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Enhancing Sex Ratio, Yield and its Attributing Traits with Exogenous Application of Phytohormones in Bottle Gourd (*Lagenaria siceraria* L.)

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ABSTRACT

A field experiment was conducted at the Vegetable research farm, Khanaura of Punjab Agricultural University, Ludhiana, Punjab during summer seasons of 2021 and 2022 with three phyto-harmones in varying concentrations *viz.*, Ethrel (100, 200, 300 ppm), Indole acetic acid (100, 150, 200 ppm) and Gibberellic acid (20, 40, 60 ppm) to enhance the production potential and reproductive behavior of bottle gourd (*Lagenaria siceraria* M.) variety Punjab Komal. The experimental results showed that foliar spray of ethrel @ 300 ppm observed to be significantly better than control for reproductive characteristics *viz.,* number of pistillate flowers/vine, days to first fruit harvest, fruit set percentage, lowered sex: ratio, furthermore, the exogenous application of gibberellic acid @ 60 ppm increased vine length at maturity and number of staminate flowers/vine. The yield attributing traits *i.e.,* fruit weight, number of fruits as well as total yield/plant had also improved with ethrel @ 300 ppm. Therefore, it may be concluded that spray of the ethrel @300 ppm at 2 true leaf stage and superimposed at 4 true leaf stage can be recommended to enhance number of female flowers in bottle gourd ultimately producing early and higher fruit yield.

Key Words: Bottle gourd, Growth ,Regulators, Sex ratio, Reproductive traits, Yield.

INTRODUCTION

Bottle gourd (*Lagenaria siceraria* L.) is a significant vegetable crop within the cucurbitaceae family, commonly referred to as white-flowered gourd/calabash gourd. Bottle gourd fruits has been recognized for their high nutritional value, serving as a rich source of carbohydrates, essential vitamins, and minerals (Wamiq *et al,*2022). The fruit pulp act as an antidote for poisons and also helps in curing the constipation, night blindness and coughing (Leghari *et al,* 2014). In India, bottle gourd is grown across 116.9 thousands of hectares, producing an annual yield of 1,428.3 thousand tonnes. In Punjab, cucurbits are grown across 18.01 thousand of hectares, yielding an annual production of 184.27 thousand MT (Anonymous, 2021) in the state of Punjab.

Bottle gourd initiates flowering approximately 40–50 days after sowing based on cultivar and prevailing environmental conditions. Cross-pollination highly favoured a monoecious flowering pattern, with solitary white male as well as female flowers emerging at different nodes on the same plant (Ilyas *et al,* 2017). Staminate flowers emerge earlier than pistillate flowers along the nodal axis of both the main and secondary branches. Usually, most of male flowers occur on main vine (branch), whereas female flowers are borne on secondary branches (Patel *et al,* 2017). The natural tendency of all the cucurbitaceous crops to produce higher male flowers than female flowers proved to be a limitation in crop yield. Generally, the rapid growth of the main vine limits the development of secondary branches, consequently reducing the number of pistillate flowers and leading to a decline in overall yield. Thus, in order to obtain early and higher yield manipulation of sex ratio is mandatory in cucurbits.

The sex modification can be attained through altering the time of flowering as well as sex ratio through manipulating the endogenous

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concentrations of gibberellin, auxin, ethylene as well as ascorbic acid during development . Hence, it could be achieved through the foliar spray of PGRs which modulate plant growth and development through alterations in their physiological homeostasis (Rafeekher *et al,* 2002). Pertinent literature demonstrates that PGRs could alter flowering as well as yield (Gedam *et al,*1998; Damodhar *et al,* 2004), promote initial flowering along with fruit maturation, enhance length of fruit (Ghani *et al,* 2013), and increase both total number of fruits and individual weight of fruit (Hossain *et al,* 2006), fruit yield in cucurbits (Nagamani *et al,* 2015).

Although plant growth regulators have significant potential to enhance the growth and yield of various vegetable crops. However, limited information is available regarding the optimal dosage along with time of application specifically for bottle gourd. The primary aim of this research was to examine effects of PGRs on modulating the sex ratio by promote pistillate flower development, induce femaleness to enhance fruit set along with yield of bottle gourd. The study will enlighten the new path in way of changing sex expression for the research community to utilize phyto-hormones enhancing the production potential of bottle gourds in terms of vegetable and seed crop.

MATERIALS AND METHODS

The field trial had been performed at two different geographical locations of the Punjab Agricultural University, District Ludhiana (Punjab) during the summer seasons of 2021 and repeated during 2022 for the confirmation of the results. The experimental material comprised Punjab Komal variety of Bottle gourd. The field trial was designed using a Completely Randomized Block Design (CRBD) along with three replications. Those treatments comprised of three phytohormones each with three concentrations *i.e.,* Ethrel @ 100, 200, 300ppm, Indole Acetic acid (IAA) @ 100, 150, 200ppm and Gibberellic acid (GA_3) @ 20, 60, 80ppm. The specified amounts of each phytohormone were individually diluted in small amount of 95% absolute alcohol along with stock solutions had been subsequently prepared by solublized with distilled water.

The treatments were applied as foliar sprays at 2 true leaf stage and superimposed at 4 true leaves stage and control plot was sprayed with distilled water in morning hours. Ten plants from each treatment were randomly chosen for observation recording. Data were collected for various morphological parameters *i.e.,* inter-nodal distance, length of vine at maturity, number of branches/vine along with reproductive parameters *i.e.,* days to appearance of first female flower, number of pistillate flowers/vine, fruit weight, number of fruits/plant and total yield/plant. The recorded data from both locations were pooled and analyzed using statistical analysis of variance procedure (Sheoran *et al,*1998). The mean comparisons were conducted using the LSD method at a significance level of 5 per cent.

RESULTS AND DISCUSSION

Vegetative traits

The pooled statistical analysis demonstrated that application of phytohormones with varying concentrations significantly affected the inter-nodal distance and vine length at maturity during both the years (Table 1) . However, the variations in tendril length and number of branches/vine were non-significant. The spray of ethrel @ 300ppm was significantly efficient in reducing inter-nodal distance compared to the control across both years of study. As closely results had reported by (Kumar *et al,* 2020), whom seen a comparable impact of PGRs on the growth of bottle gourd vines. The data recorded for vine length at maturity indicated that spray of GA3 @ 60 ppm increased vine length which was at par with both GA3 @ 40 ppm and 20 ppm. Similarly, the applications of ethrel @ 300ppm, IAA @ 100 ppm and @ 200 ppm significantly improved the vine length than the control treatment. While, the lower concentrations of ethrel both @100 ppm and 200 ppm failed to statistically improve the vine length at maturity. The number of branches/vine were determined as statistically non-significant through various concentration of phytohormones in bottle gourd.

However, foliar spray of ethrel @ 300 ppm resulted in highest number of branches/vines followed by ethrel @ 200 ppm. Therefore, treatment of control observed minimum number of branches/vine. A similar findings were observed by (Kumari *et al,* 2017).

Yield traits

The data for the yield traits *viz.,* fruit weight, diameter, length, number of fruits along with total yield/plant for both locations and years as shown in table 2. The highest fruit weight was observed through foliar spray of ethrel @ 300 ppm and ethrel @ 200ppm afterward IAA @ 100ppm over both locations whereas, control treatment observed the minimum fruit weight in comparable with all other treatments. The results were closely related to earlier study of (Sandra *et al,*2015) who observed that ethrel treatment enhanced fruit weight in cucurbit. The exogenous application of ethrel @ 300 ppm showed significantly maximum fruit diameter followed by the foliar spray of ethrel @ 200 ppm consist the fruit diameter. The lower fruit weight percentage recorded in treatment of control. These results were closely related to Vyas *et al* (2015) who observed that diameter of fruit was significantly increased by application of ethrel @ 300 ppm in cucurbit. The use of ethrel @ 300 ppm subsequently enhanced the length of fruit then ethrel @ 200ppm. The least fruit length percentage reported in treatment control. Results were closely associated to previous study of Barot (2022)) who observed that length of fruit had been maximised through foliar spray of ethrel @ 300 ppm. The application of all the phytohormones at varying concentrations significantly improved the number of fruits/plant. The highest number of fruits was observed by foliar spray of ethrel @ 100, 200 and 300 ppm. While, the lower number of fruits/plant had been observed in control treatment. The results were closely associated with previous study of (Kumar *et al,* 2020). The number of fruits/plant subsequently increased because, ethephon functions as a growth retardant without inhibiting gibberellic biosynthesis. The action of mechanism is to release ethylene, that has been retained within a plant as well as interfere in process of growth. However, ethephon reduces the photosynthesis by enhancing level of ethylene (Ouzounidou *et al,* 2008). The statistical analysis revealed that use of all the phytohormones subsequently enhanced the total fruit yield/plant. As increased in total yield/plant had observed through spray of ethrel @ 300ppm afterward @ 100ppm and 200ppm over both environments. Similar findings have been reported by Jyoti *et al,*(2016). Moreover, the application IAA @ 200 ppm recorded total yield per plant at par with all other remaining treatments with foliar application whereas, the control treatment observed statistically lowest total yield per plant.

Reproductive traits

The pooled data analysis of variance (Table 3) revealed that that induction of staminate flowers was not statistically influenced with exogenous application of phytohormones at various concentrations. Similarly, the non-significant effect of phytohormones on production of staminate flowers cucumber was observed by (Gosai *et al,*2020). The spray of ethrel @ 300ppm maximised number of pistillate flower/vine at par with ethrel @ 200 ppm. Similarly, the treatment with IAA @ 200ppm recorded higher number of pistillate flowers at par with both IAA @150 ppm, IAA @ 100 ppm along with GA3 @ 20 ppm. Control treatment observed minimum number of pistillate flowers at par with GA3 @ 40 ppm, GA3@ 60 ppm. The results were closely associated with previous findings of (Sulochanamma 2001). Ethrel is an essential growth regulator which has been applied to increase the fruit weight, because of its ability to stimulate the gynoecium development, stress induction, ripening of fruit and lateral cell expansion. It also enhances the starch and carbohydrate levels (Rajala *et al,*2001). Moreover, the lower sex: ratio was observed by spray of ethrel @ 300 ppm followed by ethrel @ 200 ppm. This could be possible by increased number of pistillate flowers or suppression of maleness with the application of ethrel. The similar findings were recorded by (Imamsaheb *et al,*2014). The control treatment recorded statistically highest sex: ratio than all the treatments with phytohormones application. The fruit set percentage was increased under application of ethrel @ 300 ppm, ethrel @ 200

Table 1. Impact of application of phyto-harmones on vegetative characteristics of bottle gourd.

Treatment/ Environment (E)		Inter-nodal distance (cm)		Vine length at maturity (cm)		Tendril length (cm)		number of branches/vine	
		2021	2022	2021	2022	2021	2022	2021	2022
Ethrel 100 ppm	(E^1)	7.12*	7.04*	529.6	531*	13.5	12.5	7.0	7.8
	(E^2)	7.06*	7.10*	530.1*	530.5	13.1	12.9	7.5	7.3
Ethrel 200 ppm	(E^1)	6.92*	7.18*	529.5	530.5*	13.9	13.1	8.2	7.4
	(E^2)	7.08*	7.02*	530.1*	529.9	13.4	13.6	7.0	8.6
Ethrel 300 ppm	(E^1)	6.96*	7.04*	535.4*	536.0*	13.9	13.3	7.8	8.4
	(E^2)	7.02*	6.98*	536.3*	535.1*	14.0	13.2	7.5	8.7
IAA 100 ppm	(E^1)	7.10*	7.80	530.0	536.6*	14.2	13.6	7.2	8.0
	(E^2)	7.30*	7.60	531*	535.6*	13.8	14	7.5	7.7
IAA 150 ppm	(E^1)	7.58	7.08*	522.5	523.5	14.1	13.1	8.2	7.2
	(E^2)	7.20*	7.46	524.0	522.0	13.9	13.3	7.9	7.5
IAA 200 ppm	(E^1)	7.52	7.65	532.0*	534.0*	14.2	13.4	7.1	7.7
	(E^2)	7.60	7.57	534.5*	531.5	13.9	13.7	7.6	7.2
$GA_3$20 ppm	(E^1)	7.00*	7.20*	541.0*	540.4*	13.4	13.6	7.9	7.1
	(E^2)	7.11*	7.09*	539.5*	541.9*	13.9	13.1	7.2	7.8
$GA_3$40 ppm	(E^1)	8.06	7.96	543.5*	542.5*	13.3	14.1	8.0	7.2
	(E^2)	8.00	8.02	542.6*	543.4*	14.0	13.0	7.7	7.3
$GA_3$60 ppm	(E^1)	8.26	8.40	547.8*	546.8*	13.3	14.5	8.2	7.2
	(E^2)	8.46	8.20	546.9*	547.7*	14.2	13.6	7.8	7.6
Control	(E^1)	7.86	8.00	522.2	521.2	13.9	13.5	6.8	7.2
	(E^2)	7.96	7.90	520.8	522.9	14.1	13.3	7.4	7.6
CD (5%)		0.48		8.81		NS		NS	
CV		3.78		0.95		2.80		4.19	

* Significant at 5 % level of significance

Table 2. Impact of application of phyto-harmones on the yield and its attributing traits of bottle gourd.

Treatment		Fruit weight (g)		Fruit diameter (cm)		Fruit length (cm)		Number of fruits per plant (number)		Total yield per plant (kg/plant)	
		2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Ethrel 100 ppm	(E^1)	810*	790.46*	40.80*	41.42*	16.82*	17.52*	7.66*	8.36*	6.86*	6.38*
	(E^2)	785.06*	815.40*	41.21*	41.01*	17.06*	17.28*	8.56*	7.46*	6.26*	6.98*
Ethrel 200 ppm	(E^1)	812.25*	837.81*	41.85*	43.25*	17.12*	17.32*	8.18*	7.86*	7.18*	6.40*
	(E^2)	820.25*	829.81*	42.15*	42.95*	17.06*	17.38*	8.00*	8.04*	6.62*	6.96*
Ethrel 300 ppm	(E^1)	857.85*	843.05*	43.15*	42.61*	19.06*	18.28*	7.86*	8.28*	7.22*	7.52*
	(E^2)	860.35*	840.55*	42.05*	43.71*	18.88*	18.46*	8.92*	7.22*	7.12*	7.62*
IAA 100 ppm	(E^1)	810.80*	829.86*	38.06	36.60	16.22*	16.44	6.82*	7.24	5.56*	6.08*
	(E^2)	822.20*	818.46*	37.10	37.56	16.58*	16.08	7.16*	6.90	5.88	5.76*
IAA 150 ppm	(E^1)	790.20*	809.88*	34.84	35.82	17.00*	16.12	6.72	7.34*	6.20*	5.92*
	(E^2)	815.85*	784.23*	35.00	35.66	16.26*	16.86*	7.82*	6.24	5.60	6.52*
IAA 200 ppm	(E^1)	816.24*	804.58*	36.10	36.34	17.12*	16.92*	7.10*	7.06	6.58*	6.06*
	(E^2)	812.66*	808.16*	35.96	36.48	16.76*	17.28*	6.66	7.50*	6.36*	6.28*
$GA_3$20 ppm	(E^1)	795.24*	765.42*	32.12	32.48	15.92*	16.12	7.44*	6.72	5.36*	5.94*
	(E^2)	784.20*	779.46*	32.06	32.54	16.92*	15.12	6.88	7.28*	6.14*	5.16*
$GA_3$40 ppm	(E^1)	815.24*	806.10*	35.16	34.84	16.64*	15.84	7.62*	7.30*	5.86*	6.20*
	(E^2)	812.30*	809.04*	34.12	35.88	15.70	16.78*	7.86*	7.06*	6.16*	5.90*
$GA_3$60 ppm	(E^1)	814.46*	806.92*	36.06	36.60	16.84*	17.26*	7.14*	6.96	6.36*	6.06*
	(E^2)	812.24*	809.14*	36.54	36.12	17.24*	16.86*	7.04	7.06*	6.18*	6.24*
Control	(E^1)	715.60	744.5	35.18	34.38	14.58	15.56	6.52	7.02	4.64	5.06
	(E^2)	718.40	741.7	34.66	34.90	15.04	15.10	6.84	6.70	5.44	4.26
CD (5%)		5.99		3.28		1.01		0.24		0.50	
CV		0.43		5.02		3.52		1.87		4.65	

*** Significant at 5 % level of significance**

ppm and ethrel @ 100 ppm. The control treatment observed lowest fruit set percentage. However, higher concentration of GA3 @ 60 ppm also improved the fruit set percentage at par with the remaining treatments such as GA3@ 40 ppm, IAA @ 100, 150 and 200 ppm, respectively. The results were closely associated summer squash with previous study of (MR *et al,*2016). The use of ethrel @ 300ppm results in maximum fruit retention percentage afterward ethrel @ 200ppm.

Table 3. Impact of foliar application of phyto-harmones on various reproductive traits of bottle gourd.

Treatment		Number of staminate flowers (number/vine)		Number of pistillate flowers (number/vine)		Sex: ratio		Fruit set (%)		Fruit retention (%)	
		2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Ethrel 100 ppm	(E^1)	20.9	21.9	14.3*	13.7*	1.62*	1.68*	42.0*	41.34*	51.6*	50.4*
	(E^2)	21.6	21.2	13.8*	14.2*	1.64*	1.66*	41.84*	41.50*	50.9*	51.1*
Ethrel 200 ppm	(E^1)	21.7	20.9	14.8*	13.8*	1.55*	1.41*	42.67*	41.99*	52.8*	53.2*
	(E^2)	21.1	21.5	14.2*	14.4*	1.45*	1.51*	41.79*	42.87*	52.2*	53.8*
Ethrel 300 ppm	(E^1)	21.2	20.8	15.7*	14.9*	1.23*	1.27*	45.65*	44.35*	54.7*	55.3*
	(E^2)	20.4	21.6	15.1*	15.5*	1.28*	1.22*	44.95*	45.05*	55.4*	54.6*
IAA 100 ppm	(E^1)	21.2	21.4	11.7	12.3*	1.66*	1.62*	39.87	39.79*	49.8*	52.8*
	(E^2)	21.5	21.1	12.3*	11.7	1.72*	1.56*	40.21*	40.45	52.2*	50.4*
IAA 150 ppm	(E^1)	20.8	21.8	11.9	12.7*	1.58*	1.74*	40.79*	41.87*	51.6*	50.4*
	(E^2)	21.0	21.6	12.4*	12.2*	1.64*	1.68*	41.27*	41.39*	51.5*	50.5*
IAA 200 ppm	(E^1)	21.7	21.3	12.8*	13.8*	1.68*	1.78*	41.33*	40.67*	52.8*	51.8*
	(E^2)	21.4	21.6	13.0*	13.6*	1.58*	1.88*	41.45*	40.55	52.2*	52.4*
$GA_3$20 ppm	(E^1)	20.9	21.9	12.7*	11.9*	1.76*	1.72*	39.75	40.25*	50.7*	51.3*
	(E^2)	21.2	21.8	12.5*	12.1*	1.66*	1.82*	40.66*	39.34	51.8*	50.2*
$GA_3$40 ppm	(E^1)	22.2	21.2	10.5	10.9	1.80*	1.94*	40.44	41.56*	51.4*	50.6*
	(E^2)	21.8	21.6	11.0*	10.4	1.90*	1.84*	41.26*	40.74	50.3*	51.7*
$GA_3$60 ppm	(E^1)	22.2	21.4	11.9	11.5	2.10*	2.04*	42.78*	41.22*	52.2*	51.8*
	(E^2)	21.0	22.6	12.0*	11.4	2.0	2.14*	41.34*	42.66*	51.8*	52.2*
Control	(E^1)	21.3	22.1	10.0	10.6	2.38	2.12	38.4	37.6	47.6	46.4

* Significant at 5 % level of significance

Lower fruit retention percentage had been reported in treatment of control. These results were closely related to Banyal *et al* (2015) who observed that fruit retention was significantly enhanced with the application of ethrel in the cucurbits. The maximum number of days to emergence of first male flower was found under the spray of GA3 @ 60 ppm followed by the control treatment. The application of ethrel @ 100 ppm reported least days for appearance of first male flower. However, results of days to appearance of first male flower in bottle gourd plants were statistically found non-significant and hence bears no practical significance. The above results were in close agreement with those of Sabu *et al* (2022) who reported the impact about several PGRs on bottle gourd. The foliar spray of ethrel @ 300 ppm took lower days to emergence of the first female flower at par along with spray of ethrel @ 200ppm, ethrel @ 100 ppm. The similar findings were observed by Ansari *et al*(2018). The earlier formation of female flowers induced by the spraying of ethrel might be due to enhanced starch and carbohydrate levels (Sabu *et al,*2022). Treatment of ethrel @ 300ppm reduced the node/number of the first male flower followed by ethrel @ 200 ppm. Highest number of nodes at which the first male flower emerged was seen in treatment control. However, the results of node/number of the first male flower in bottle gourd plants were statistically non-significant and hence bears no practical significance. The above results were closely related to Thappa *et al* (2011) who reported that lowest number of first male flower had been identified with spray of ethrel @ 300 ppm. The minimum node/number for emergence of first female flower was observed by use of ethrel @ 300ppm then ethrel @ 200ppm. Similar findings have been reported by Shafeek *et al (*2016) who reported that lowest number of nodes for first female flower was found with spray of ethrel @ 300 ppm. The exogenous application of ethrel @ 300 ppm showed subsequently lowest number of days for fruit set afterwards spray of ethrel @ 200 ppm. Maximum number of days to the fruit set was identified in control treatment. The above results were in agreement with Thakur (2022) who reported that foliar spray of ethrel had

Table 3 (Contd..): Impact of foliar application of phyto-harmones on various reproductive traits of bottle gourd.

Treatment		Days to appearance of first male flower		Days to appearance of first female flower		Node/ number of first male flower (number)		Node/ number of first female flower (number)		Days to fruit set	
		2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Ethrel 100 ppm	(E^1)	44.4	46.8	47.8*	48.2*	9.5	9.3	11.2*	10.8*	42.52*	85.34
	(E^2)	45.4	45.8	48.5*	47.5*	9.2	9.6	10.6*	11.4*	42.82*	45.52*
Ethrel 200 ppm	(E^1)	45.0	46.2	47.2*	48.2*	8.9	9.9	11.2*	10.2*	41.88*	42.12*
	(E^2)	45.2	46.0	47.8*	47.6*	9.5	9.3	10.8*	10.6*	42.62*	41.38*
Ethrel 300 ppm	(E^1)	45.5	45.9	46.9*	47.7*	8.7	9.9	9.7*	10.3*	38.78*	39.22*
	(E^2)	46.2	45.2	47.2*	47.4*	9.0	9.6	10.1*	9.9*	39.72*	38.28*
IAA 100 ppm	(E^1)	45.8	45.6	51.2*	50.2*	9.6	9.4	11.7*	10.9*	45.82*	44.84*
	(E^2)	46.3	45.1	49.9*	51.5*	9.2	9.8	10.8*	11.8*	45.24*	45.42*
IAA 150 ppm	(E^1)	45.8	46.4	50.8*	51.2*	10.2	9.2	12.2*	11.2*	48.36	48.30
	(E^2)	45.7	46.5	51.8*	50.2*	9.6	9.8	12.0*	11.4*	48.16	48.50
IAA 200 ppm	(E^1)	45.4	46.8	49.6*	50.4*	9.8	9.0	12.4*	13.0*	46.54*	46.12*
	(E^2)	46.2	46.0	50.8*	49.2*	9.2	9.6	12.9*	12.5*	45.86*	46.80*
$GA_3$20 ppm	(E^1)	45.8	45.6	49.7*	50.9*	9.8	9.4	11.2*	12.2*	47.15*	93.34
	(E^2)	46.2	45.2	51.0*	49.6*	9.2	10.0	12.4*	11.0*	46.25*	47.09*
$GA_3$40 ppm	(E^1)	45.8	46.2	49.2*	50.8*	10.2	9.2	11.1*	12.3*	43.12*	42.22*
	(E^2)	46.2	46.4	50.5*	49.5*	9.8	9.6	11.9*	11.5*	42.62*	42.72*
$GA_3$60 ppm	(E^1)	46.8	45.8	51.4*	52.6*	9.4	10.0	13.2*	12.2*	46.36*	46.30*
	(E^2)	46.2	46.4	52.3*	51.7*	9.8	9.6	12.6*	12.8*	46.44*	46.22*
Control	(E^1)	45.8	46.6	55.8	56.8	10	9.6	15.1	14.3	51.16	50.84
	(E^2)	46.3	46.1	56.0	56.6	9.4	10.2	14.8	14.6	51.24	50.76
CD (5%)		NS		1.91		NS		1.09		3.07	

* Significant at 5 % level of significance

minimum number of days to fruit set in the bottle gourd plants.

CONCLUSION

It may be concluded that spray of the ethrel @300 ppm at 2 true leaf stage and superimposed at 4 true leaf stage can be recommended to enhance number of female flowers in bottle gourd ultimately producing early and higher fruit yield.

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