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Effect of different levels of cycocel (CCC) on two different cultivars of okra (*Abelmoschus esculantus L.*) under Prayagraj Agro climatic conditions

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Abstract
A field experiment was conducted during February to june, 2019 at the Horticulture Research Farm, Department of Horticulture, Naini Agricultural Insitute, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj to study the "Effect of different levels of cycocel (CCC) on two different cultivars of okra (*Abelmoschus esculentus* L.) under Prayagraj Agro climatic conditions". The experiment was conducted in Factorial Randomized Block Design having 2 factors (Cultivers, Cycocel in different concentrations) with 6 various treatments (Control, Cycocel @ 200 ppm, 250 ppm, 300 ppm, 350 ppm and 400 ppm) in three replications. The allocation of treatments of the individual plots using random number in each replication. The plant height ranged from 90.58 cm to 122 cm. The minimum plant height (90.58 cm) was recorded in foliar spray cycocel at 400 ppm which was significantly over all other treatments. Based on the results obtained, the most effective concentration of cycocel for 50 per cent flowering (34.33 days), maximum number of pods per plant (30.83), maximum number of picking per plant (15.66) and maximum pod yield per hectare (132.32 qu.) was found superior at 400 ppm of cycocel as foliar spray. Among two cultivars, the most effective concentration of cycocel for number of nodes per plant (26.30), number of pickings per plant (14.23), maximum number of pods per plant (26.54), and maximum pod yield per hectare (107.7 qu.) was found superior in Pusa sawani cultivar of okra.

Keywords: Okra cultivars, Cycocel, growth, yield, quality, factorial randomized block design

Introduction
Okra [*Abelmoschus esculentus* (L.) Moench] is most popular vegetable of the family Malvaceae which is locally known as Bhendi and Lady's finger. Globally India ranks first in okra production having area of 509 hectares with an annual production of 6094.9 million tons and productivity of 12 million tonnes/ha. The crop is grown throughout India, Gujarat is the leading okra producing state which has production of around 921.72 thousand tons from an area of 75.27 thousand ha, with a productivity of 12.25 tonnes/ha. It is followed by West Bengal (914.86 thousand tonnes from 77.5 thousand ha with 11.5 tonnes/ha productivity. In Uttar Pradesh area, production and productivity of okra is 22.93 ha, 307.29 tonnes, 13.40 metric tonnes/ha, respectively (NHB 2017-18) [7]. The role of cycocel when used as seed priming agent has been found to promote early germination and foliar spray has been found to retard the plant height by reducing internodal length and simultaneously induces the formation of lateral shoots, thereby plants possess more number of pod bearing shoots and may also enhance the reproductive phase thus giving higher yields (Arora and Dhankar, 1992) [1].

Materials and Methods
The experiment was carried out at the Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad. The experiment was conducted in Factorial Randomized Block Design having 2 factors (Cultivers, Cycocel in different concentrations) with 6 various treatments (Control, Cycocel @ 200 ppm, 250 ppm, 300 ppm, 350 ppm and 400 ppm)in three replications. The allocation of treatments of the individual plots using random number in each

replication. Prayagraj is situated at an elevation of 78 meters above sea level at 25.87 degree North latitude and 81.15 degree E longitude.

Okra cultivar Arka anamica and Pusa sawani was used for studies. It has average yield potential of 170-180 q per hectare in kharif and 130-140 q per hectare in summer season with duration of 90 days. It is resistant to yellow vein mosaic virus. The gross and net plot sizes of the treatments were 1.75 m x 1.75 m (3.06 m^2) and 1.5 m x 1.5 m (2.25 m^2) respectively. Bund size of plot is 0.25 m. One main irrigation channel of 1 m width and two sub-irrigation channels of 50 cm each were prepared in the experimental field to meet out the irrigation requirement. A common dose of farm yard manure 15 tonnes per hectare was applied to experimental land area uniformly in last ploughing and incorporated into the soil. Nitrogen (100 Kg per ha) was applied in three splits *viz*., one third as a basal dose and remaining two thirds in two equal splits at 30 and 45 days after sowing as a top dressing in each plot. Phosphate (60 kg per ha) and potash (50 kg per ha) fertilizers were applied along with the basal dose of nitrogen in each plot. Nitrogen, Phosphorus and Potash were applied in the form of Urea, Single Super Phosphate and Muriate of Potash respectively. The first irrigation was given immediately after sowing while subsequent irrigations were given as and when required depending upon soil moisture and weather conditions.

Results and Discussion

Among all the different treatments, application of cycocel (400 ppm) as foliar spray significantly reduced plant height (98.83 cm) whereas control recorded maximum (121.33 cm) plant height. The average plant height (102.45) reduced in Arka anamika and maximum (115.94) in Pusa sawani. The decrease of plant height might be due to its additional availability of cycocel to the plant as foliar application, the plant height decreased with the increase in growth retardant concentration Sajjan *et al.* (2003) [14] and Porwal *et al.* (2002) [10].

Among all the treatments maximum number of nodes per plant (27.21) was observed in foliar spray of cycocel at 400 ppm. The average maximum number of nodes per plant (26.3) were recorded in Pusa sawani. The increase of number of nodes might be due to its additional availability of cycocel to the plant as foliar application, the number of nodes increase with the increase in growth retardant concentration Mahorkar *et al.* (2007) [5] and Praveen *et al.* (2018) [12].

Among all the treatments reduced internodal length (4.92 cm) was observed in foliar spray of cycocel at 400 ppm. The average internodal length (5.16) reduced in Arka anamika and maximum (5.52) in Pusa sawani. Spraying of CCCtwice significantly reduced the internodal length Prasad *et al.* (2008) [11] and maximum retardation in internodal length by increasing concentration of cycocel Patil *et al.* (2014) [9].

The minimum number of days to 50 per cent flowering (34.33 days) was observed in foliar spray of cycocel at 400 ppm. The average minimum number of days to 50 per cent flowering (36.88 days) was observed in Arka anamika. The maximum number of days to 50 per cent flowering (40 days) was observed in absolute control of Pusa sawani. Kokare *et al.* (2006) [3] revealed that growth retardant CCC found to be decreased days to 50% flowering in okra.

The maximum number of pickings (15.66) per plant was observed in foliar spray of cycocel at 400 ppm. The average maximum number of pickings (14.23) per plant was observed in Pusa sawani. Patil *et al.* (2014) [9] reported that the application of growth retardent with specific concentration of cycocel leads to maximum pickings. The maximum number of pickings was shown by foliar application of cycocel Sajjan *et al.* (2003) [14].

The maximum number of pods per plant (30.83) and maximum yield per plant (357.29 g) were observed in higher concentrations of cycocel at 400 ppm as foliar spray. The average maximum number of pods per plant (26.54) and maximum yield per plant (290.83 g) were observed in Pusa sawani. Bora *et al.* (2006)[2] studied the effect of cycocel as well recorded more pods. Kshirsagar *et al.* (2009) [4] showed that foliar spray of cycocel enhanced number of pods per plant.

Among all the treatments maximum total soluble solids 3.73 ^{0}Brixwas observed in foliar spray of cycocel at 400 ppm. There is no significant change of average maximum total soluble solids (3.55) in both cultivars. Mandel *et al.* (2012) [6] reported that the crop was foliar spray of cycocel fetched the maximum TSS. The total soluble solids was found more in cycocel treatment combinations Parmar *et al.* (2016) [8].

The maximum yield of green pods per hectare (132.32 q) was recorded with foliar spray of cycocel at 400 ppm. The average maximum yield of green pods per hectare (107.71 q) was recorded in Pusa sawani. Patil *et al.* (2014) [9] and Rajput *et al.* (2011) [13] reported that okra investigate the influence of cycocel result indicated that the maximum fruit yield per hectare.

Table 1: Effect of cycocel on plant height (cm), number of nodes and internodal length at different stages of crop growth period on two cultivars of okra.

Notation	Treatments	Plant height at 90DAS			Number of nodes at 90DAS			Internodal length at 90DAS		
		Arka Anamika	Pusa Sawani	Mean	Arka Anamika	Pusa Sawani	Mean	Arka Anamika	Pusa Sawani	Mean
T_0	Control	120.67	122	121.33	24	23.67	23.83	5.73	6.13	5.93
T_1	CCC @ 200ppm	112.92	120.83	116.87	24.83	25.17	25	5.32	5.71	5.52
T_2	CCC @ 250ppm	103.33	119.25	111.29	25	25.58	25.29	5.27	5.59	5.43
T_3	CCC @ 300ppm	95.67	117.25	106.46	25.42	27.17	26.29	4.97	5.38	5.18
T_4	CCC @ 350ppm	91.5	109.25	100.37	25.92	28.08	27	4.88	5.23	5.06
T_5	CCC @ 400ppm	90.58	107.08	98.83	26.25	28.17	27.21	4.74	5.1	4.92
Mean		102.45	115.94	109.19	25.24	26.30	25.77	5.16	5.52	5.34
F- test		S	S		S	S		S	S	
Source of variation		CD (0.05)	SE.m.(±)		CD (0.05)	SE.m.(±)		CD (0.05)	SE.m.(±)	
Factor A		2.417	9.54	-	1	0.75	-	0.192	0.26	-
Factor B		4.187	8.98		1.732	1.29		0.332	0.36	
A X B		-	11.64		-	1.44		-	0.39	

Table 2: Effect of cycocel on 50 per cent flowering, number of pickings and number of pods at different stages of crop growth period on two cultivars of okra.

Notation	Treatments	50 per cent flowering			Number of pickings			Number of pods		
		Arka Anamika	Pusa Sawani	Mean	Arka Anamika	Pusa Sawani	Mean	Arka Anamika	Pusa Sawani	Mean
T_0	Control	39.3	40	39.65	11.5	11.92	11.71	21.08	22.67	21.87
T_1	CCC @ 200ppm	39	39	39	13	13.58	13.29	22.75	24.92	23.83
T_2	CCC @ 250ppm	38.3	37.67	37.98	13.42	14.25	13.83	24.92	25.17	25.04
T_3	CCC @ 300ppm	36.3	36.67	36.48	14.67	14.5	14.58	27.25	26.08	26.66
T_4	CCC @ 350ppm	35.3	34.3	34.8	15	15.33	15.16	29	29.17	29.08
T_5	CCC @ 400ppm	35	33.67	34.33	15.5	15.83	15.66	30.42	31.25	30.83
Mean		37.2	36.88	36.88	13.84	14.23	14.04	25.90	26.54	26.22
F- test		S	S		S	S		S	S	
Source of variation		CD (0.05)	SE.m.(±)		CD (0.05)	SE.m.(±)		CD (0.05)	SE.m.(±)	
Factor A		1.047	0.22	-	0.408	0.27	-	0.903	0.45	-
Factor B		1.813	2.19		0.706	1.43		1.563	3.33	
A X B		-	2.13		-	1.38		-	3.24	

Table 3: Effect of cycocel on TSS (^{0}Brix) and pod yield per hectare (q) at different stages of crop growth period on two cultivars of okra.

Notation	Treatments	TSS (^{0}Brix)			pod yield per hectare (q)		
		Arka Anamika	Pusa Sawani	Mean	Arka Anamika	Pusa Sawani	Mean
T_0	Control	3.35	3.37	3.36	77.77	83.17	80.47
T_1	CCC @ 200ppm	3.64	3.46	3.55	91.35	88.11	89.73
T_2	CCC @ 250ppm	3.45	3.51	3.48	107.62	108.17	107.89
T_3	CCC @ 300ppm	3.41	3.67	3.54	111.57	111.26	111.41
T_4	CCC @ 350ppm	3.69	3.55	3.62	124.68	122.06	123.37
T_5	CCC @ 400ppm	3.75	3.72	3.73	131.17	133.48	132.32
Mean		3.55	3.55	3.55	107.36	107.71	107.53
F- test		S	S		S	S	
Source of variation		CD (0.05)	SE.m.(±)		CD (0.05)	SE.m.(±)	
Factor A		0.126	0.0011	-	5.441	0.14	-
Factor B		0.218	0.126		9.424	19.66	
A X B		-	0.142		-	18.82	

Conclusion

Based on the results obtained, the most effective concentration of cycocel for 50 per cent flowering, maximum number of pods per plant, maximum number of picking per plant and maximum pod yield per hectare was found better at treatment T_5 that is 400 ppm of cycocel as foliar spray. Among two cultivars, the most effective concentration of cycocel for number of nodes per plant, number of pickings per plant, maximum number of pods per plant and maximum pod yield per hectare was found superior in Pusa sawani cultivar of okra.

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