AJH
eISSN- 0976-724X

THE ASIAN JOURNAL OF HORTICULTURE
Volume **11** | Issue 1 | June, 2016 | 1-6
Visit us -*www.researchjournal.co.in*

RESEARCH PAPER

DOI : 10.15740/HAS/TAJH/11.1/1-6

Article history :
Received : 28.03.2016
Revised : 01.04.2016
Accepted : 15.04.2016

Effect of harvesting at different nodes on growth and flower yield of carnation (*Dianthus caryophyllus* Linn) in second season crop

■ **ASHWINI KASTURI[1] AND R. CHANDRA SEKHAR**

Members of the Research Forum

Associated Authors:
[1]Dr. Y.S.R. Horticultural University, V.R. Gudem, WEST GODAVARI (TELANGANA) INDIA
Email : kasturiashwini.horti@gmail.com

Author for correspondence :
R. CHANDRA SEKHAR
College of Horticulture, S.K.L.T.S. Horticultural University, Rajendranagar, HYDERABAD (TELANGANA) INDIA

ABSTRACT : The present study was under taken in a commercial floriculture farm under protected cultivation with three cultivars of carnation during July 2010 to February 2011. The experiment was laid out in Randomized Block Design with factorial concept. Harvesting of carnation flower stalk at 3rd node from the ground level recorded minimum number of days to sprouting of buds than other harvesting nodes *i.e.*, 2nd, 4th and 5th nodes. Days to first flower bud appearance, colour break stage and days to harvest was also minimum with harvesting at 3rd node in cultivars Domingo, Dover and Keiro. And the length of lateral, length of flower stalk and flower, diameter of flower stalk and flower, number of flower stalks per plant, fresh flower weight and vase life was maximum with harvesting at 3rd node than other harvesting heights in cultivar Domingo.

KEY WORDS : Carnation, Harvesting of flower stalk, Heights, Cultivars

HOW TO CITE THIS ARTICLE : Kasturi, Ashwini and Sekhar, R. Chandra (2016). Effect of harvesting at different nodes on growth and flower yield of carnation (*Dianthus caryophyllus* Linn) in second season crop. *Asian J. Hort.*, **11**(1) : 1-6, **DOI : 10.15740/HAS/TAJH/11.1/1-6.**

Carnation (*Dianthus caryophyllus* Linn, Fy: Caryophyllaceae), has been extensively cultivated for cut flowers in Columbia, Japan, Israel, Netherlands etc., A study indicated that about 34 per cent of the total flower consumers expressed their liking for carnation compared to only 20 per cent of the people who favoured roses (Staby *et al*., 1978). The maximum area under cultivation of carnation (2500 ha) is in Columbia (Bhattacharjee, 1993). In India, carnations are being grown in places like Nasik, Pune, Jammu & Kashmir, Himachal Pradesh and surrounding areas of Hyderabad in Andhra Pradesh (Mukherjee, 1996).

Application of various special horticultural practices after standardization can be one of the means to achieve the target of quality flower production. Carnation is a plurannual commercial cut flower crop exhibits apical dominance and development of lateral shoots and flower production are influenced by the presence of apical dominance (Cline, 1997). Generally carnation flowers are harvested at different heights or at different nodes without knowing its impact on growth and flower production in successive crop. To induce early sprouting of buds and transformation of laterals, the levels of harvest plays an important role and also have an impact on number of buds sprouting at the bottom or top of the left over harvested shoots, which finally determines the number of flower stalks produced per harvested stalk. The buds sprouted at different levels have direct impact on the quality of flower stalk and flower bud. Organized research work in these lines on commercial cultivars of carnation is not available.

RESEARCH METHODS

The experiment was conducted in three cultivars

of carnation *i.e.,* Domingo, Keiro and Dover during July 2010 to February 2011 in a commercial floriculture farm at Mudimyal, Ranga Reddy district of Andhra Pradesh. In this experiment, selected first season flower stalks of carnation were harvested at 2nd, 3rd, 4th and at 5th node from the ground level. Observations were recorded on number of days for sprouting of buds after harvest of flower stalk, number of buds sprouted per node, number of buds sprouted per plant, length of lateral at 20, 30, 40, 50, 60, 70 and 80 days after harvest of flower stalk and internodal length of flower stalk at the time of harvest, number of days for first flower bud appearance, color break stage, days to harvest, length of flower stalk, flower length, number of flower stalks harvested per plant and vase life of cut flower in the recommended holding solution.

RESEARCH FINDINGS AND DISCUSSION

The data pertaining to number of days for sprouting of buds after harvest of flower stalk of carnation are presented in Table 1.There were significant differences in number of days for sprouting of buds after harvest of flower stalk of carnation due to harvesting at different nodes of flower stalk, cultivars studied and their interaction. Harvesting of flower stalk at 3rd node recorded significantly minimum number of days for sprouting of buds (7.91 days) followed by harvesting at 4th (9.55 days), 5th (10.96 days) and at 2nd node (12.97 days) from the ground level. Among the cultivars studied cv. DOMINGO (9.05 days) registered minimum number of days for sprouting of buds which differed significantly over cvs. Dover (10.07 days) and Keiro (11.93 days).

The interaction between harvesting at different nodes of flower stalk and cultivars studied differed significantly on number of days for sprouting of buds. These results are in conformity with those reported by Rao *et al.* (2008) on carnation pinching at 10 cm height and at 3rd node recorded early sprouting of buds in cv. DOMINGO than other cvs. ANGELICA AND GOLDEN BOY and with the findings of Jadhav *et al*. (2003) in roses.

The data pertaining to number of buds sprouted per node after harvesting of carnation are presented in Table 1. There were significant differences in number of buds sprouted per node after harvesting of flower stalk of carnation due to harvesting at different nodes of flower stalk and cultivars studied. Harvesting of flower stalk at 3rd node (1.12) recorded significantly maximum number of buds sprouted per node. Among the cultivars studied, cv. DOMINGO (1.11) registered maximum number of buds sprouted per node which differed significantly over the cvs. Dover (1.06) and Keiro (1.03). It could be due to harvesting by leaving 3 nodes might have encouraged sprouting of all the axillary buds at each node and recorded maximum number of buds per node. These results are in conformity with Rao *et al*. (2008) in carnation cvs. Domingo, Angelica and Golden Boy.

The data pertaining to number of buds sprouted per harvested stalk of carnation are presented in Table 1. Harvesting of flower stalk at 5th node (5.15) recorded significantly maximum number of buds sprouted per harvested stalk. These results are in conformity with Beniwal *et al*. (2005) in chrysanthemum and Narayana Gowda and Jayanthi (1991) in China aster. Similar results were also observed in rose by Uma and Gowda (1987).

The length of lateral at 80 days after harvest was found to be significant due to harvesting at different nodes of flower stalk and cultivars studied. The data are presented in Table 2. Harvesting of flower stalk at 3rd node recorded maximum length of lateral (60.46 cm) which was significantly superior to harvesting of flower stalk at 4th (55.90 cm), 5th (51.65 cm) and at 2nd node (47.92 cm) from the ground level. Among the cultivars, cv. Domingo (61.58 cm) registered maximum length of lateral which was significantly superior to rest of the cvs. Dover (54.29 cm) and Keiro (46.08 cm). The interaction between harvesting of flower stalk at different nodes and cultivars studied differed significantly on length of lateral at 80 days after harvest. It could be due to less number of laterals and maximum utilization of available reserve food might have resulted in maximum growth of laterals. Similar increase in length of lateral was observed by Bunt (1980) in carnation cv. WHITE SIM. These results are in conformity with Rao *et al*. (2008) in three cultivars of carnation.

The internodal length of lateral at the time of harvest was found to be significant due to harvesting at different nodes of flower stalk and cultivars studied. The data are presented in Table 2. Harvesting of flower stalk at 3rd node (7.52 cm) recorded maximum internodal length of lateral which was significantly superior to harvesting of flower stalk at 4th (6.90 cm), 5th (5.89 cm) and at 2nd node (5.19 cm) from the ground level. Among the cultivars, cv. DOMINGO (6.87 cm) registered maximum internodal length of lateral which was significantly superior to rest of the cvs. Dover (6.23 cm) and Keiro (6.03 cm). These results are in conformity with

Mukhopadhyay *et al*. (1987) in rose cv. HAPPINESS.

The data on number of days for first flower bud appearance in carnation (Table 3) revealed that harvesting of flower stalk at 3rd node recorded minimum number of days for first flower bud appearance (106.07 days) which was significantly superior to harvesting of flower stalk at 4th (111.51 days), 5th (121.63 days) and at 2nd node (132.76 days) from the ground level. Among the cultivars, cv. DOMINGO (109.13 days) registered minimum number of days for first flower bud appearance which was significantly superior to rest of the cvs. Dover (116.08 days) and Keiro (128.75 days).

The interaction between harvesting at different nodes of flower stalk and cultivars studied differed significantly on number of days for first flower bud appearance. Harvesting of flower stalk at 3rd node recorded minimum number of days for first flower bud appearance in all cv. DOMINGO (95.63 days), Dover (102.16 days) and Kiero (120.41 days). Cultivar Domingo being vigorous growing in nature which resulted in early sprouting of buds. Maximum utilization of available food reserves might have encouraged attaining flowering stage early over other cultivars studied. It could be due to early physiological maturity of shoots after harvest. These

Table 1 : Effect of harvesting at different nodes on sprouting of buds in three cultivars of carnation

Treatments	Number of days for sprouting of buds after harvest (days)				Number of buds sprouted per node				Number of buds sprouted per plant			
	Cultivars				Cultivars				Cultivars			
	Domingo	Keiro	Dover	Mean	Domingo	Keiro	Dover	Mean	Domingo	Keiro	Dover	Mean
2nd node	11.00[a]	15.50[c]	12.43[b]	12.97[d]	1.06	1.02	1.03	1.04[c]	2.15	2.01	2.05	2.07[d]
3rd node	6.66[a]	9.50[b]	7.56[a]	7.91[a]	1.21	1.06	1.11	1.12[a]	3.30	3.20	3.20	3.23[c]
4th node	7.96[a]	11.16[c]	9.53[b]	9.55[b]	1.09	1.04	1.06	1.06[b]	4.20	4.05	4.10	4.10[b]
5th node	10.56[a]	11.56[b]	10.76[a]	10.96[c]	1.11	1.03	1.06	1.06[b]	5.30	5.10	5.15	5.18[a]
Mean	9.05[a]	11.93[c]	10.07[b]	10.34	1.11[a]	1.03[c]	1.06[b]	1.07	3.73[a]	3.59[b]	3.62[b]	3.64
	Cultivars	Nodes	Cultivars x Nodes		Cultivars	Nodes	Cultivars x Nodes		Cultivars	Nodes	Cultivars x Nodes	
S.E. ±	0.21	0.24	0.42		0.01	0.01	0.02		0.03	0.11	0.06	
C.D. (P=0.05)	0.62	0.71	1.24		0.03	0.04	--		0.09	0. 38	--	

Table 2 : Effect of harvesting at different nodes on length of lateral (cm) and internodal length (cm) in three cultivars of Carnation

Treatments	Length of lateral at 80 days after harvest of flower stalk				Internodal length at the time of harvest of flower stalk			
	Cultivars				Cultivars			
	Domingo	Keiro	Dover	Mean	Domingo	Keiro	Dover	Mean
2nd node	53.93[a]	39.52[c]	50.33[b]	47.92[d]	5.58	4.90	5.10	5.19[d]
3rd node	68.56[a]	53.96[c]	58.86[b]	60.46[a]	8.00	7.31	7.26	7.52[a]
4th node	63.86[a]	48.70[c]	55.15[b]	55.90[b]	7.26	6.70	6.62	6.90[b]
5th node	59.96[a]	42.16[c]	52.83[b]	51.65[c]	6.50	5.21	5.96	5.89[c]
Mean	61.58[a]	46.08[c]	54.29[b]	53.98	6.87[a]	6.03[c]	6.23[b]	6.38
	Cultivars	Nodes	Cultivars x Nodes		Cultivars	Nodes	Cultivars x Nodes	
S.E. ±	0.20	0.23	0.40		0.06	0.07	0.13	
C.D. (P=0.05)	0.59	0.68	1.19		0.19	0.22	--	

Table 3 : Effect of harvesting at different nodes on days for flowering to harvesting in three cultivars of carnation

Treatments	Days to first flower bud appearance (days)				Days to colour break stage(days)				Days to harvest (days)			
	Domingo	Keiro	Dover	Mean	Domingo	Keiro	Dover	Mean	Domingo	Keiro	Dover	Mean
2nd node	125.08[a]	140.28[c]	132.93[b]	132.76[d]	141.28[a]	154.33[c]	146.36[b]	147.32[d]	148.50[a]	161.43[c]	153.38[b]	154.43[d]
3rd node	95.63[a]	120.41[c]	102.16[b]	106.07[a]	111.53[a]	135.40[c]	116.33[b]	121.08[a]	118.16[a]	142.46[c]	123.30[b]	127.97[a]
4th node	100.33[a]	125.38[c]	108.83[b]	111.51[b]	115.46[a]	140.46[c]	132.27[b]	129.40[b]	122.60[a]	148.10[c]	139.60[b]	136.76[b]
5th node	115.56[a]	128.93[c]	120.40[b]	121.63[c]	130.63[a]	143.16[c]	135.40[b]	136.40[c]	138.36[a]	150.28[c]	143.15[b]	143.93[c]
Mean	109.13[a]	128.75[c]	116.08[b]	117.98	124.72[a]	143.34[c]	132.59[b]	133.55	131.90[a]	150.57[c]	139.85[b]	140.89
	Cultivars	Nodes	Cultivars x Nodes		Cultivars	Nodes	Cultivars x Nodes		Cultivars	Nodes	Cultivars x Nodes	
S.E. ±	0.22	0.25	0.44		0.32	0.37	0.65		0.46	0.54	0.93	
C.D. (P=0.05)	0.65	0.75	1.31		0.96	1.11	1.92		1.37	1.59	2.75	

results are in conformity with Arora and Khanna (1986) in marigold cv. AFRICAN GAINT DOUBLE ORANGE. According to Ubukata (1999) working with carnation indicated that early raised shoots took less time to attain physiologically mature which in turn bear flowers. Pinching at 10 cm height resulted in early initiation of first flower bud (86.52 days) due to early breakage of apical dominance (Rao *et al*., 2008 in carnation).

There were significant differences in number of days for colour break stage of carnation due to harvesting of flower stalk at 3rd node (121.08 days) recorded minimum number of days for colour break stage. This could be due to less number of shoots and maximum utilization of photosynthates. These results are in conformity with Srivastava *et al*. (2002) in marigold cv. PUSA NARANGI GAINDA.

The data in Table 3 also revealed that the number of days for harvesting in carnation had differed significantly due to harvesting of flower stalk at 3rd node (127.97 days) recorded minimum number of days for harvest which was significantly superior to harvesting of flower stalk at 4th (136.76 days), 5th (143.93 days) and at 2nd node (154.43 days) from the ground level. Among the cultivars, cv. DOMINGO (131.90 days) registered minimum number of days for harvesting which was significantly superior to rest of the cvs. Dover (139.85) and Keiro (150.57 days).

The interaction between harvesting at different nodes of flower stalk and cultivars studied differed significantly on number of days for harvest. Harvesting of flower stalk at 3rd node recorded minimum number of days for harvesting in all cvs. Domingo (118.16 days), Dover (123.30 days) and Kiero (142.46 days). Cultivar Domingo being vigorous growing in nature, on removal of apical dominance through harvesting resulted in early sprouting of axillary buds and also early in flowering in turn leading to early harvest over cvs. DOVER AND KIERO. Both the cultivars are slow growing in habit and very sensitive to frequent changes in climate due to these both the cultivars might have performed poorly. These results are in conformity with Rao *et al*. (2008) in carnation.

There were significant differences in length of flower at the time of harvest of carnation due to harvesting at different nodes of flower stalk and cultivars studied (Table 4). Harvesting of flower stalk at 3rd node (2.87 cm) recorded maximum length of flower at the time of harvest which was significantly superior to

Table 4 : Effect of harvesting at different nodes on length of flower stalk and flower; number of flower stalks and vase life of cut flower (days) in three cultivars of carnation

Treatments	Length of flower stalk at the time of harvest (cm)				Length of flower at the time of harvest (cm)				Number of flower stalks harvested per plant				Vase life of cut flower (days)			
	Domingo	Keiro	Dover	Mean	Domingo	Keiro	Dover	Mean	Domingo	Keiro	Dover	Mean	Domingo	Keiro	Dover	Mean
2nd node	61.53	54.93	58.93	58.46^{d}	2.40	2.25	2.33	2.32^{c}	4.61	4.10	4.35	4.35^{d}	10.55	9.81	10.15	10.17^{c}
3rd node	88.20	81.83	85.20	85.19^{a}	3.00	2.75	2.88	2.87^{a}	6.84	6.25	6.65	6.58^{c}	14.00	12.00	11.50	12.50^{a}
4th node	85.66	78.30	82.16	82.04^{b}	2.70	2.50	2.60	2.60^{b}	9.63	9.10	9.26	9.33^{b}	12.00	11.23	11.00	11.41^{b}
5th node	83.20	77.43	79.40	80.01^{c}	2.50	2.40	2.45	2.45^{b}	12.10	11.37	11.75	11.74^{a}	11.00	10.60	9.86	10.48^{c}
Mean	79.65^{a}	73.12^{c}	76.42^{b}	76.39	2.65	2.47	2.56	2.56	8.29^{a}	7.70^{b}	8.00^{c}	8.00	11.88^{a}	10.91^{b}	9.20^{c}	11.14
	Cultivars	Nodes	Cultivars x Nodes		Cultivars	Nodes	Cultivars x Nodes		Cultivars	Nodes	Cultivars x Nodes		Cultivars	Nodes	Cultivars x Nodes	
S.E. ±	0.55	0.65	1.14		0.07	0.08	0.15		0.06	0.07	0.13		0.29	0.33	0.58	
C.D. (P=0.05)	1.65	1.95	--		--	0.26	--		0.20	0.23	--		0.85	0.98	--	

harvesting of flower stalk at 4th (2.60 cm), 5th (2.45 cm), and at 2nd node (2.32 cm) from the ground level. The cultivars studied did not differ significantly on length of flower.

The data in Table 4 also revealed that number of flower stalks harvested per plant of carnation has differed significantly due to harvesting at different heights of flower stalk and cultivars studied. Harvesting of flower stalk at 5th node recorded significantly maximum number of flower stalks harvested per plant (11.74) followed by harvesting at 4th (9.33), 3rd (6.58) and at 2nd node (4.35) from the ground level.

Imamura and Suto (2001) working with carnation cv. FRANCESCO indicated that pinching the shoots at higher nodes recorded maximum flower yield compared to pinching at lower nodes from the ground level. Sawwan and Samawi (2000) working with carnation cv. WHITE OPALE also indicated that progressive increase in total number of flower stalks with pinching at higher nodes. Groshkov and Angelov (1981) working with carnation indicated that pinching at 4th node recorded maximum number of flower stalks for both Scania and Arthur sim cultivars of carnation. Similar results were also reported by Singh and Baboo (2003) in chrysanthemum cv. JAYANTHI.

There was significant difference in vase life of cut flower of carnation due to harvesting at different heights of flower stalk and cultivars studied (Table 4). Harvesting of flower stalk at 3rd node (12.50 days) recorded maximum vase life of cut flower which was significantly superior to harvesting of flower stalk at 4th (11.41 days), 5th (10.48 days) and at 2nd node (10.17 days) from the ground level. Among the cultivars, cv. DOMINGO (11.88 days) registered maximum vase life of cut flower which was significantly superior to rest of the cvs. Keiro (10.91 days) and Dover (9.20 days). Flower stalks harvested at lower levels recorded maximum vase life than flower stalks harvested at higher levels. It might be due to better quality flowers produced by harvesting at lower levels which has maximum length and diameter of flower.

Conclusion :

The results obtained in the present study indicated that in carnation, harvesting of flower stalk especially at 3rd node is the optimum level of harvesting to get good vegetative growth, good quality flowers and for advancement of flowering for capturing early market.

REFERENCES

Arora, J.S. and Khanna, K. (1986). Effect of nitrogen and pinching on growth and flower production of marigold cv. AFRICAN GAINT DOUBLE ORANGE. *Indian J. Hort.,* **43** (1-2): 291-29.

Barman, D., Ghosh, S. and Pal, P. (1993). Effect of planting date and pinching height on flowering of chrysanthemum (*Chrysanthemum morifolium* Ramat) cv. CHANDRAMA. *Hort. J.,* **6** (2): 121-124.

Beniwal, B.S., Ahlawat, U., Rakesh, P. and Dahiya, S.S. (2005). Effect of spacing and pinching on flower production of chrysanthemum cv. FLIRT. *Haryana J. Hort. Sci.,* **34** (1/2): 97-98.

Bhattacharjee, S.K. (1993). Studies on the effect of gibberellic acid on growth, flowering, flower quality and post harvest life of Rosa hybrid cv. RAKTAGANDHA. *Indian Rose Annual,* **11**: 77-83.

Borrelli, A. (1988). The effect of the method of pruning on the productivity of rose cultivar grown under glass. *Rivista della orto florfrutticultura, Italiana,* **65** (2): 109-117.

Bunt, A.C. (1980). Cropping of carnation as affected by date of planting and by removing apical bud. *J. Hort. Sci.,* **54** (3): 235-242.

Cline, M. (1997). Concepts and terminology of apical dominance. *American J. Bot.,* **84**(8): 1064 – 1069.

Dubois, L.A.M. and Devries, D.P. (1994). The effect of pinching on the growth and development of *Rosa chinensis* minima (Sims) Voss cultivars. *Gartenbauwissenschaft,* **59** (1): 18-20.

Grawal, H.S., Ramesh Kumar and Singh, Harmeet (2004). Effect of nitrogen, planting time and pinching on flower production in chrysanthemum (*Dendranthema grandiflora* Ramat.) cv. FLIRT. *J. Ornam. Hort. New Series,* **7** (2): 196-199.

Groshkov, I. and Angelov, A. (1981). Grandinarska I Lozarska. *Nauka,* **18** : 74-80.

Imamura, H. and Suto, K. (2001). Method of forcing carnations to bloom to meet special market demand. *Japan Agric. Res. Quarterly,* **35**(1) : 47-52.

Jadhav, Y.B., Patil, M.T., Gaikwad, A.M. and Patil, J.J. (2003). Influence of different pruning levels on growth and flowering of roses under greenhouse. *J. Maharashtra Agri. Univ.,* **28** (3): 313-314.

Laxmi Prasanna, Dilip Babu, J., Chandra Sekhar, R. and Amarender Reddy, S. (2001). Studies on the effect of different levels of pruning and plant growth regulators on growth, yield and quality parameters of rose (*Rosa indica* L.). cv. GLADIATOR. M.Sc. (Hort.) Thesis, Achraya N.G. Ranga Agricultural University, Hyderabad, A.P. (INDIA).

Malhotra, R. and Kumar, R. (2000). Effect of pruning height, shading and polythene covering on growth and flower production of rose cv. RAKTAGANDHA. *J. Ornam. Hort. New Series,* **3** (2): 94-99.

Mukherjee, D. (1996). Greenhouse cultivation of carnation. *Floriculture Today,* **1**: 46-48.

Mukhopadhyay, A., Sujatha, K. and Singh, K.P. (1987). Note on the influence of different levels of pruning on growth and flowering of roses cv. HAPPINESS. *Indian J. Hort.,* **44**: 102-103.

Nanjan, K. and Muthuswamy, S. (1976). A note on the effect of pinching on Edward rose (*Rosa bourboniana* Besp.). *S. Indian J. Hort.,* **22** (1-2): 37-40.

Narayana Gowda, J.V. and Jayanthi, R. (1991). Effect of cycocel and maleic hydrazide on growth and flowering of African marigold (*Tagetes erecta*). *Prog. Hort.,* **23** (1-4): 114-118.

Rao, U.M.K., Chandra Sekhar, R., Dilip Babu, J. and Raj Kumar, M. (2008). Effect of pinching at different levels on growth and flowering of three cultivars of carnation (*Dianthus caryophyllus* Linn.). M.Sc. (Hort.) Thesis, Achraya N.G. Ranga Agricultural University, Hyderabad, A.P. (INDIA).

Sawwan, J. and Samawi, M. (2000). Effect of pinching in plastic grown spray type carnation yield and yield distribution. *Dirasat Agric. Sci.,* **27**(1) : 106-111.

Singh, M.K. and Baboo, R. (2003). Response of nitrogen, potassium and pinching levels on growth and flowering in chrysanthemum cv. JAYANTHI. *J. Orna. Hort.,* **6**(4) : 390-393.

Srivastava, S.K., Singh, H.K. and Srivastava, A.K. (2002). Effect of spacing and pinching on growth and flowering of 'Pusa Narangi Gainda' marigold (*Tagetes erecta*). *Indian J. Agric. Sci.,* **72** (10): 611-612.

Staby, G.L., Robertson, J.L., Kiplinger D.C. and Conover, C.A. (1978). *Chain of life, Ohio Florists Associations,* Ohio State University, Columbus.

Ubukata,M. (1999). Evaluation of one half pinch method of spray carnation cultivation in Hokkaido. *Bull. Hokkaido Prefectural Agric. Exp. Stations,* **77** : 39-43.

Uma, S. and Gowda, J.V.N. (1987). Studies on the effect of pruning, nutrients and their interaction on growth and flowering of rose cv. SUPERSTAR. *Mysore J. Agric. Sci.,* **21** (4): 455-460.

Wainwright, H. and Irwin, H.L. (1987). The effects of paclobutrazol and pinching on antirrhinum flowering pot plants. *J. Hort. Sci.,* **62** (3): 401-404.

Zieslin, N. and Halvely, A.M. (1976). Effect of environmental factors on gibberellins activity and ethylene production in flowering and non flowering shoots. *Physiologia Plantarum,* **47** (4): 331-335.