan AMA 2011. Study of genotypic and phenotypic correlation for some agro-economic traits in okra, *Abelmoschus esculentus* (L) Moench. Asian Journal of Crop Science **3(2)**: 85-91.
- Saha PK, Aditya DK and Sharfuddin AFM 2005. Effect of plant spacing and picking interval on the growth and yield of okra cv Pusa Sawani. Bangladesh Horticulture **17(2)**: 10-14.
- Saimbhi MS, Singh D, Sandhu KH, Kooner KS, Phillon NPS and Singh D 1997. Effect of plant spacing on fruit yield of okra. Agricultural Sciences Digest **17(1)**: 40-42.
- Sajjan AS, Shekhengouda M and Badanur VP 2002. Influence of date of sowing, spacing and level of nitrogen on yield attributes and seed yield of okra. Karnataka Journal of Agricultural Sciences **15(2)**: 267-274.
- Sharma SK 2000. Response of nitrogen and spacing on fenugreek seed production. Horticulture Journal **13(2)**: 39-42.
- Talukder MA, Mannaf MA, Alam MK, Salam MA and Amin MMU 2003. Influence of sowing time, plant spacing and picking interval on the growth and yield of okra. Pakistan Journal of Biological Sciences **6(18)**: 1626-1630.