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Effect of Plant Densities and Cycocel on Fruit and Yield Attributes of Okra (*Abelmoschus Esculentus*. (L.) Moench) Cv. Parbhani Kranti

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A B S T R A C T

An experiment was conducted at College of Horticulture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, during 2018 to know the effect of different plant densities (60 x 30 cm,60 x 25 cm, 40 x 30 cm and 40 x 25 cm) and foliar spray of cycocel (0, 400, 600 and 800 ppm) on various fruit and yield attributes of okra. Experiment was laid in Factorial Randomized Block Design with three replications during summer season under shadenet house. The observations on fruit and yield attributes were recorded during investigation. Results revealed, that the significant effect of spacing levels on number of fruits per plant, fruit length, fruit yield per plot and fruit yield per hectare. Whereas, cycocel levels were found significant for the traits like days to first fruit set, days to first harvest, number of fruits per plant, average fruit weight, fruit length, fruit yield per plot and fruit yield per hectare. In case of interaction effects the characters like number of fruits per plant, average fruit weight, fruit length, fruit yield per plot and fruit yield per hectare was found significant. Remaining traits were not showed any significant performance under the experiment. The important characters like number of fruits per plant (9.38), average fruit weight (17.93 g), fruit length (8.26 cm), fruit yield per plot (10.28 kg) and fruit yield per hectare (16.13 Mt), were performed significantly maximum at 40 x 25 cm spacing with the foliar application of cycocel at 600 ppm. However, these characters were at par with the spacing 40 x 30 cm with the foliar application of cycocel at 800 ppm. Plant density either at 40 x 25 cm with cycocel at 600 ppm or 40 x 30 cm with cycocel at 800 ppm at 30 and 45 DAS was found better for yield in okra.

Introduction

Okra (*Abelmoschus esculentus* (L.) Moench) is an annual vegetable crop belongs to the family Malvaceae. It's adaptability to a wide range of growing condition made it popular among vegetable growers. Okra crop requires long warm growing season and it is susceptible to frost. The optimum day temperature for its better growth is between 25 to 40^{o}C and that of night is over 22^{o}C. It thrives in all kinds of soils but to well drained medium black and light clayey soils, rich in organic matter and favourable soil pH range

from 6.0 to 6.8 is more suitable for okra cultivation.

Increasing plant population increases yield per unit area of okra till a certain limit, beyond which resources for plant become limited and the yield decreases (Weimer, 1990). Planting with proper spacing increases yield quality and size of fruit. It has been observed that suitable planting spacing can lead to optimum okra fruit yield while improper planting spacing could result in relatively low yield and poor quality fruits (Maurya *et al.,* 2013). Hossain *et al.,* (2001) recommended that intra-row spacing for optimal okra fruit yield ranged from 20 cm to 40 cm. Therefore, optimum plant population is required for higher yields of okra.

Suitable planting spacing and cycocel can lead to optimum okra fruit yield while improper planting spacing could result in relatively low yield and poor quality fruits (Maurya *et al.,* 2013). The present investigation was undertaken by aiming to produce better more yield of okra with specific standards *viz*. tenderness, 3 to 4 cm in length, uniform in size, dark green in colour, disease and pest free with better yield potential per unit area. Cycocel is growth retardant that inhibits both cell elongation and cell division It plays an important role of anti-gibberellin growth retardant. Appropriate plant densities coupled with foliar application of cycocel resulted in increasing fruit yield and quality in okra. Therefore, the present investigation was undertaken to study the effect of plant densities and cycocel on fruit and yield attributes of okra.

Materials and Methods

The investigation was undertaken at Instructional cum Research Farm of College of Horticulture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani to know the effect of plant densities and cycocel on fruit and yield attributes of okra. The experiment was laid out in Factorial Randomized Block Design with three replications during summer season of 2018 under shade net house. Sowing was undertaken at four different spacing levels *i.e* 60 x 30 cm, 60 x 25 cm, 40 x 30 cm and 40 x 25 cm. Whereas, cycocel was applied as foliar spray at 30 and 45 days after sowing (DAS) at four different concentration levels *i.e.* 0 ppm (distilled water), 400, 600 and 800 ppm. All, recommended practices like nutrient and plant protection measures were given during the experiment. Different commercial characters of okra were recorded during growth of the crop *viz.* days to first fruit set, days to first fruit harvest, number of fruits per plant, average fruit weight, fruit length, fruit diameter, fruit yield per plant, fruit yield per plot and fruit yield per hectare. Collected information was subjected to statistical analysis to test the significance among the treatments on various characters of okra under study was done according to the procedure given by Panse and Sukhatme (1985).

Results and Discussion

Effect of plant density

The results of the experiment indicated that the significant effect of different plant densities were shown for the characters like number of fruits per plant, fruit length, fruit yield per plot and fruit yield per hectare. Whereas, other characters like days to first fruit set, days to first fruit harvest, average fruit weight, fruit diameter and fruit yield per plant were found non significant (Table 1). Number of fruits per plant were recorded significantly more at spacing of 40 x 25 cm (8.50) followed by 40 x 30 cm (8.40), whereas, fruit length was found significantly maximum in 40 x 30 cm (7.63) followed by 60 x 30 cm and 60 x 25 cm *i.e.* 7.61 cm and 7.54 cm, respectively. Characters like fruit yield

per plot (7.86 kg) and fruit yield per hectare (13.36 Mt) was recorded at spacing of 40 x 25 cm followed by 40 x 30 cm (7.31 kg and 12.29 Mt, respectively). Similar results were also reported by Maurya *et al.,* (2013) and Ekwu *et al.,* (2012).

Effect of cycocel

Cycocel showed significant effect on different characters of okra like days to first fruit set, days to first fruit harvest, number of fruits per plant, average fruit weight, fruit length, fruit diameter, fruit yield per plot and fruit yield per hectare, whereas, fruit yield per plant was not shown more difference among the treatments. Number of fruits per plant was found significantly maximum (8.50) at floiar application of cycocel at 600 ppm followed by 800 ppm (7.90). Average fruit weight, fruit length, fruit diameter, fruit yield per plot and fruit yield per hectare were recorded maximum at foliar application of cycocelat 600 ppm *i.e.* 18.75 g, 7.61cm, 18.75 cm, 7.65 kg and 12.69 Mt, respectively. These findings are in agreement with those of Singh (2013), Rajput *et al.,* (2011), Munikrishnappa and Shantappa (2009), Pateliya (2008) and Parmar *et al.,* (2008).

Effect of interaction

Interaction effects revealed that the traits like number of fruits per plant, average fruit weight, fruit length, fruit yield per plot and fruit yield per hectare was found significant, while other characters like days to first fruit set, days to first fruit harvest, fruit diameter and fruit yield per plant were not shown any more differences among the treatments (Table 2).

Number of fruits per plant was exhibited maximum and significant number (9.38) at S_4C_3 *i.e.* spacing at 40 x 25 cm with the foliar application of cycocel at 600 ppm. Whereas, S_4C_4 (40 x 25 cm, cycocel at 800 ppm), S_3C_3 (40 x 30 cm, cycocel at 600 ppm) and S_3C_4 (40 x 30 cm, cycocel at 800 ppm) were also found at par with S_4C_3 (40 x 25 cm, cycocel at 600 ppm) *i.e.* 9.16, 9.14 and 9.05 fruits per plant per ha, respectively.

The characters like average fruit weight, fruit length, fruit yield per plot and fruit yield per hectare were also recorded significantly maximum in S_4C_3 (40 x 25 cm,cycocel at 600 ppm) *viz.* 17.93 g, 8.26 cm, 10.28 kg and 16.13 Mt, respectively. Audus (1960) and Kakade *et al.,* (2010) were also reported similar findings.

Among the treatments, significantly maximum yield potential was reported from S_4C_3 (40 x 25 cm with the foliar application of cycocel at 600 ppm) treatment recorded 16.13 Mt per hectare and whereas, plant density at S_4C_4 (40 x 25 cm with the foliar application of cycocel at 800 ppm) and S_3C_3 (40 x 30 cm with foliar application of cycocel at 600 ppm) were also found at par with S_4C_3 (40 x 25 cm with the foliar application of cycocel at 600 ppm) with yield level of 15.97 Mt and 15.53 Mt per hectare, respectively followed by S_3C_4 (40 x 30 cm with the foliar application of cycocel at 800 ppm) *i.e.* 14.11 Mt per hectare.

Whereas, S_1C_4 (60 x 30 with the foliar application of cycocel at 800 ppm) and S_1C_1 (60 x 30 without the foliar application of cycocel recorded significantly, the lowest *i.e.* 10.11 Mt and 10.24 Mt per hectare yield level out of all the treatments under study. Similar results were also reported by Maurya *et al.,* (2013) and Ekwu *et al.,* (2012).

It is concluded that the spacing at 40 x 25 cm with the foliar applications of cycocel at 600 ppm at 30 and 45 DAS or spacing at 40 x 30 cm with the foliar applications of cycocel at 800 ppm at 30 and 45 DAS was found better for fruit yield in okra.

Table .1 Effect of plant densities and cycocel on fruit and yield attributes in okra

Traits/ Treatment details		Days to first fruit set	Days to first fruit harvest	No. of fruits per plant	Average fruit weight (g)	Fruit length (cm)	Fruit diameter (mm)	Fruit yield per plant (g)	Fruit yield per plot (kg)	Fruit yield per hectare (MT/ha.)
S_1	60 x 30 cm	43.85	51.17	6.41^{c}	16.80	7.61^{a}	12.59	115.11	6.14^{d}	10.15^{d}
S_2	60 x 25 cm	43.28	51.11	7.60^{b}	16.96	7.54^{a}	12.74	117.20	6.53^{c}	10.86^{c}
S_3	40 x 30 cm	43.12	50.98	8.40^{a}	17.00	7.63^{a}	12.75	118.31	7.31^{b}	12.29^{b}
S_4	40 x 25 cm	42.48	50.53	8.50^{a}	17.27	7.28^{b}	12.88	122.93	7.86^{a}	13.36^{a}
C.D @ 5%		**NS**	**NS**	**0.720***	**NS**	**0.177***	**NS**	**NS**	**0.375***	**0.591***
C_1	0 ppm	43.78^{a}	51.70^{a}	6.30^{b}	16.63^{d}	7.28^{b}	16.63^{d}	113.36	6.02^{c}	10.11^{d}
C_2	400 ppm	43.10^{a}	51.00^{ab}	6.80^{b}	17.05^{c}	7.57^{a}	17.05^{c}	119.15	6.24^{c}	10.73^{c}
C_3	600 ppm	43.05^{ab}	50.80^{b}	8.50^{a}	18.75^{a}	7.61^{a}	18.75^{a}	121.3	7.65^{a}	12.69^{a}
C_4	800 ppm	42.80^{b}	50.20^{b}	7.90^{a}	17.69^{b}	7.58^{a}	17.69^{b}	120.12	7.18^{b}	11.68^{b}
C.D @ 5%		**0.885***	**0.915***	**1.489***	**0.415***	**0.177***	**0.359***	**NS**	**0.375***	**0.591***

Within a treatment group, means in a column followed by the same letter(s) are not significantly different using CD at 5% level of probability.
NS = Not Significant, * = Significant. S= Spacing levels, C= Cycocel levels

Table.2 Interaction effect of plant densities and cycocel on fruit and yield attributes of okra

Traits/ Treatment details		Days to first fruit set	Days to first fruit harvest	No. of fruits per plant	Average fruit weight (g)	Fruit length (cm)	Fruit diameter (mm)	Fruit yield per plant (g)	Fruit yield per plot (kg)	Fruit yield per hectare (MT/ha.)
T_1	S_1 C_1	44.73	52.80	7.74^{e}	15.91^{e}	6.86^{h}	12.01	104.18	6.61^{e}	10.24^{f}
T_2	S_2 C_1	44.47	51.85	8.07^{de}	16.06^{e}	7.03^{g}	12.28	106.09	6.91^{de}	10.4^{f}
T_3	S_3 C_1	43.87	51.80	8.16^{d}	16.61^{de}	7.22^{f}	12.45	111.07	6.96^{de}	10.44^{f}
T_4	S_4 C_1	43.53	51.61	8.19^{d}	16.73^{cde}	7.25^{f}	12.44	115.29	7.03^{de}	10.52^{f}
T_5	S_1 C_2	43.51	51.60	8.18^{d}	16.74^{cde}	7.27^{ef}	12.65	116.89	7.11^{de}	10.69^{ef}
T_6	S_2 C_2	43.33	51.20	8.17^{d}	16.94^{bcd}	7.29^{ef}	12.67	117.31	7.11^{de}	10.76^{ef}
T_7	S_3 C_2	43.27	51.01	8.27^{d}	16.99^{bcd}	7.29^{ef}	12.71	117.48	7.23^{de}	10.85^{ef}
T_8	S_4 C_2	43.20	51.00	8.31^{d}	16.99^{bcd}	7.31^{ef}	12.75	118.94	7.36^{de}	11.83^{de}
T_9	S_1 C_3	43.07	50.81	8.34^{d}	17.05^{bcd}	7.38^{e}	12.82	119.71	7.40^{d}	12.07^{d}
T_{10}	S_2 C_3	42.93	50.80	8.78^{c}	17.08^{bcd}	7.70^{d}	12.86	121.01	7.45^{d}	12.25^{d}
T_{11}	S_3 C_3	42.53	50.20	9.14^{ab}	17.50^{abc}	7.95^{c}	12.91	123.69	9.92^{ab}	15.53^{ab}
T_{12}	S_4 C_3	42.07	48.93	9.38^{a}	17.93^{a}	8.26^{a}	12.97	132.13	10.28^{a}	16.13^{a}
T_{13}	S_1 C_4	42.87	50.61	8.85^{b}	17.12^{abcd}	7.71^{d}	13.00	121.27	7.45^{d}	10.11^{f}
T_{14}	S_2 C_4	42.73	50.60	8.90^{b}	17.42^{abcd}	7.72^{d}	13.02	121.34	8.84^{c}	13.74^{c}
T_{15}	S_3 C_4	42.60	50.50	9.05^{abc}	17.49^{abc}	7.86^{c}	13.04	123.37	9.22^{bc}	14.11^{bc}
T_{16}	S_4 C_4	42.20	49.87	9.16^{ab}	17.59^{ab}	8.13^{b}	13.24	124.44	10.18^{a}	15.97^{a}
C.D @ 5%		**NS**	**NS**	**0.355***	**0.831***	**0.122***	**NS**	**NS**	**0.751***	**1.182***

Within a treatment group, means in a column followed by the same letter(s) are not significantly different using CD at 5% level of probability. NS = Not Significant, * = Significant S= Spacing levels, C= Cycocel levels

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