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**Rajani Pant**

Ph.D Scholar, Department of Horticulture, G.B. Pant University of Agriculture and Technology Pantnagar, U.S. Nagar, Uttarakhand, India

**DC Dimri**

Professor, Department of Horticulture, G.B. Pant University of Agriculture and Technology Pantnagar, U.S. Nagar, Uttarakhand, India

**Ratna Rai**

Professor, Department of Horticulture, G.B. Pant University of Agriculture and Technology Pantnagar (U.S. Nagar) Uttarakhand, India

**Corresponding Author:****Rajani Pant**

Ph.D Scholar, Department of Horticulture, G.B. Pant University of Agriculture and Technology Pantnagar, U.S. Nagar, Uttarakhand, India

## Effect of soil applied paclobutrazol on chemical quality of Litchi (*Litchi chinensis* Sonn.) cv. rose scented

**Rajani Pant, DC Dimri and Ratna Rai**

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**Abstract**

Paclobutrazol is a plant growth retardant and triazole fungicide has been reported to be very effective for dwarfing a wide range of crops including litchi. It is a cell elongation and internode extension inhibitor that retards plant growth by inhibition of gibberellins biosynthesis. The effect of paclobutrazol at varying time intervals of litchi as soil drench application (1.00-4.00 g a.i. per meter canopy diameter) was investigated during 2016-18 in Pantnagar condition. The Chemical quality of litchi was significantly increased due to higher dose of paclobutrazol (2.0-4.0 g a.i./meter canopy diameter). Application of paclobutrazol at the rate 2.0, 3.0 a.i./tree through soil application method was noted to be more efficient in increasing Ascorbic acid, Total soluble solids, Total sugar, and Anthocyanin. The paclobutrazol applied at the rate 40 ml/tree was the most effective in increasing the Ascorbic acid (27.29 mg/100gm) followed by 60 ml/tree (27.15 mg/100g), while the minimum Ascorbic acid was recorded under control (25.37 mg/100gm). The application of paclobutrazol @ 40 ml/tree, the Titratable acidity of litchi tree was found to be minimum (0.49%) as compared to control (0.54 %). In different time intervals the D<sub>2</sub> (October) estimated the minimum titratable acidity (0.51%) followed by D<sub>2</sub> (October), while the maximum titratable acidity was noted under D<sub>3</sub> (0.53%). The main purpose of this study is to focus upon contemporary information about paclobutrazol in litchi growth.

**Keywords:** Paclobutrazol, ascorbic acid, titratable acidity, anthocyanin

**Introduction**

Litchi (*Litchi chinensis* Sonn.) is the most important sub-tropical evergreen fruit tree belonging to family Sapindaceae, under sub-family Napeleae. Litchi is originated in China, but now found in most of the South - East Asian countries. After China, India is the second largest producer of litchi in the world. Besides China and India, the cultivation of litchi is also practiced in Australia, Central and South America, Thailand, South Africa and Malaysia (Anonymous, 2011) [2]. Litchi produces leaf flushes, flowers and fruit on terminals of new growth and the reproductive phase is associated with the ability to alternate between the production of vegetative and reproductive buds. The vegetative flushing just prior to floral induction resulted in poor or no initiation and often remains vegetative. The new flushes emerge 3-4 time after harvest viz., early (after harvest), mid (August to October) and late (after November) season; the early and mid-season flushing influenced the yield, whereas the late season flushing do not have any contribution towards yield (Pereira *et al.*, 2005) [6]. The ripe fruits are also a rich source of sugars which ranges from 10-22% and minerals (0.7%) like calcium, phosphorus and iron. The dominant organic acid present in the fruit is malic acid, which constitutes 80% of the total acids. The value addition of litchi through processing is less than 2.00% of total litchi produced in India.

Paclobutrazol is a plant growth retardant and triazole fungicide has been reported to be very effective for dwarfing a wide range of crops. It is commonly known as "Cultar" and used as a way of improving crop productivity (Davis and Andersen, 1989). Paclobutrazol can be used safely in crop fields because it is eco-friendly and nontoxic. It plays various influential roles in physiological system of various plants. Absorbed by roots it is translocated rapidly to the shoot and reaching the tip within 2 or 3 days of application, but when applied just before the leaf fall, it moved relatively slow in the soil.

Paclobutrazol moved rapidly between the basal nodes and shoot tips in the acropetal and basipetal directions and persisted for several months (Browning *et al.*, 1992)<sup>[3]</sup>.

## Materials and Methods

This experiment was carried out during the year 2016 to 2018 at Horticultural Research Centre, Patharachatta, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar (Uttarakhand). Pantnagar is situated at 29.5° North latitude and 79.3° East longitudes at an altitude of 243.94 meters above mean sea level in the Tarai region of Himalayas. The experiment was laid out in randomized block design. All the treatments were replicated thrice with a unit of one plant in a treatment. The total 45 plants of Rose scented were included in this experiment.

### Experimental details

These five treatments were Control (P<sub>0</sub>); 1.0 g a.i. per meter canopy diameter (20ml/tree) (P<sub>1</sub>); 2.0 g a.i. per meter canopy diameter (40ml/tree) (P<sub>2</sub>); 3.0 g a.i. per meter canopy diameter (60ml/tree) (P<sub>3</sub>); 4.0 g a.i. per meter canopy diameter (80ml/tree) (P<sub>4</sub>) and three date of application of paclobutrazol i.e., 15 September (120 days before expected date of bud break) (D<sub>1</sub>); 15 October (90 days before expected date of bud

break) (D<sub>2</sub>); 15 November (60 days before expected date of bud break) (D<sub>3</sub>). Paclobutrazol was applied through ring basin method which is 20 cm wide and 15 cm deep around the tree trunk. The strength of used paclobutrazol was 25% only. Hence, for obtaining 100% strength the quantity of paclobutrazol was taken 4 times and thus the final doses used in the experiment were 20ml/tree, 40ml/tree, 60ml/tree and 80ml/tree of per meter tree canopy spread. The measured quantity of paclobutrazol was dissolved in 10 liter of water in a bucket and thoroughly stirred before pouring in the ring.

### Observations Recorded

The data were observed for the various parameters described below under the following heads.

### Fruit chemicals parameters

#### (i) Ascorbic acid content (mg/100g)

The ascorbic acid content from the fruit juice sample was estimated by dye 2, 6-Dichlorophenol-indophenol visual titration method as described by Ranganna (1986). The reagents used in this procedure are; 3 per cent metaphosphoric acid (HPO<sub>3</sub>), ascorbic acid standard solution and dye solution. The ascorbic acid content of the sample was recorded in mg/100g and calculated by following formula.

$$\text{Ascorbic acid} = \frac{\text{Titre} \times \text{Dye factor} \times \text{Volume made up} \times 100}{\text{Extract taken for acid estimation} \times \text{Weight of volume sample}}$$

#### (ii) Total soluble solids (°B)

Total soluble solids (TSS) content of three randomly selected fruit per treatment was determined with the help of a hand refractometer (0-32°B) by putting a few drops of juice on the prism of refractometer. The refractometer was callibrated with distilled water before use and the mean values of total

soluble solid was expressed in °Brix.

#### (iii) Titratable acidity (%)

The titratable acidity was determined by method as suggested in AOAC (1980). The total titratable acidity was expressed in percentage and calculated by using following formula.

$$\text{Total acidity} = \frac{\text{Titre value} \times \text{Normality of alkali} \times \text{Volume made up} \times \text{Eq. weight of acid} \times 100}{\text{Weight of sample} \times \text{Weight of aliquot} \times 1000}$$

#### (iv) Anthocyanin content (mg/100g)

The anthocyanin content was calculated by following formula and expressed in mg/100g.

$$\text{Total anthocyanin} = \frac{\text{Absorbance at 535 nm} \times b \times c}{D \times A} \times 100$$

Where,

b = Volume made up of extract for colour measurement

c = Total volume made

D = Volume of aliquot taken for estimation

A = Weight of sample taken

### Statistical analysis

The statistical analysis was carried out for each observed character by using MS-Excel, OPSTAT. All the data pertaining to growth, yield and quality attributes were statistically analyzed as per design of experiment (Randomized Block Design) suggested by Gomez and Gomez (1983)<sup>[4]</sup>. The level of significance was tested for different variables at 5 per cent level of significance. The results are presented by way of tables and graphs.

## Results and Discussion

### Effect of paclobutrazol on fruit chemical characters

#### (i) Ascorbic acid (mg/100g)

The data presented in table 1 make it evident that the

application of different doses of paclobutrazol as well as their interaction (P×D) showed significant differences, however the time of application was non-significant during both the years. The respective values of maximum ascorbic acid i.e., 27.18 mg/100g and 27.40 mg/100g was estimated under treatment P<sub>2</sub> (40 ml/tree) followed by P<sub>3</sub> (27.05 mg/100g and 27.24 mg/100g), while the minimum under control (25.38 mg/100g and 25.36 mg/100g), in 2017 and 2018. Among the treatments the differences of P<sub>0</sub> and P<sub>1</sub> as well as P<sub>2</sub> and P<sub>3</sub> were statistically *at par* with each other during both the years. The time of application of paclobutrazol showed the highest ascorbic acid i.e., 26.43 mg/100g and 26.51 mg/100g in D<sub>2</sub> (October), while the lowest ascorbic acid was noted in D<sub>1</sub> (September) i.e., 26.25 mg/100g and 26.32 mg/100g, respectively in the year of 2017 and 2018. The pooled observation also showed the significant differences under different doses of paclobutrazol as well as their interaction (P×D), however its time of application was non-significant. The paclobutrazol applied at 40 ml/tree (P<sub>2</sub>) recorded the most effective in increasing the ascorbic acid (27.29 mg/100g) followed by P<sub>3</sub> (27.15 mg/100g), while the minimum ascorbic acid was noted under control (25.37 mg/100g). The differences of treatments P<sub>0</sub> and P<sub>1</sub> as well as P<sub>2</sub> and P<sub>3</sub> were statistically *at par* with each other. Among different time intervals the D<sub>2</sub> (October) recorded the maximum ascorbic acid (26.48 mg/100g), while the minimum ascorbic acid was estimated under D<sub>1</sub> (September) i.e., 26.29 mg/100g. In

agreement with our present findings Pires and Yamanishi (2014) <sup>[7]</sup>, while studying the different concentration and different time of paclobutrazol application on fruit quality in litchi. The highest Vitamin C content (85 mg/100 g of pulp)

with the application of paclobutrazol at the rate 2.5 ml/tree as compared to control and also found the application of Paclobutrazol in the month of October having the highest Vitamin C (76.78 mg/100).

**Table 1:** Effect of paclobutrazol doses and dates of application on ascorbic acid (mg/100g) in litchi Cv. Rose Scented.

Time of Application													
	Year	2016-17				2017-18				Pooled Mean			
Paclobutrazol (ml/tree)	Doses	15 Sep. (D <sub>1</sub> )	15 Oct. (D <sub>2</sub> )	15 Nov. (D <sub>3</sub> )	Doses	15 Sep. (D <sub>1</sub> )	15 Oct. (D <sub>2</sub> )	15 Nov. (D <sub>3</sub> )	Doses	15 Sep. (D <sub>1</sub> )	15 Oct. (D <sub>2</sub> )	15 Nov. (D <sub>3</sub> )	Doses
	Control (P <sub>0</sub> )	25.13	25.23	25.79	25.38	24.91	25.35	25.82	25.36	25.02	25.29	25.81	25.37
	20 ml (P <sub>1</sub> )	25.18	25.23	26.52	25.64	25.00	25.12	26.54	25.55	25.09	25.18	26.53	25.60
	40 ml (P <sub>2</sub> )	27.32	27.63	26.58	27.18	27.63	27.82	26.76	27.40	27.47	27.73	26.67	27.29
	60 ml (P <sub>3</sub> )	27.08	27.50	26.58	27.05	27.42	27.68	26.61	27.24	27.25	27.59	26.60	27.15
	80 ml (P <sub>4</sub> )	26.58	26.59	26.56	26.58	26.65	26.60	26.60	26.62	26.62	26.60	26.58	26.60
	Mean D	26.25	26.43	26.40	-	26.32	26.51	26.47	-	26.29	26.48	26.44	-

Year	2016-17		2017-18		Pooled Mean	
Treatments	CD at 5%	Sem ±	CD at 5%	Sem ±	CD at 5%	Sem ±
Paclobutrazol (P)	0.56	0.19	0.47	0.16	0.51	0.17
Date of Application (D)	NS	0.15	NS	0.12	NS	0.13
Interactions (PXD)	0.98	0.33	0.82	0.28	0.89	0.30

### (ii) Total soluble solids (TSS)

The data presented in table 2 shows the maximum TSS (18.83<sup>0</sup>B) under treatment P<sub>2</sub> (40 ml/tree) followed by P<sub>3</sub> (18.25<sup>0</sup>B), while the minimum under P<sub>0</sub> (16.47<sup>0</sup>B). Among the treatments the differences of P<sub>1</sub> and P<sub>4</sub> were statistically *at par* with each other. In the same year, the time of application of paclobutrazol showed the highest TSS (17.94<sup>0</sup>B) in D<sub>2</sub> (October), while the lowest was noted in D<sub>3</sub> (November) i.e., 17.63<sup>0</sup>B. Thus, the treatment combination P<sub>2</sub>D<sub>2</sub> (19.06<sup>0</sup>B) recorded the maximum TSS, while minimum was found under P<sub>0</sub>D<sub>3</sub> (16.20<sup>0</sup>B) in the year 2017. During the second year of the experiment i.e., 2018 it clearly visualizes the maximum TSS (19.30<sup>0</sup>B) was estimated under treatment P<sub>2</sub> (40 ml/tree) followed by P<sub>3</sub> (18.76<sup>0</sup>B) and P<sub>4</sub> (18.00<sup>0</sup>B), while the minimum under P<sub>0</sub> (16.24<sup>0</sup>B). The differences of treatments P<sub>1</sub> and P<sub>4</sub> were statistically *at par* with each other. The time of application of paclobutrazol showed the highest TSS (18.28<sup>0</sup>B) in D<sub>2</sub> (October), while the lowest TSS was noted in D<sub>3</sub> (November) i.e., 17.82<sup>0</sup>B. The pooled data of two

years observations also shows maximum TSS (19.06<sup>0</sup>B) was found in P<sub>2</sub> followed by P<sub>3</sub> (18.51<sup>0</sup>B). However, the minimum TSS was recorded under control (16.36<sup>0</sup>B). Among the treatments, the differences of P<sub>1</sub> and P<sub>4</sub> were statistically *at par* with each other. The effect of different time intervals showed highest TSS (18.11<sup>0</sup>B) in D<sub>2</sub> (October), while the minimum was noted in D<sub>3</sub> (November) i.e., 17.73<sup>0</sup>B.

The increase in TSS with the paclobutrazol treated tree might be due to rapid hydrolysis of polysaccharides in to soluble sugars. Vijayalakshmi and Srinivasan (2000) also found that the application of paclobutrazol at 20 mg per liter increased the chemical composition of fruits in terms of TSS, TSS/acid ratio in mango. Pires and Yamanishi (2014) <sup>[7]</sup> studied that the different concentration and different time of paclobutrazol application affect the fruit quality in litchi. The maximum TSS/acid ratio was recorded with 5 ml/tree paclobutrazol, while minimum in control. The application of Paclobutrazol in the month of October has the highest TSS/acid ratio i.e., 76.78 mg/100 g of pulp.

**Table 2:** Effect of paclobutrazol doses and dates of application on TSS (<sup>0</sup>B) in litchi Cv. Rose Scented.

Time of Application													
	Year	2016-17				2017-18				Pooled Mean			
Paclobutrazol (ml/tree)	Doses	15 Sep. (D <sub>1</sub> )	15 Oct. (D <sub>2</sub> )	15 Nov. (D <sub>3</sub> )	Doses	15 Sep. (D <sub>1</sub> )	15 Oct. (D <sub>2</sub> )	15 Nov. (D <sub>3</sub> )	Doses	15 Sep. (D <sub>1</sub> )	15 Oct. (D <sub>2</sub> )	15 Nov. (D <sub>3</sub> )	Doses
	Control (P <sub>0</sub> )	16.66	16.56	16.20	16.47	16.40	16.53	15.80	16.24	16.53	16.55	16.00	16.36
	20 ml (P <sub>1</sub> )	17.33	17.83	17.46	17.54	17.46	18.06	17.66	17.73	17.40	17.95	17.56	17.63
	40 ml (P <sub>2</sub> )	18.66	19.06	18.76	18.83	18.93	19.73	19.23	19.30	18.80	19.40	19.00	19.06
	60 ml (P <sub>3</sub> )	18.20	18.43	18.13	18.25	18.80	19.10	18.40	18.76	18.50	18.76	18.26	18.51
	80 ml (P <sub>4</sub> )	17.70	17.80	17.60	17.70	17.96	18.00	18.03	18.00	17.83	17.90	17.81	17.85
	Mean D	17.71	17.94	17.63	-	17.91	18.28	17.82	-	17.81	18.11	17.73	-

Year	2016-17		2017-18		Pooled Mean	
Treatments	CD at 5%	Sem ±	CD at 5%	Sem ±	CD at 5%	Sem ±
Paclobutrazol (P)	0.42	0.14	0.33	0.11	0.32	0.11
Date of Application (D)	NS	0.11	0.25	0.08	0.24	0.08
Interactions (PXD)	NS	0.25	NS	0.19	NS	0.19

### (iii) Titratable acidity (%)

The effects of different doses of paclobutrazol at different time intervals as soil drench application on titratable acidity of litchi are presented in table 3. In the first year the minimum titratable acidity (0.50%) was noted under treatment P<sub>2</sub> (40 ml/tree) followed by P<sub>3</sub> (0.51%), while the maximum under

control (0.55%). Among the treatments, the differences of P<sub>0</sub> and P<sub>1</sub> as well as P<sub>2</sub> and P<sub>3</sub> were statistically *at par* with each other. The time of application of paclobutrazol showed the lowest titratable acidity (0.52%) in D<sub>2</sub> (October), while the maximum titratable acidity was found in D<sub>1</sub> and D<sub>3</sub> i.e., 0.53%. During the second year (2018) the lowest shoot

length (0.47%) was recorded in treatment P<sub>2</sub> (40 ml/tree) followed by P<sub>3</sub> (0.49%), while the highest under P<sub>0</sub> (0.54%). All the differences among the various doses of paclobutrazol were found significant with respect to titratable acidity. In the pooled data the paclobutrazol applied at the rate 40 ml/tree (P<sub>2</sub>) recorded the most effective in reducing the titratable acidity (0.49%) followed by P<sub>3</sub> (0.50%), while the maximum titratable acidity was found under control (0.54%). All the differences among the various doses of paclobutrazol were found significant. In different time intervals the D<sub>2</sub> (October)

estimated the minimum titratable acidity (0.51%) followed by D<sub>2</sub> (October), while the maximum titratable acidity was noted under D<sub>3</sub> (0.53%). The possible reason for decrease in acidity with paclobutrazol may be due to increase in sugar content in many fruits (Steffens *et al.*, 1985) [10]. Webster and Quinlan (1984) [13] reported that soil applied paclobutrazol at the rate 2.0 g a.i./tree decreased the acidity level as compared with control in European plum. Vijayalakshmi and Srinivasan (2000) found that the application of paclobutrazol at the rate 20 mg/lit reduced titratable acidity in mango.

**Table 3:** Effect of paclobutrazol doses and dates of application on titratable acidity (%) in litchi Cv. Rose Scented.

Time of Application													
Year		2016-17				2017-18				Pooled Mean			
Paclobutrazol (ml/tree)	Doses	15 Sep. (D <sub>1</sub> )	15 Oct. (D <sub>2</sub> )	15 Nov. (D <sub>3</sub> )	Doses	15 Sep. (D <sub>1</sub> )	15 Oct. (D <sub>2</sub> )	15 Nov. (D <sub>3</sub> )	Doses	15 Sep. (D <sub>1</sub> )	15 Oct. (D <sub>2</sub> )	15 Nov. (D <sub>3</sub> )	Doses
	Control (P <sub>0</sub> )	0.54	0.56	0.55	0.55	0.55	0.56	0.51	0.54	0.55	0.56	0.53	0.54
	20 ml (P <sub>1</sub> )	0.53	0.54	0.54	0.54	0.53	0.52	0.54	0.53	0.53	0.53	0.54	0.53
	40 ml (P <sub>2</sub> )	0.50	0.49	0.52	0.50	0.47	0.45	0.50	0.47	0.49	0.47	0.51	0.49
	60 ml (P <sub>3</sub> )	0.51	0.50	0.52	0.51	0.48	0.48	0.51	0.49	0.50	0.49	0.52	0.50
	80 ml (P <sub>4</sub> )	0.55	0.53	0.53	0.54	0.53	0.50	0.51	0.51	0.54	0.52	0.53	0.53
	Mean D	0.53	0.52	0.53	-	0.51	0.50	0.52	-	0.52	0.51	0.53	-

Year	2016-17		2017-18		Pooled Mean	
Treatments	CD at 5%	Sem ±	CD at 5%	Sem ±	CD at 5%	Sem ±
Paclobutrazol (P)	0.02	0.008	0.019	0.007	0.018	0.006
Date of Application (D)	NS	0.006	NS	0.005	NS	0.005
Interactions (PXD)	NS	0.01	0.033	0.011	NS	0.011

#### (iv) Anthocyanin (mg/100g)

The data presented in table 4 make it evident that the significant differences of various levels of paclobutrazol (P), its time of application as well as their interaction (P×D) during both the years (figure 1 ). In the year 2017 and 2018 the maximum respective value of anthocyanin i.e., 63.44 mg/100g and 65.15 mg/100g was estimated under treatment P<sub>3</sub> (60 ml/tree) followed by P<sub>2</sub> (62.88 mg/100g and 65.03 mg/100g), while the minimum under control (36.10 mg/100g and 41.73 mg/100g). Among the treatments the differences of P<sub>2</sub> and P<sub>3</sub> were statistically *at par* with each other in both the years. The time of application of paclobutrazol showed the highest anthocyanin i.e., 55.96 mg/100g and 58.34 mg/100g in D<sub>2</sub> (October), while the lowest anthocyanin was noted in D<sub>1</sub> (September) i.e., 51.23 mg/100g and 54.56 mg/100g, respectively in the year of 2017 and 2018. Date D<sub>1</sub> and D<sub>3</sub> were statistically *at par* with each other with respect to anthocyanin during both the years.

The pooled observation showed the significant differences of various levels of paclobutrazol (P), its time of application as well as their interaction (P×D). The paclobutrazol applied at

60 ml/tree (P<sub>3</sub>) recorded the most effective in increasing the anthocyanin (64.30 mg/100g) followed by P<sub>2</sub> (63.96 mg/100g), while the minimum anthocyanin was noted under control (38.92 mg/100g). Among the treatments the differences of P<sub>2</sub> and P<sub>3</sub> were statistically *at par* with each other. Among different time intervals the D<sub>2</sub> (October) recorded the maximum anthocyanin (57.15 mg/100g), while the minimum anthocyanin was estimated under D<sub>1</sub> (September) i.e., 52.90 mg/100g. Date D<sub>1</sub> and D<sub>3</sub> were statistically *at par* with each other with respect to anthocyanin. The results also elucidate the findings of Wani *et al.* (2007) [12] who observed that the soil application of paclobutrazol increased the amount of anthocyanin (64.85 mg/100g) as compared to control in apple cv. 'Red Delicious'. Jindal and Chandel (1996) [5] reported that the application of paclobutrazol at 500 ppm once at full bloom and repeated at pit hardening stage noted the highest anthocyanin content (0.299 %) compared with control in plum. Anthocyanin in paclobutrazol treated trees may have improved due to more diversion of photosynthates towards the fruits (Rai and Bist, 1992) [8].

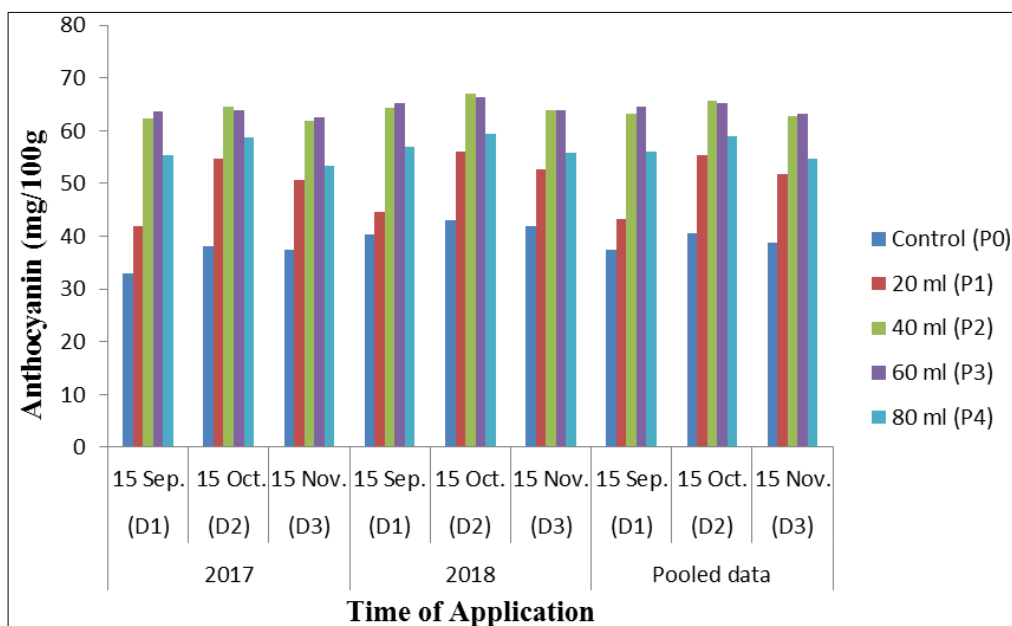
**Table 4:** Effect of paclobutrazol doses and dates of application on anthocyanin (mg/100g) in litchi Cv. Rose Scented.

Time of Application													
Year		2016-17				2017-18				Pooled Mean			
Paclobutrazol (ml/tree)	Doses	15 Sep. (D <sub>1</sub> )	15 Oct. (D <sub>2</sub> )	15 Nov. (D <sub>3</sub> )	Doses	15 Sep. (D <sub>1</sub> )	15 Oct. (D <sub>2</sub> )	15 Nov. (D <sub>3</sub> )	Doses	15 Sep. (D <sub>1</sub> )	15 Oct. (D <sub>2</sub> )	15 Nov. (D <sub>3</sub> )	Doses
	Control (P <sub>0</sub> )	32.86	38.10	37.35	36.10	40.34	43.04	41.82	41.73	37.34	40.57	38.85	38.92
	20 ml (P <sub>1</sub> )	41.88	54.59	50.69	49.05	44.55	55.94	52.79	51.09	43.22	55.27	51.74	50.07
	40 ml (P <sub>2</sub> )	62.32	64.50	61.82	62.88	64.24	66.94	63.91	65.03	63.28	65.72	62.87	63.96
	60 ml (P <sub>3</sub> )	63.76	63.99	62.56	63.44	65.25	66.41	63.80	65.15	64.50	65.20	63.18	64.30
	80 ml (P <sub>4</sub> )	55.33	58.63	53.43	55.80	56.96	59.36	55.75	57.35	56.14	59.00	54.59	56.58
	Mean D	51.23	55.96	53.17	-	54.56	58.34	55.32	-	52.90	57.15	54.24	-

Year	2016-17		2017-18		Pooled Mean	
Treatments	CD at 5%	Sem ±	CD at 5%	Sem ±	CD at 5%	Sem ±
Paclobutrazol (P)	2.95	1.01	3.00	1.03	2.73	0.93



Date of Application (D)	2.28	0.78	2.32	0.79	2.11	0.72
Interactions (PXD)	5.11	1.75	NS	1.78	4.73	1.62



**Fig 1:** Effect of paclobutrazol doses and dates of application on anthocyanin (mg/100g) in litchi Cv. Rose Scented

## Conclusion

From the investigation, it was concluded that different doses of paclobutrazol at varying time intervals reduces the vegetative growth of litchi. Paclobutrazol a plant growth retardant has been reported to be very effective for increasing the Ascorbic acid, Total soluble solids and Anthocyanin. Paclobutrazol applied @ 2.0, 3.0 a.i./meter canopy diameters through soil application method was noted to be more efficient to reducing Titratable acidity. These findings demonstrate the positive effects, no negative effect and most promising commercial applications of paclobutrazol on litchi.

## References

1. AOAC. 1980. Official Methods of Analytical Chemists, 13th ed. (Hortwitz W.ed). Association of Official Chemists. 1980; 33:617-623.
2. Anonymous, Annual report for 2011, NRC on litchi, Mushahari, Muzaffarpur, 2011, 66.
3. Browning G, Kuden A, Blake P. Site of (2RS, 3RS) paclobutrazol promotion of axillary flower initiation in pear cv. Doyenne du Cornice. Journal of Horticulture Science. 1992; 67:121-128.
4. Gomez KA, Gomez AA. Statistical procedures for agricultural Research. John Wiley and Sons Inc. New York, 1983, 357-427.
5. Jindal KK, Chandel JS. Effect of triconanol and paclobutrazol on fruit set, growth and quality of *Prunus salicina*. Indian Journal of Horticulture. 1996; 53(4):262-268.
6. Pereira LS, Pathak P, Mitra SK. Relation between flushing cycles and flowering in different litchi cultivars. Indian Journal of Horticulture. 2005; 62:141-144.
7. Pires MC, Yamanishi OK. Girdling combined with paclobutrazol boosted yield of Bengal lychee in Brazil. Acta Horticulturae. 2014; 1042:189-195.
8. Rai N, Bist LD. Effect of soil and foliar applied paclobutrazol on vegetative growth, flowering, fruit set and yield of ornamental pear (*Pyrus pyrifolia* Burn.). Scientia Horticulturae. 1992; 50:153-158.
9. Ranganna S. Handbook of Analysis and quality control for fruit and vegetable products. Tata Mc Graw-Hill Publishing Company, New Delhi, India, 1986, 780.
10. Steffens GL, Byun JK, Wang SY. Controlling plant growth via the gibberellins biosynthesis system. Growth parameter alterations in apple seedlings. Physiologia Plantarum. 1985; 63:163-168.
11. Vijayalakshmi D, Srinivasan PS. Altering the enzyme activities for enhancing yield in off year mango cv. Alphonso through chemicals and growth regulators. The Orissa Journal of Horticulture. 2000; 28(2):1-7.
12. Wani AM, Peer FA, Lone IA. Effect of paclobutrazol on growth, picking maturity and storage behavior of Red Delicious apples. The Asian Journal of Horticulture. 2007; 2(1):171-175.
13. Webster AD, Quinlan JD. Chemical control of tree growth of plum (*Prunus domestica* L.) preliminary studies with the growth retardant paclobutrazol. Journal of Horticulture Science. 1984; 59:367-375.