DOI : 10.5958/0974-0112.2016.00007.4

Indian J. Hort. 72(4), December 2015: 485-488

Influence of plant bio-regulators on yield, physico-chemical attributes and post harvest quality of pear cv. Gola under *Terai* region of Northern India

Prashant K. Nimbolkar*, P.N. Rai, D.S. Mishra and Saurabh K. Singh

Department of Horticulture, College of Agriculture, G.B. Pant University of Agriculture & Technology Pantnagar 263145, U.S. Nagar, Uttarakhand

ABSTRACT

***Terai* region of northern India is having great potentiality for growing low chilling cultivars of different temperate fruits as this region receives sufficient amount of low temperature every year. However, the major problems of low chill cultivars are small fruit size, along with poor physico-chemical quality attributes. The present investigation was aimed at addressing these problems. For determining the influence of plant bio-regulators CPPU (5 and 10 ppm), NAA (10 and 20 ppm) and salicylic acid (50 and 100 ppm) were applied as once, twice and thrice spray at fortnightly interval after fruit set. CPPU @ 10 ppm was found most effective for increasing fruit length (6.79 cm), width (6.67 cm), fruit weight (182.84 g) and volume (179.11 ml), while TSS (13.38°Brix), total sugars (8.25%), acidity (0.55%), number of fruits per tree (285.00) and yield (47.66 kg) were found better with the application of CPPU @ 5 ppm. Higher per cent of marketable fruits (86.56) and ascorbic acid (7.08 mg/ 100 g) content was found in SA @ 100 ppm treatment.**

Key words: *Pyrus pyrifolia,* plant bio-regulators, quality attributes, yield.

INTRODUCTION

Pear [*Pyrus pyrifolia* (Burm.) Nakai] is one of the second important fruit crop in temperate regions of the world next only to apple. In India, pear cultivation is mainly confined to the temperate Himalayan mountains at 1,700-2,400 m above mean sea level, which is ideal conditions to grow a large number of European and Oriental pears. However, selection and development of low chill pear cultivars had made its cultivation possible in *terai* regions of Uttar Pradesh, Punjab and Uttarakhand. Fruits are harvested during last week of July to first week of August and have a good demand and market due to unavailability of high chill pears from Himachal Pradesh, Jammu and Kashmir *etc*. during this period. Among different low chill pear cultivars, cultivation of Gola pear due to its hardy nature has been a unique success in the *terai* region of North India. Improving marketable yield of good quality pear fruits has always been a challenge for scientists and growers. On the basis of some preliminary studies, Varga (10) reported that cytokinin spray reduced the fruit drop in pear.

MATERIALS AND METHODS

The present investigation was conducted at the Horticulture Research Centre (HRC) Patharchatta, GBPUA&T, Pantnagar, Uttarakhand during the year of 2012-13. The centre is situated in *Terai* region in the foothills of Shivalik range of Himalayas. The experiment was laid out on 14-year-old bearing pear trees of cv. Gola having uniform vigour and size. All the trees were maintained under uniform cultural practices during the course of investigation. The experiment was laid out in randomized block design with three replications, comprising seven treatments of *N*-(2-Chloro-4-pyridyl)-*N*-phenylurea (CPPU), naphthalene acetic acid (NAA) and salicylic acid (SA). One tree served as a unit of treatment in each replication. The treatments were CPPU @ 5 ppm, CPPU @ 10 ppm, NAA @ 10 ppm, NAA @ 20 ppm, SA @ 50 ppm, SA @ 100 ppm and control. These treatments were applied as a first, second and third spray after fruit set, at fortnightly interval end of March during 2013. The observations were recorded on yield, physico-chemical and quality parameters of fruits.

The fruit size (length and width) was measured with the help of Vernier calipers. Average weight was recorded by weighing balance and volume by water displacement method. The specific gravity of fruit was calculated by dividing the average weight (w) with average fruit volume (v). Total soluble solids in fruits were recorded at room temperature using hand refractometer. The titrartable acidity and ascorbic acid of pear fruits were calculated by methods of Ranganna (8). The total and reducing sugars were calculated by using standardized methods of AOAC (1). The loss in fruit weight was determined by taking average weight of 10 fruits from date of harvest at 8 day intervals. For assessing other qualitative attributes, such as colour and texture of fruits was evaluated by a panel of

*Corresponding author's E-mail: prashantnimbolkar111@gmail.com

experts by using hedonic rating scale and expressed in score 1 to 9. The marketability of stored fruits was expressed in per cent on the basis of weight loss and general appearance. The data was statistically analyzed and mean differences were tested by 'F' test.

RESULTS AND DISCUSSION

The observations recorded in term of number of fruits per tree revealed that spray of CPPU, NAA and SA with different concentrations had significantly influenced the number of fruits (Table 1). The maximum number of fruits (285/ tree) and yield (47 kg/ tree) were recorded in case application of CPPU @ 5 ppm. The possible reason of significantly increased number of fruits per tree may be due to increase in fruit retention and reduced fruit drop. Similar result was reported by Kassem *et al*. (3) on jujube and Chandel and Devi (2) on kiwi.

It was evident that spray of CPPU, NAA and SA with their different concentrations had significant effect on fruit size, weight and volume (Table 1). The maximum fruit length (6.79 cm) and width (6.67 cm) was found in case of CPPU @ 10 ppm closely followed by CPPU @ 5 ppm with fruit length (6.53 cm) and width (6.63 cm). Data pertaining to maximum mean fruit weight (182.44 g) was recorded in CPPU @ 10 ppm. Control recorded minimum size and weight of fruits compared to other treatments. The increase in size and weight of fruits due to application of CPPU is because of its positive action on enhancing cell division and cell elongation as well as its role in activating the biosynthesis of proteins, RNA and DNA (Nickell, 7). There was significant effect of CPPU, NAA and SA sprays on fruit volume over water spray (control). The higher mean fruit volume (179.11 ml) was recorded in CPPU @ 10 ppm, while the minimum was recorded in control (150.55 ml). However, non-significant difference was found among all the treatments in relation to specific gravity (Table 1).

Total soluble solids were also significantly influenced by sprays of growth regulators (Table 2). The higher total soluble solids (13.38°Brix) content was recorded in CPPU @ 5 ppm. Increase in total soluble solids of 'Bing' sweet cherry fruits by application of cytokinins was also reported by (Zhang and Whiting 14). Whereas, the minimum total soluble solids content was recorded in control (11.48°Brix). The data presented (Table 2) manifests that the CPPU significantly decrease acidity in fruits. The minimum (0.55%) mean titratable acidity was recorded in the CPPU @ 5 ppm, while maximum (0.63%) in control. The decrease in acidity might be due to reduction in the enzyme activities by foliar application of these plant growth regulators. The similar findings were reported by Latocha and Krupa (4) in kiwi. The significant differences were also observed for mean values of ascorbic acid content for pear with the application of CPPU, NAA and SA (Table 2). The maximum ascorbic acid (7.08 mg/100 g) content was found in SA @ 100 ppm. Whereas, minimum value (6.10 mg/100 g) was found in control. Salicylic acid (SA) works as antioxidant, as it activates ascorbate peroxidase, which increases antioxidant ability and ascorbic acid amount in fruits (Wang *et al*., 12).

The critical examination of the data revealed that total sugars content in pear varied significantly among all the treatments over control. The mean value of total sugars ranged from 7.03 to 8.25%. Among all the treatments under study, CPPU @ 5 ppm recorded significantly higher total sugars (8.25%), whereas, lowest (7.03%) was recorded under control. The significantly higher mean reducing sugar (7.83%) was recorded in CPPU @ 5 ppm and lower (6.52%) reducing sugar was recorded in control. However, non-significant difference was found for non-reducing sugar among all the treatments. The CPPU could increase reducing sugar and total sugars as well as could

Table 1. Effect of CPPU, NAA and SA on fruit yield, size, weight, volume and specific gravity of pear cv. Gola.

Treatment	No. of fruits/ tree	Yield (kg/ tree)	Fruit length (cm)	Fruit width (cm)	Fruit wt. (g)	Fruit vol. (ml)	Specific gravity
CPPU @ 5 ppm	285.00	47.66	6.53	6.63	180.00	173.88	1.04
CPPU @ 10 ppm	276.00	41.66	6.79	6.67	182.44	179.11	1.02
NAA @ 10 ppm	269.00	39.33	6.43	6.37	174.33	167.66	1.04
NAA @ 20 ppm	267.00	40.66	6.50	6.58	173.88	170.11	1.02
SA @ 50 ppm	250.33	38.66	6.35	6.24	166.22	159.66	1.04
SA @ 100 ppm	260.00	39.66	6.38	6.30	167.55	161.99	1.03
Control (water spray)	241.00	31.66	6.33	6.05	158.44	154.23	1.02
CD at 5%	5.90	4.39	0.27	2.45	9.28	5.06	NS

Table 2. Effect of CPPU, NAA and SA on TSS, titratable acidity and ascorbic acid content in pear cv. Gola.

Treatment	TSS (°Brix)	Titratable acidity (%)	Ascorbic acid (mg/100 g)	Total sugars (%)	Reducing sugar (%)	Non-reducing sugar (%)
CPPU @ 5 ppm	13.38	0.55	6.41	8.25	7.83	0.42
CPPU @ 10 ppm	12.73	0.56	6.11	8.15	7.66	0.49
NAA @ 10 ppm	12.09	0.58	6.87	7.49	6.89	0.60
NAA @ 20 ppm	12.33	0.57	6.93	7.43	6.73	0.70
SA @ 50 ppm	11.80	0.61	7.05	7.29	6.80	0.49
SA @ 100 ppm	12.10	0.56	7.08	7.35	6.90	0.45
Control (water spray)	11.48	0.63	6.10	7.03	6.52	0.51
CD at 5%	0.87	0.15	0.43	0.43	0.46	NS

promote starch degradation content of persimmon cv. Zinjimaru (Xiao *et al*., 13). The maximum mean value of physiological loss in weight of fruits after 8 days of storage was recorded in control (5.88%) and the minimum was in SA @ 100 ppm (3.98%) (Table 3). Overall, the maximum physiological loss in weight (23.91%) was recorded in control at the end of 32nd days of storage. While, minimum physiological loss in weight (19.43%) was recorded in SA @ 100 ppm at end of 32nd day of storage. Possible reason for the reduction in physiological loss in weight by a spray of CPPU, NAA and SA is attributed to retain fruit firmness and tissue rigidity, thereby checking moisture loss from fruit surface (Looney, 5; Rao *et al*., 9). The percent marketable fruits up to 8th days of storage at room temperature were 100 per cent, while at final stage up to 32 days, the maximum (70.33%) per cent marketable fruits were found in SA @ 100 ppm and minimum marketable fruits were recorded (48.00%) in control. Salicylic acid is a phenolic compound that inhibits ethylene biosynthesis (Zhang *et al*., 11).

The higher score rating of colour on hedonic scale at initial stage of storage (9.00) was recorded for both SA @ 50 ppm and SA 100 ppm, and lower (6.87) was noted for control. At the end of storage, highest score (7.92) was recorded in SA @ 100 ppm. While, lowest score (4.50) was in control (Fig. 1). This might be due to the positive effect of SA on physical and chemical characteristic during storage period, which reduce decaying, delay ripening and extend postharvest life of apples (Mo *et al*., 6). It clearly demonstrates that highest score (8.92) for texture obtained in SA @ 100 ppm, while lowest score (6.50) was recorded in control. At the end of storage, highest score (7.02) for texture was recorded in SA @ 100 ppm, while lowest score (3.90) was recorded in control (Fig. 1). The results are in agreement with Vatanparast *et al*. (11).

Hence, from the results it can be concluded that plant bio-regulators CPPU, NAA and SA have potential for increasing yield, quality and marketability of pear fruits. Since, on the basis of results, it will be better to use CPPU @ 5 ppm for improving the physico-chemical attributes of fruits. While, SA @ 100 ppm will be better for maintaining post-harvest life during the storage.

Table 3. Effect of CPPU, NAA and SA on physiological loss in weight and marketable fruits of pear cv. Gola.

Treatment	Initial fruit wt. (g)	PLW at different storage periods				Per-cent marketable fruits at different storage periods			
		8 day	16 day	24 day	32 day	8 day	16 day	24 day	32 day
CPPU @ 5 ppm	180.00	5.39	8.59	11.59	21.62	100	81.67	70.67	55.67
CPPU @ 10 ppm	182.44	5.03	8.90	11.90	20.27	100	83.96	74.00	58.67
NAA @ 10 ppm	174.33	5.46	9.26	12.26	22.34	100	77.00	67.33	53.00
NAA @ 20 ppm	173.88	5.76	7.45	10. 45	20.68	100	79.33	68.67	52.67
SA @ 50 ppm	166.22	4.65	8.90	11.90	20.27	100	91.00	82.33	68.67
SA @ 100 ppm	167.55	3.98	6.98	9.98	19.43	100	92.33	83.59	70.33
Control (water spray)	158.44	5.88	10.88	13.88	23.91	100	72.33	58.90	48.00
CD at 5%	9.28	1.03	1.12	1.12	1.15	-	2.84	3.00	2.95

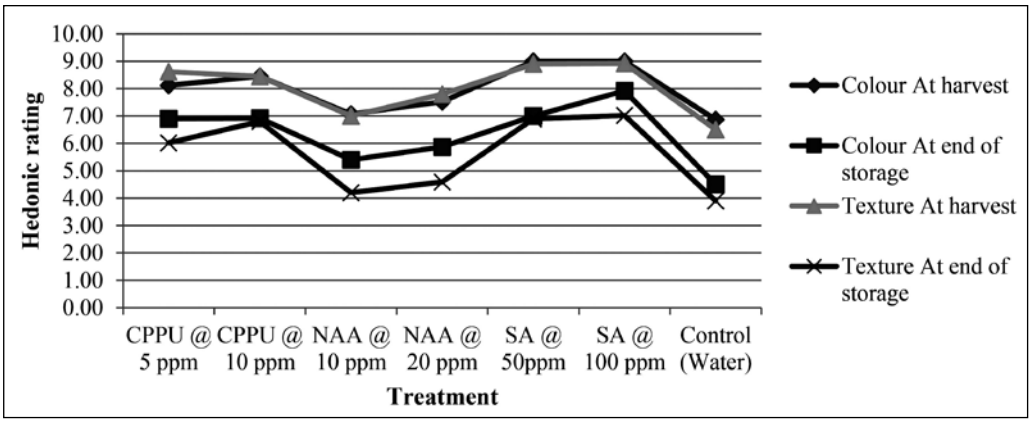

Fig. 1. Effect of CPPU, NAA and SA on fruit colour and texture of pear cv. Gola.

REFERENCES

1. A.O.A.C. 2000. *Official Methods of Analysis*, Association of Official Analytical Chemists (15th Edn.), Washington, D.C.
2. Chandel, J.S. and Devi, S. 2010. Effect of CPPU, promalin and hydrogen cyanamide on flowering, yield and fruit quality of kiwifruit. *Indian J. Hort.* **67**: 120-23.
3. Kassem, H.A., Al-Obeed, R.S., Ahmed, M.A. and Omar, A.K.H. 2011. Productivity, fruit quality and profitability of jujube trees improvement by pre harvest application of agro-chemicals. *Middle-East J. Sci. Res.* **9**: 628-37.
4. Latocha, P. and Krupa, T. 2007. Effect of CPPU application on fruit development and quality of different *Actinidia* genotypes. *Biostimulators Modern Agric. Fruit Crops,* **60**: 60-67.
5. Looney, N.E. 1993. Improving fruit size, appearance, and other aspects of fruit crop "quality" with plant bioregulating chemicals. *Acta Hort*. **329**: 120-27.
6. Mo, Y., Gong, D., Liang, Han, G.R., Xie, J. and Li, W. 2008. Enhanced preservation effects of sugar apple fruits by salicylic acid treatment during post-harvest storage. *J. Sci. Fd. Agri.* **88**: 2693-99.
7. Nickell, L.G. 1985. New growth regulator increases grape size. *Plant Gr. Reg. Soc. America*, **12**: 1-7.
8. Ranganna, S. 1986. *Handbook of Analysis and Quality Control for Fruit and Vegetable Products*, ***In***: II Ed., Tata McGraw Hill, pp. 12-26, 40-42, 63-64 and 105-106.
9. Rao T.V.R., Gol, N.B and Shah, K.K. 2011. Effect of postharvest treatments and storage temperatures on the quality and shelf-life of sweet pepper (*Capsicum annum* L.). *Scientia Hort*. **132**: 18-26.
10. Varga, A. 1969. Effects of growth regulators on fruit and June drop of pears and apples. *Netherlands J. Agric. Sci*. **17**: 229-33.
11. Vatanparast, G., Mirdehghan, H., Karimi, H., and Vazifeshenas, M. 2013. Foliar application of salicylic acid, methyl jasmonate and potassium sulfate on photosynthetic characteristics and fruit quality of pomegranate*. Iranian Agri. Res.* **31**: 23-34.
12. Wang, L.J., Chen, S.H., Kong, W.F., Li, S.H. and Archbold, D.D. 2006. Salicylic acid pre-treatment elevates chilling injury and affects the antioxidant system and heat shock proteins of peaches during cold storage. *Postharvest Biol. Tech.* **41**: 244-51.
13. Xiao, H.Y., Wang, J.X., Huang, M., Chen, S.X., and Fan, G.R. 2007. Influence of CPPU on sugar and acid content of *Diospyros kaki* cv. 'Zenjimaru'chu fruit. *J. Zhejiang Forest. Sci. Tech.* **27**: 28.
14. Zhang, C. and Whiting, M.D. 2011. Improving 'Bing' sweet cherry fruit quality with plant growth regulators. *Scientia Hort.* **127**: 341-46.

Received : December, 2014; Revised : October, 2015; Accepted : November, 2015