The Pharma Innovation Journal 2018; 7(6): 180-184

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2018; 7(6): 180-184

www.thepharmajournal.com
Received: 28-04-2018
Accepted: 30-05-2018

Praveen Kumar
M.Sc. vegetable science,
Department of Horticulture/Dr. BS. Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, Maharashtra, India

PM Haldankar
Department of Horticulture, Dr. Balasaheb Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

PC Haldavanekar
Department of Horticulture, Dr. Balasaheb Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

Correspondence
Praveen Kumar
M.Sc. vegetable science,
Department of Horticulture/Dr. BS. Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, Maharashtra, India

Study on effect of plant growth regulators on flowering, yield and quality aspects of summer okra (*Abelmoschus esculentus* L. Moench) Var. Varsha Uphar

Praveen Kumar, PM Haldankar and PC Haldavanekar

Abstract
The purpose of this study was to carry out a comparative evaluation of the physicochemical properties of A field trial was undertaken during 2014 summer season to determine the "Effect of plant growth regulators on flowering, yield and quality aspects of summer okra (*Abelmoschus esculentus* L. Moench) Var. Varsha Uphar" at Department of Horticulture, College of Agriculture, Dapoli. The experiment consisted of three treatments *viz,* cycocel (200, 400 & 600 ppm), PBZ (150, 250 & 300 ppm) and ethrel (150, 250 & 300 ppm) was sprayed once at 30 DAS. From the results the observations were recorded on various traits and concluded that the lowest days to first flowering and 50 per cent flowering, nodal position of first flower, highest total number of harvestings, number of fruits per plant, yield per plant and per hectare, weight of a single fruit, fruit breadth, Vitamin – 'A' and crude fiber per cent were recorded most in CCC @ 600 ppm while maximum number of nodes, lowest absolute growth rate (AGR) and relative growth rate (RGR) of plant, fruit length and ascorbic acid were higher in ethrel @ 300 ppm.

Keywords: Okra, CCC, PBZ, Ethrel, foliar spray, growth and yield

Introduction
Okra (*Abelmoschus esculentus* (L.) Moench, 2n=130) is an important herbaceous annual plant belongs to family Malvaceae growing in tropical and subtropical parts of the world but it is injured when exposed to no freezing temperatures, *i.e.* below 12°C. It is cultivated since ages, and extensively disseminated from Africa to Asia, southern Europe and America (Ariyo, 1993; Oyelade *et al.,* 2003) and currently grown in many countries. During 2013-14, in the world okra was grown an area of 11.17 lakh hectare with production of 87.06 lakh tonnes and productivity was 7.8 MT. At the same time 63.46 lakh tonnes green fruits were produced from 5.33 lakh hectare area with productivity of 11.9 MT per hectare in India (Anonymous, 2014) [3]. It is specially valued for its tender and delicious fruits and has been reported to have an average nutritive value (ANV) of 3.21 which is higher than tomato, eggplant and most of the cucurbits (Grubben, 1977) [14]. All over India, it's immature tender fruits which are botanically called capsules are used as vegetable. These green fruits are rich sources of vitamins, calcium, potassium and other minerals (*i.e.* Ca, Mg & P) (Matloob *et. al.,* 1989), which can help in minimizing their deficiency in the daily diet. After the harvest of the fruits the stalks are generally allowed to go waste or used as fuel. If however they are collected green and subjected to retting, a useful fibre can be extracted which white, light cream or yellow is in color, silky, strong and pliant. It can be spun into yarn and be used for rope, twine and sacking. The fibre can be spun on jute mill machinery. It can be used in an 85 per cent admixture with 15 per cent jute in sacking cloth. The fibre is also suitable for the manufacture of paper and cardboard (Aloni, 1990) [2].
Growth and yield analysis in crop plants helps in understanding the contribution of various growth processes in accumulation of dry matter, also to identify plant growth and yield components for higher productivity. Plant growth regulators (PGR's) considered as a new generation of agrochemicals which affect the physiology of plant growth and influence the natural rhythm of a plant when added in small amounts. In crop production plant growth regulators promotes growth along with the longitudinal area, increase number of branches, early flower initiation, fruit set, fruit quality and subsequently contributes towards higher production when applied at various concentration. As stated earlier growth regulators help in efficient utilization of metabolites in certain physiological processes going on in plant systems (Antony *et al.,* 2003) [4]. Among the plant growth regulators, Cycocel, Paclobutrazol and

Ethrel has been reported to be very effective in improving yield and quality of certain vegetable crops, which causes retardation of vegetative growth and diversion of assimilates towards reproductive growth (Nerson *et al.*, 1989) [23]. Due to this it is possible to achieve the desirable standards and norms in term of quality for exportable production.

Materials and Methods

The experiment was conducted during summer 2014 at nursery No. 4, Department of Horticulture, College of Agriculture, Dapoli in a randomized complete block design with ten treatments having three replication. Seed of okra cultivar Varsha Uphar was collected from Vegetable Improvement Scheme Central Experiment Station, Wakawali, Ratnagiri (M.S.). A recommended dose of Nitrogen, Phosphorus and Potassium @ 120, 50 and 60 kg/ha was supplied by using Urea, di-ammonium phosphate (DAP) and sulphate of potash (SOP). One week before final cultivation, pre-emergence chemical weed control was with Tok E-25 (5L/ha) for all plots. During the season two hoeing were done. All plots were irrigated six times. In each replication seeds were dibbled at each hill 60 cm apart of row and 20 cm between plants. The treatments (Table 1) comprising different concentrations of plant growth regulators, *i.e.* CCC (200, 400 & 600 ppm), PBZ (150, 250 & 300 ppm), Ethrel (150, 250 & 300 ppm) and control were applied 30 days after sowing. Preventive measures were undertaken against the attack of bud borer and fruit borer by periodical sprayings of recommended pesticides. The fruits were harvested when they attained the size of 8 to 10 cm length and pods were hand picked at two days interval. Average fresh fruit weight, yield per plant, per hectare and the yield attributing components *viz.*, time to first flowering, 50 per cent flowering, total number of harvesting, vitamin 'A', vitamin 'C and crude fibre per cent was calculated as per the formula given by Ranganna (1986). The observation were recorded at 30, 60, 90 DAS and at last harvest. The data were analyzed statistically with standard procedure.

Table 1: Concentrations of growth regulators sprayed on okra.

S. No.	Treatments	Symbols
1	Cycocel 200 ppm	T_1
2	Cycocel 400 ppm	T_2
3	Cycocel 600 ppm	T_3
4	Paclobutrazol 150 ppm	T_4
5	Paclobutrazol 250 ppm	T_5
6	Paclobutrazol 300 ppm	T_6
7	Ethrel 150 ppm	T_7
8	Ethrel 250 ppm	T_8
9	Ethrel 300 ppm	T_9
10	Control	T_{10}

Results and Discussion

Changes induced by PGRs on flowering characteristic of okra

The application of plant growth regulators significantly improved flowering related traits. The data presented in Table 2 revealed that foliar application of growth regulators minimized the number of days taken to first flowering, nodal position of first flower and 50 per cent flowering. Significantly the lowest number of days required for initiation of flowering and also for 50 per cent flowering was recorded in treatment T_3 *i.e.* CCC @ 600 ppm (45.26 & 48.36 DAS) followed by T_6 (46.29 & 50.23 DAS). The highest number of days (52.41 & 58.64 DAS) for first flowering and 50 per cent flowering was recorded in T_9 *i.e.* ethrel @ 300 ppm which was at par with T_8 (51.93 & 56.03 DAS).

Higher concentration of cycocel induced early flowering which might be due to suppression of vegetative growth and induction of early reproductive phase (Acharya, 2004) [1].

The increases concentration of ethrel delayed both first flowering and 50 per cent flowering. It may be due to decrease in the endogenous gibberellins level in the plants by ethrel. This may be attributed to increased evolution for ethylene due to ethrel which in turn reduces activity of gibberellin and increases synthesis of abscissic acid in plant (Rudich *et al.*, 1972) [29]. These results get support with the findings of Kokare *et al.* (2006) [16], Barche *et al.* (2010) [8], in okra with CCC, Arora *et al* (1989) [6] in summer squash, Baruah *et al.* (1995) in tomato with PBZ and Deepak *et al.* (2007) [12] with ethrel in okra.

The nodal position of first flower varied significantly among all different concentration of growth regulator treatments. The lowest node (3.98) for initiation of first flower was noticed in T_3 *i.e.* CCC @ 600 ppm followed by T_6 (4.0) and T_2 (4.31). Whereas, the highest node (5.60) for initiation of first flower was recorded in T_7 *i.e.* ethrel @ 150 ppm.

Changes induced by PGRs on harvesting and yield attributes of okra

Foliar application of plant growth regulators significantly influenced days to first harvesting, total number of harvestings and yield attributing characters such as number of fruits per plant, yield per plant (g) and yield per hectare (q).

Days to first harvest

The data presented in Table 2 revealed that significantly the lowest days (52.50) required to first harvest was noticed in T_3 *i.e.* CCC @ 600 ppm. Whereas, the plant treated with ethrel *i.e.* @ 300 ppm recorded the highest days (59.97) to first harvest, which was at par with T_8 (59.51).

Number of harvestings

The highest total number of harvesting (17.63) was recorded in T_3 *i.e.* CCC @ 600 ppm followed by T_4 (17.43) and lowest total number of harvesting (16.16) was recorded in T_{10} (Control).

Number of fruits per plant

From the data depicted in Table 2 revealed that the number of fruits per plant was varied significantly among all the growth regulator treatment. The highest number of fruit per plant (22.02) was recorded in T_3 *i.e.* CCC @ 600 ppm followed by T_9 (21.39) and T_4 (21.33). The lowest number of fruit per plant (16.75) was recorded in T_{10} *i.e.* control.

It might be due to higher concentration treated plants had higher number of internodes *i.e.* short internodal length, which resulted to produce more number of fruit. Significantly improvement in yield might be due to cycocel reduced height of plant and increased branching resulting in diversion of food material for the improvement of flowering and fruiting (Prasad and Shrihari, 2008) [26]. This is in agreement with findings as earlier reported by Munikrishnappa *et al.* (2009) [22] with CCC, Rajput *et al.* (2011) [28] with CCC and ethrel in okra and Mandal *et al.* (2012) [18] in okra with CCC. The promotory effect of PBZ on number of fruits per plant was also observed by Asghar *et al.* (1997) [7] in okra and Rai *et al.* (2006) [27] in tomato.

Table 1: Effect of plant growth regulators on flowering, harvesting and yield attributes of okra cv. Varsha Uphar

S. No.	Treatments	First flowering (DAS)	Nodal position of first flower	50 % flowering	Days to first harvest	No. of harvesting	Fruit/plant	Yield/plant (g)	Yield/ha (q)
1	T_1 – CCC 200 ppm	49.33	4.62	53.43	56.89	16.67	19.32	248.99	138.33
2	T_2 – CCC 400 ppm	47.30	4.31	51.40	54.86	17.24	20.50	266.91	148.28
3	T_3 – CCC 600 ppm	45.26	3.98	48.36	52.50	17.63	22.02	290.73	161.52
4	T_4 – PBZ 150 ppm	47.85	4.81	51.95	55.44	17.43	21.33	279.14	155.08
5	T_5 – PBZ 250 ppm	47.79	4.45	50.65	55.12	17.03	20.14	258.71	143.73
6	T_6 – PBZ 300 ppm	46.29	4.00	50.23	53.85	16.94	20.09	248.28	137.93
7	T_7 – Ethrel 150 ppm	51.23	5.60	54.35	58.75	16.74	19.58	254.21	141.23
8	T_8 – Ethrel 250 ppm	51.93	5.40	56.03	59.51	17.07	20.27	264.29	146.83
9	T_9 – Ethrel 300 ppm	52.41	5.29	58.64	59.97	17.28	21.39	281.11	156.17
10	T_{10} – Control	49.70	4.64	52.19	57.26	16.16	16.75	205.45	114.14
	S.Em. ±	0.61	0.15	0.60	0.40	0.11	0.25	3.50	1.94
	CD (p=0.05)	1.82	0.43	1.78	1.19	0.33	0.75	10.39	5.77

DAS (days after sowing)

Yield per plant (g)

The highest green fruit yield per plant (290.73 g) was recorded in T_3 *i.e.* CCC @ 600 ppm followed by T_9 (281.11 g). Significantly the lowest green fruit yield per plant (205.45 g) was noticed in T_{10} *i.e.* control treatment.

Yield per hectare (q)

The plants treated with T_3 *i.e.* CCC @ 600 ppm produced highest (161.52 q) fruit yield per hectare, which was at par with T_9 (156.17 q). Whereas, the lowest fruit yield per hectare was recorded in T_{10} *i.e.* control (114.14 q).

Higher fruit yield in T_3 *i.e.* CCC @ 600 ppm was may be due to more number of fruits per plant and it may be possible that increasing concentration of CCC was also increased total fruit yield per plant and also per hectare due to reduced plant height and increased branching resulting in diversion of food material for the improvement of flowering and fruiting (Sajjan *et al.*, 2003 and Prasad and Shrihari, 2008) [, 30 26] in okra. The results obtained are similar with the findings of Pateliya *et al.* (2008) [28], Rajput *et al.* (2011) [28] with CCC and ethrel in okra, Rai *et al.* (2006) [27] in tomato and Chutichudet *et al.* (2007) [11] in okra with PBZ.

Changes induced by PGRs on quality aspects of okra

Physical parameters of fruit

The data presented in Table 3 revealed that the various fruit characters of okra such as length of fruit (cm), weight of fruit (g) and breadth of fruit (mm) were also influenced by different plant growth regulator treatments.

The highest fruit length (13.08 cm) was recorded in T_9 *i.e.* ethrel @ 300 ppm followed by T_3 (13.01 cm). While, the lowest fruit length (11.22 cm) was recorded with spray of PBZ @ 300 ppm. Reduction in fruit length by PBZ might be due to reduced cell division and cell elongation or nutritional factor and fertility of soil as well as weather conditions. Similar findings were also recorded by Pateliya *et al.* (2008) [28] with CCC and ethrel, Sanganagoud *et al.* (2014) [31] with CCC in okra. Joshi (2001) in capsicum, Chutichudet *et al.* (2007) [11] with PBZ in okra and Rajput *et al.* (2011) [28] with ethrel in okra.

Increases concentration of growth regulators significantly increased weight of a single fruit. The highest weight (13.21 g) of a single fruit was recorded by foliar sprays of T_3 *i.e.* CCC @ 600 ppm followed by T_9 (13.14 g) and T_4 (13.08 g). Whereas, the lowest fruit weight (12.27 g) was recorded in the T_{10} (Control) treatment. Increase in fruit weight might be due to higher diameter of fruit and individual fruit weight in these treatments. It may also due to the accumulation of carbohydrate, leaf area, and chlorophyll content of leaves that produced more photosynthates towards the economic parts. These finding are in agreement with the finding of Sanganagoud *et al.* (2014) [31] with CCC in okra, Mohsen Kazemi (2013) [21] in cucumber with PBZ and Singh and Kumar (1988) [32] with ethrel in okra.

The breadth of fruit was significantly varied among all the growth regulator treatments. However, the treatment T_3 *i.e.* CCC @ 600 ppm showed the highest (16.13 mm) fruit breadth followed by T_9 (16.07 mm) and lowest fruit breadth (14.27 mm) was in T_{10} (Control). The breadth of fruit was increased due to effective diversification of photosynthates to fruits buy the action of growth regulators. Similar increase in breadth of economic part was also seen by Mandal *et al.* (2012) [18] and Sanganagoud *et al.* (2014) [31] with CCC in okra and Mehdi *et al.* (2012) [20] in cucumber with ethrel.

Table 2. Effect of plant growth regulators on quality aspects of okra fruit cv. Varsha Uphar

S. No.	Treatments	Length of fruit (cm)	Weight of fruit (g)	Breadth of fruit (mm)	Vitamin A (µg/100 g)	Ascorbic acid (mg/100 g)	Crude fiber (%)
1	T_1 – CCC 200 ppm	12.13	12.89	15.16	27.31	13.97	1.96
2	T_2 – CCC 400 ppm	12.46	13.02	15.66	28.02	13.33	2.04
3	T_3 – CCC 600 ppm	13.01	13.21	16.13	29.05	13.05	2.19
4	T_4 – PBZ 150 ppm	11.61	13.08	15.08	27.07	13.11	2.10
5	T_5 – PBZ 250 ppm	11.42	12.85	15.25	27.55	13.28	1.98
6	T_6 – PBZ 300 ppm	11.22	12.36	15.31	28.21	13.75	1.84
7	T_7 – Ethrel 150 ppm	12.33	12.98	15.21	25.78	13.73	2.18
8	T_8 – Ethrel 250 ppm	12.54	13.04	15.41	26.64	13.92	2.05
9	T_9 – Ethrel 300 ppm	13.08	13.14	16.07	27.41	14.06	1.95
10	T_{10} – Control	12.01	12.27	14.27	25.81	13.12	1.82
	S.Em. ±	0.08	0.05	0.04	0.24	0.03	0.02
	CD (p=0.05)	0.23	0.15	0.12	0.71	0.10	0.06

Chemical composition of fruit

Application of different growth regulators at different concentrations increased the vitamin A content over control. Significantly the highest vitamin A (29.05 µg/100 g) was noted with T_3 *i.e.* CCC @ 600 ppm followed by T_6 (28.21 µg/100 g) while, lowest vitamin A (25.78 µg/100 g) was recorded in T_7 *i.e.* ethrel @ 150 ppm. The results are in agreement with the finding of Bose *et al.* (1999), Tharasena1 and Lawan (2012) [33] in okra.

The highest value (14.06 mg/100 g) for the ascorbic acid content was recorded in the treatment T_9 *i.e.* ethrel @ 300 ppm followed by T_1 (13.97 mg/100 g). Whereas, the lowest value (13.05 mg/100 g) for the ascorbic acid content was noticed in the T_3 *i.e.* CCC @ 600 ppm treatment. Similar results were obtained by Kumar *et al.* (2012) [17] with CCC in okra. Chutichudet *et al.* (2007) [11] with PBZ in okra whereas, Dhall and Singh (2013) [13] with ethrel in Tomato.

The highest crude fiber content (2.19%) was recorded in spray of T_3 *i.e.* CCC @ 600 ppm, which was at par with T_7 (2.18%) and lowest (1.82%) was noticed in T_{10} (control).

Conclusion

On the basis of different characteristics in present investigation, it could be concluded that foliar application of growth regulators like CCC, PBZ and ethrel have the ability to reduce the vegetative growth and enhance fruiting, yield per plant and fruit quality in okra cv. Varsha Uphar. Foliar application of cycocel and paclobutrazol induced early flowering and fruiting, whereas ethrel concentration delayed flowering and fruiting period. Among the various plant growth regulator treatments tested, the foliar spraying on the okra variety Varsha Uphar with CCC @ 600 ppm, ethrel @ 300 ppm and PBZ @ 150 ppm at 30 days after sowing found to be optimum for maximization of the yield per plant.

References

1. Acharya UK. Effect of plant growth regulators on growth and yield of spring summer season okra (*Abelmoschus esculentus* L. Moench). M.Sc. Thesis, Department of Horticulture, IASS, Rampur, Chitwan, Nepal. 2004, 75.
2. Aloni R, Tollier MT, Monties B. The role of auxin and gibberellin in controlling lignin formation in primary phloem fibres and in xylem of Coleus blumei stems. Plant Physiol. 1990; 94:1743-1747.
3. Anonymous. www.nhb.gov.in, Indian Horticulture database, 2014, 4-155.
4. Antony E, Chowdhury SR, Kar G. Variations in heat and radiation use efficiency of green gram as influenced by sowing dates and chemical sprays. Journal of Agrometeorology. 2003; 5(2):58-61.
5. Ariyo OJ. Stability of performance of okra as influenced by planting date. Theor. Appl. Genet. 1987; 74:83-86.
6. Arora SK, Pandita MI, Kumar J. Effect of Paclobutrazol (pp333) on growth, flowering and fruit set in summer squash (*Cucurbita pepo* L.) cv. Hissar Selection-1. Haryana Agric. Univ. J Res. 1989; 14(3):214-217.
7. Asghar S, Ali N. Effect of exogenous growth regulators on growth, flowering and yield of okra (*Abelmoschus esculentus* L). Sarhad J of Agric. 1997; 13(5):449-453.
8. Barche S, Kirad KS, Sharma AK, Mishra PK. Response of growth retardants on growth, development and yield of Okra (*Abelmoschus esculentus*) cv. Parbahani Kranti, JNKVV Res J. 2010; 44(2):167-170.
9. Baruah GKS, Arora SK, Pandita ML. Effect of Paclobutrazol and nitrogen levels on growth, flowering and yield of tomato (*Lycopersicon esculentum* Mill.). Ann. Agric. Res. 1995; 16(4):490-492.
10. Bose TK, Kabir J, Maity TK. Vegetable crops, Vol. 3. Bidhan Chandra Krishi Viswavidyalaya, West Bangal. 1999; 3:209.
11. Chutichudet B, Chutichudet P, Chanaboon T. Effect of Chemical Paclobutrazol on Growth, Yield and Quality of Okra (*Abelmoschus esculentus* L.) Har Lium Cultivar in Northeast Thailand. Pak. J of Biol. Sci. 2007; 10:433-438.
12. Deepak KD, Deshpande VK, Vyakarnahal BS, Ravi kumar RL, Uppar DS, Hosamani RM. Chemical Induction of Male Sterility and Histological Studies in Okra (*Abelmoschus esculentus* (L.) Monech.) Karnataka J Agric. Sci. 2007; 21(2):202-205.
13. Dhall RK, Singh P. Effect of Ethephon and Ethylene Gas on Ripening and Quality of Tomato (*Solanum Lycopersicum* L.) during Cold Storage. J Nut. Food Sci. 2013; 3:244.
14. Grubben CJH. Okra In: Tropical vegetables and their genetic resources, IBPGR, Rome, 1977, 111-114.
15. Joshi SG. Effect of bio-regulators on growth, flowering, yield and quality of sweet pepper (*Capsicum annum* var. grossum (L.) Sendt) cv. California Wonder. M.Sc. (Agri.) Thesis, Dr. B.S.K.K.V. Dapoli, 2001.
16. Kokare RT, Bhalerao RK, Prabu T, Chavan SK, Bansode AB, Kachare GS. Effect of plant growth regulators on growth, yield and quality of Okra [*Abelmoschus esculentus* (L.) Moench] cv. Parbhani Kranti, Agril. Sci. Digest. 2006; 26(3):178-181.
17. Kumar J, Madan Lal1, Krishan Pal. Effect of Cycocel on Tomato (*Lycopersicon esculentum* MILL.). Hort. Flora Res. Spectrum. 2012; 1(2):162-164.
18. Mandal PN, Singh KP, Singh VK, Roy RK. Effect of the growth regulators on growth and yield of hybrid okra (*Abelmoschus esculentus* (L.) Moench) Asian J Hort. 2012; 7(1):72-74.
19. Matlob AN, Mohammed AS, Abdul KS. Vegetable Production, II. Directorate of Book House of Publishing and Pressing, Mosul Univ., Iraq. (In Arabic), 1989.
20. Mehdi M, Ahmed N, Jabeen N, Afroza B. Effect of different concentration of ethrel on growth, fruiting behavior and yield of cucumber (*Cucumis sativus* L.) under greenhouse conditions, Asian J Hort. 2012; 7(2):579-581.
21. Mohsen Kazemi. Response of Cucumber Plants to Foliar Application of Calcium Chloride and Paclobutrazol under Greenhouse Conditions. Bull. Env. Pharmacol. Life Sci. 2013; 2(11):15-18.
22. Munikrishnappa PM, Tirakannanavar S. Influence of seed treatment and foliar application of growth regulators on growth and yield of bhendi (*Abelmoschus esculentus*) cv. Arka Anamika, J Ecology biology. 2009; 25(4):323-328.
23. Nerson H, Cohen R, Edelstein M, Burger Y. Paclobutrazol a plant growth retardant for increasing yield and fruit quality in Muskmelon (*Cucumis melo*). J Amer. Soc. Hort. Sci. 1989; 114:762-766.
24. Oyelade OJ, Ade-Omowaye BIO, Adeomi VF. Influence of variety on protein, fat contents and some physical characteristics of okra seeds. J Food Eng. 2003; 57:111-114.
25. Pateliya CK, Parmar BR, Tandel YN. Effect of different

growth retardants on flowering, yield and economics of okra (*Abelmoschus esculentus* L. Moench) cv. go-2 under South Gujarat conditions. Asian J Hort. 2008; 3(2):317-318.

26. Prasad KR, Srihari D. Effect of seed soaking and foliar spray of Cycocel on germination, growth and yield of okra (*Abelmoschus esculentus* (L.) moench), Department of Horticulture, College of Agriculture, Rajendranagar, Hyderabad-500 030, J Res. ANGRAU. 2008; 36(2. 3):23-27.
27. Rai N, Yadav DS, Patel KK, Yadav RK, Asati BS, Chaubey T. Effect of plant growth regulators on growth, yield and quality of tomato (*Solanum lycopersicon* (Mill.) wettsd.) grown under mid hill of meghalaya, Veg. Sci. 2006; 33(2):180-182.
28. Rajput BS, Singh A, Patel P, Gautam US. Study of different plant growth retardants on flowering, fruiting, yield and economics of okra (*Abelmoschus esculentus*) Var. VRO-6. Progressive. Hort. 2011; 43(1):166-167.
29. Rudich J, Halevy AH, Kedar N. Ethylene evolution from cucumber plants as related to sex expression. Plant Physio. 1972; 49:98-99.
30. Sajjan AS, Shekhargouda M, Pawar KN, Vyakarnahal BS. Effect of regulatory chemicals on growth, yield attributes and seed yield in okra. (*Abelmoschus esculentus* (L.) Moench). Orissa J Hort. 2003; 31(2):37-41.
31. Sanganagoud PR, Chaitanya HS, Nagesh L. Effect of Plant Growth Regulators and Fruit Picking on Growth Characters of Okra (*Abelmoschus esculentus* L. Moench) at Coastal Karnataka, Environment and Ecology. 2014; 32(3):896-900.
32. Singh RK, Kumar R. Effect of NAA, ethrel and 2, 4-D on vegetative growth and yield of okra (*Abelmoschus esculentus* (L.) Moench) cv. Pusa Sawani, Veg. Sci. 1988; 15(2):190-192.
33. Tharasena B, Lawan S. Content of Beta-Carotene, Xanthophyll, Lutein and Zeaxanthin in Vegetables as Thai Side Dish. International Conference on Nutrition and Food Sciences IPCBEE 39 IACSIT Press, Singapore. 2012.