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# Effects of paclobutrazol on flowering of juvenile durian trees cv. 'Monthong' and its costs and returns of production

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**Abstract** Application of paclobutrazol 25% WP with foliar spray at 750 ppm or 60 ml/20 L water/tree on juvenile durian trees cv. 'Monthong' for treatment in December 5 (paclobutrazol application) had a significant effect in enhancing flower bud emergence duration faster by 7 days than treatment in November 5 (paclobutrazol application). However, both treatments (November5 and December5) had a very high percentage of flowering ranged from 93.6-97% after flower induction. Application of paclobutrazol for treatment in December 5 contributed to having a high number of flowered branches per tree, high fruit number per tree, high fruit weight per tree and consequently high yield compared with treatment in November5, except one-fruit weight. Although this value was not a significant parameter to determine the high yield. Through stepwise multiple regression analysis, the fruit weight per tree had the most significant influence on yield. The positive coefficient value indicates that by increasing fruit weight per tree, yield also increases. The gross cost of production in both treatments was not significantly different. But, the gross rate of return derived from treatment December5 was significantly higher than from treatment in November5. Treatment in December5 contributed to having mature fruits harvested at the peak season in June, which obtained the selling price higher than treatment in November5 where mature durian fruits harvested at the middle season in May. Therefore, flowering induced by paclobutrazol for treatment in December5 on the juvenile trees of durian cv. 'Monthong' was better than treatment in November5. It accounted for treatment in December5 having a high net profit as indicated by the value of benefit-cost ratio that was greater than 1 suggesting that this treatment can deliver a positive net present value to the producers of the juvenile durian trees and its investors rather than treatment in November5.

**Keywords:** Benefit-cost ratio, Durian, Flowering, Growth retardant, Juvenile

## Introduction

Durian (*Durio zibethinus* Murr.) is a tropical fruit tree, and considered to be a worthy fruit tree with high potential for cultivation in Thailand. Its aril

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contains a number of different bioactive compounds, many of which are beneficial to human health (Ketsa *et al*., 2020). Every 100 g of edible durian fruit contains 156 kcal, 62.5 g water, 2.1 g protein, 3.3 g fat, 29.6 g carbohydrate, 1.4 g crude fiber, 0.9 g ash, 29 mg Ca, 34 mg P, 1.1 mg Fe, 46 µg beta carotene, 8 µg vitamin A, 0.16 mg thiamine, 0.23 mg riboflavin, 2.5 mg niacin, and 35 mg vitamin C2 (Toledo *et al*., 2008). Caffeic acid and quercetin are the dominant antioxidant substances found in durian (Ashraf *et al*., 2011). Durian is well-known as the "King of Fruits" because of its unique intense aroma and its sweet custard-like aril (Subhadrabandhu and Ketsa, 2001). In 2020, the durian growing area in Thailand was 132,362 ha but yielded only 126,586 ha with an average yield of 8.78 t/ha (OAE, 2020). Many durian cultivars are grown in Thailand but 'Monthong' is the most popular (Somsri, 2017), especially in the eastern region where this cultivar is grown commercially. 'Monthong' was the most preferred by domestic consumers (Tiyaratanakura, 1991), due to its full-bodied creamy, mild sweet-tasting aril with relatively moderate smell emitted and smaller seeds (DAT, 2011) and had aborted seeds (Wiangsamut *et al*., 2021). Exports of Thai durian to China have been increasingly consistent as durian is the outstanding fruit dominating the Chinese market (Tantrakonnsab and Tantrakoonsab, 2018). Thailand is the largest durian producer and exporter in the world market, and it generated a higher income from exports in 2019, with a value of approximately 1,345.27 million USD equivalent to an export quantity of 653,564 tons (Thongkaew *et al*., 2021). Durian fruits produced in the provinces of eastern Thailand—Chanthaburi, Rayong, and Trat—are harvested seasonally from April to June. There is a low number of fruits produced at the early season in April; the highest number in May; and again low number in June. The selling price of durian is positively related to the number of fruits. However, its price may fluctuate—high price at the early season in April due to the high demand from buyers but there is a short supply of durian fruits; price drops at the middle season in May due to abundant supply of durian fruits; and price increases again at the peak season in June due to its short supply yet high demand from the buyers. To reach this goal of demand, application of paclobutrazol is the crucial key as it has been extensively adopted in tropical fruit production to induce off-season flowering (Voon *et al*., 1992). Paclobutrazol [(2RS, 3RS)-1-(4-chlorophenyl)-4-4-dimethyl-2-(1H, 1, 2, 4-triazol-1-yl) pentan-3-ol] is a potent growth retardant in many plant species (Rushidah and Razak, 2001). For the mature durian trees, paclobutrazol has been applied for floral induction of durian in Thailand, Malaysia, Indonesia, and Vietnam (Hasan and Karim, 1989; Chandraparnik *et al*., 1992; Rushidah and Razak, 2001; Vorakuldamrongchai *et al*., 2006; Poerwanto *et al*., 2008; Tri *et al*., 2011). Paclobutrazol at 0, 750,

1000, or 1500 ppm was sprayed onto 12-year old 'Chanee' durian trees which had been pruned and managed to stimulate leaf flushing. Treated trees with higher concentrations flowered 14-45 days earlier, which produced the earliest flowering, than unsprayed controls. A continuous dry period of 10-14 days is normally required before flowering is induced, but this was then reduced to 3-7 days after paclobutrazol (PBZ) treatment (Chandraparnik *et al*., 1992). However, there were no significant differences in the flowering or fruiting characteristics of durian trees cv. Chanee sprayed with PBZ at 0, 500, or 1000 ppm, irrespective of the plant part exposed to the chemical (Subhadrabandhu and Kaiviparkbunyay, 1998). The effect of paclobutrazol application on mature trees with girth size of 50 cm were soil drenched with 4 g a.i. paclobutrazol that had significant effect in enhancing the flowering time and flower anthesis of six-year old mature trees clone D24 (Rushidah and Razak, 2001). The application of 1000 ppm paclobutrazol found that all treated trees flowered approximately 9-36 days earlier than the normal in-season flowering, while the late flowering method (foliar-sprayed with 1000 ppm PBZ) delayed flowering after the normal in-season flowering (Jantee *et al*., 2017).

Juvenile durian trees cv. 'Monthong' are trees with the age of 1-5 years old; while mature trees are classified when trees have reached 6 years of age and above due to the natural emergence of floral buds. Yan *et al*. (2021) cited that flowering time is a key transition point from vegetative to reproductive growth. The transition from vegetative to reproductive development of trees, which is accompanied by the production of novel reproductive structures, such as flowers (Amasino, 2010; Andres and Coupland, 2012; Huijser and Schmid, 2011; Wilkie *et al*., 2008). The foliar-sprayed with 750 ppm PBZ to induce the normal in-season flowering and late flowering of juvenile durian trees cv. 'Monthong' have not been studied yet. The late flowering of juvenile durian trees imposed by PBZ should increase the number of durian fruits at the peak season in June, and should be able to enhance the net profit of durian farmers in the Eastern Thailand. Accordingly, the study aimed to evaluate the effects of paclobutrazol on in-season flowering and late flowering of juvenile durian trees cv. 'Monthong' as well as its costs and returns of production.

## Materials and methods

The experiment was done at Rajamangala University of Technology Tawan-Ok Chanthaburi Campus in Chanthaburi, Thailand dated August (2020) – July (2021); with 12.8386 (12°50'18.95928" N) latitude and 102.11484 (102°6'53.41752"E) longtitude, and 49 meters sea level elevation. Temperature at day ranged from 30-32.8 ℃ while it ranged from 22.8-27.8 ℃ at night. The precipitation or rainfall in November-December 2020 and January-April 2021

was low at 51, 16, 33, 40, 95, 131 mm, respectively. The relative humidity ranged from 77-90% at these dry season periods.

The experiment was laid out in a completely randomized design (CRD) with 5 replications (1 tree/replication). Two application periods of paclobutrazol 25% WP with foliar spray at 750 ppm or 60 ml/20 L water/tree when leaves turned from light to dark green on 4-year old durian trees cv. 'Monthong' were the treatments : 1) Treatment in November5 – paclobutrazol application was made in November 5, 2020 to induce the normal in-season flowering in December; and 2) Treatment in December5, paclobutrazol application was made in December 5, 2020 to induce the late flowering in January. These two treatments differed in periods of paclobutrazol application by a 30-day gap.

Ten trees of durian cv. 'Monthong' (1 tree/mound, 8x8 m tree spacing) were selected by similar tree height, canopy diameter, stem girth, branch diameter, and number of branches per tree (Table 1). Tree parameters were: tree height – using a measuring tape attached to a stem of tree from the base of stem on the ground to the tip of tree in a unit of meter (m); canopy diameter – measured from the one edge to the opposite edge of the canopy through the stem's center of tree in a unit of m; stem girth – using a measuring tape at one-meter high of the stem girth above the ground level in a unit of centimeter (cm); branch diameter – measured at a position of 50 cm branch length extended from the stem by a vernier caliper in a unit of cm; total number of branches per tree – all branches extended from the stem in each tree, counted and recorded in a unit of number (No.).

**Table 1.** Tree height, canopy diameter, stem girth, branch diameter, and total number of branches per tree of juvenile durian trees cv. 'Monthong'

| Application period of paclocbutrazol | [1/]Tree height (m) | Canopy diameter (m) | Stem girth (cm) | Branch diameter (cm) | Total number of branches per tree (No.) |
|---|---|---|---|---|---|
| Treatment November5 | 6.84a | 5.84a | 77.60a | 4.80a | 26.8a |
| Treatment December5 | 6.84a | 6.08a | 73.16a | 4.63a | 30.6a |
| CV.(%) | 6.25 | 3.36 | 7.75 | 7.88 | 12.9 |

[1/]in the column of treatment means with the same letter is not significantly different at 0.05 probability level (LSD)

Tree parameters after application of paclobutrazol were as follows: flower bud emergence duration – counted from the day of foliar spraying with paclobutrazol 25% WP to the 100% flower bud emergence day in a unit of days (d); anthesis duration – counted from the 100% flower bud emergence day to the day of full expansion of a flower in a unit of days (d); fruit maturity

duration – counted from the day of anthesis (full bloom of flowers) to the day of mature fruits in trees in a unit of days (d); percentage of flowering – computed from the number of flowered branches per tree multiplied by a hundred then divided by the total number of branches per tree in a unit of percent (%); number of flowered branches per tree – counted all flowered branches in each tree after induction and recorded in a unit of number (No.); flowers were not thinned while fruits with poor shape, disease symptoms or insect attacks were removed after fruit setting at 6-8 weeks after anthesis, fruit number per tree were the remaining fruits with good shape and standard size of 2-6 kg/fruit and an appropriate fruit number per tree of 22-30 No. at fruit maturity stage; all harvested fruits in this stage were cut, counted, and recorded for the fruit number per tree in a unit of No.; one-fruit weight – the weight of an individual durian fruit including its peduncle after harvest, weighed in a unit of kilogram (kg); fruit weight per tree – combined weight of all fruits harvested from each tree, weighed and recorded in kg; yield – fruits at maturity stage from all five durian trees in a 320 $m^2$ area in each treatment, weighed and recorded in kg per unit area and then converted in a unit of ton per hectare (t/ha).

Costs and returns of production were based on 4-year and 7-month investment and data gathered were: gross cost of production – all expenditures counted from the first year of planting until harvest time in a unit of US dollar per hectare (USD/ha); gross rate of return – total rate of return on an investment received from fresh fruits sold in the market and recorded in USD/ha based on buying price at that period; net profit or net loss – the value of gross rate of return minus the value of gross cost of production in USD/ha; benefit-cost ratio (B/C ratio) – the ratio of the gross rate of return to the gross cost of production.

Software Statistix 7 (SXW) was used to analyse all parameters including costs and returns of production. Means comparisons were done using the least significant difference (LSD) at the 0.05 probability level. Relationships of yield with all tree parameters were determined through stepwise multiple regression analysis.

## Results

### *Flower bud emergence duration, anthesis duration, fruit maturity duration, percentage of flowering, number of flowered branches per tree, and fruit number per tree, one-fruit weight, fruit weight per tree, and yield*

Flower bud emergence treatment in December5 was significantly faster by 7 days than treatment in November5, as indicated by the value of flower bud emergence duration (Table 2). Anthesis duration and fruit maturity duration did

not change significantly between the two treatments. Percentage of flowering was 97% and 93.6% treatments in November5 and December5, respectively (Table 2). Treatment in December5 tended to be slightly high number of flowered branches per tree (28.6 No.), high fruit number per tree (29.4 No.), high fruit weight per tree (91.88 kg), and high yield (14.33 t/ha) while those values (26 No., 22.4 No., 76.42 kg, and 11.92 t/ha, respectively) tended to be low in treatment November5 (Tables 2 and 3), except one-fruit weight. This value (3.41 kg) tended to be slightly heavy when the fruit number per tree was low in treatment November5, but the one-fruit weight (3.15 kg) tended to be light when there was more fruit number per tree treatment in December5. All measured values of tree parameters—percentage of flowering, number of flowered branches per tree, fruit number per tree, one-fruit weight, fruit weight per tree, and yield—though did not change significantly between the two treatments (Tables 2 and 3).

**Table 2.** Flower bud emergence duration, anthesis duration, maturity duration, percentage of flowering, and number of flowered branches per tree of juvenile durian trees cv. 'Monthong'

| Application period of paclocbutrazol | [1/]Flower bud emergence duration (d) | Anthesis duration (d) | Maturity duration (d) | Percentage of flowering (%) | Number of flowered branches per tree (No.) |
|---|---|---|---|---|---|
| Treatment November5 | 39a | 38a | 118a | 97.0a | 26.0a |
| Treatment December5 | 32b | 36a | 117a | 93.6a | 28.6a |
| CV.(%) | 5.6 | 6.1 | 1.19 | 4.1 | 13.0 |

[1/]in the column of treatment means with the same letter is not significantly different at 0.05 probability level (LSD)

**Table 3.** Fruit number per tree, one-fruit weight, fruit weight per tree, and yield of juvenile durian trees cv. 'Monthong'

| Application period of paclocbutrazol | [1/]Fruit number per tree (No.) | One-fruit weight (kg) | Fruit weight per tree (kg) | Yield (t/ha) |
|---|---|---|---|---|
| Treatment November5 | 22.4a | 3.41a | 76.42a | 11.92a |
| Treatment December5 | 29.4a | 3.15a | 91.88a | 14.33a |
| CV.(%) | 19.7 | 9.49 | 18.28 | 18.28 |

[1/]in the column of treatment means with the same letter is not significantly different at 0.05 probability level (LSD)

***Gross cost of production, gross rate of return, net profit or net loss, and benefit-cost ratio (B/C ratio)***

Gross cost of production in treatment December5 was slightly higher than treatment in November5 as a result of high yield of the former treatment which incurred more expenses on harvest, hauling, and transportation, although the gross cost of production was not significantly different between the two (Tables 3, 4, and 5). Gross rate of return derived from treatment December5 was significantly higher than treatment in November5 (Tables 4 and 5). Treatment in December5 gained profitability as indicated by the value of the net profit of 21,401 USD/ha, while treatment in November5 was not profitable as indicated by the value of the net loss of 3,890 USD/ha. Treatment in December5 was significantly better as measured by the value of the benefit-cost ratio (B/C ratio) that was greater than 1 indicating more profit, while it was less than 1 indicating loss of treatment in November5 (Tables 4 and 5).

**Table 4.** Gross cost of production, gross rate of return, net profit or net loss, and benefit-cost ratio (B/C ratio) of juvenile durian trees cv. 'Monthong'

| Application period of paclocbutrazol | [1/]Gross cost of production (USD/ha) | Gross rate of return (USD/ha) | Net profit/ net loss (USD/ha) | B/C ratio |
|---|---|---|---|---|
| Treatment November5 | 44,024a | 40,134b | -3,890b | 0.91b |
| Treatment December5 | 44,393a | 65,794a | 21,401a | 1.48a |
| CV.(%) | 1.76 | 4.24 | 25.37 | 4.32 |

[1/]in the column of treatment means with the same letter is not significantly different at 0.05 probability level (LSD)

## Discussion

Flower bud emergence for treatment in December5 took place in January 6, 2021 (relating to the late flowering in January) or 32 days after application of paclobutrazol (DAAP) while treatment in November5 occurred in December 14, 2020 (relating to the normal in-season flowering in December) or 39 DAAP. The anthesis treatment in December5 took place in February 11, 2021, or 36 days after flower bud emergence (DAFBE) or 68 DAAP, whereas treatment in November5 occurred in January 21, 2021, or 38 DAFBE or 77 DAAP. Durian fruits of treatment in December5 matured in June 8, 2021 (mature fruits of durian cv. 'Monthong' at the peak season in June), or 117 days after anthesis (DAA) or 185 DAAP, while treatment in November5 which matured in May 19, 2021 (mature fruits of durian cv. 'Monthong' at the middle season in May), or 118 DAA or 195 DAAP.

**Table 5.** Simple costs and returns analysis derived from a 4-year and 7-month investment on the juvenile durian trees cv. 'Monthong' after flowering induced by paclobutrazol

| Items | | Total (USD/ha) | |
|---|---|---|---|
| | | Application time of paclocbutrazol | |
| Expenses | | [1/] Treatment November5 | Treatment December5 |
| 1 | Land leveling and plow area | 153 | 153 |
| 2 | Sandy loam soil (82 containers of 6-wheel truck) | 1,617 | 1,617 |
| 3 | Preparation of mounds for planting (156 mounds) | 1,224 | 1,224 |
| 4 | Preparation of planting holes (156 holes) together with planting seedlings | 120 | 120 |
| 5 | Caretaker (1 manpower) | 16,529 | 16,529 |
| 6 | Harvest, hauling and transportation (0.153 USD/kg of fruit weight) | 1,824 | 2,193 |
| 7 | Seedlings of durian cv. 'Monthong' | 957 | 957 |
| 8 | Biofungicide, pesticide, insecticide, and herbicide | 2,870 | 2,870 |
| 9 | Vermicompost and chemical fertilizers | 8,992 | 8,992 |
| 10 | Paclobutrazol | 77 | 77 |
| 11 | Fuel and agricultural equipment maintenance | 7,748 | 7,748 |
| 12 | Land rental payment | 1,913 | 1,913 |
| Gross cost of production ……..(1) | | 44,024 | 44,393 |
| Gross rate of return ……..….(2) | | 40,134 | 65,794 |
| Net profit or Net loss = (2) – (1) | | -3,890 | 21,401 |
| Benefit-cost ratio (B/C ratio) = (2) ÷ (1) | | 0.91 | 1.48 |

[1/]in the column, there were 156 trees/ha for durian cv. 'Monthong'. Yields were 11,920 kg/ha and 14,330 kg/ha when pacloburazol application was made on November 5, 2020 and December 5, 2020, respectively. Selling prices were at 3.37 USD/kg and 4.59 USD/kg when pacloburazol application was made on November 5, 2020 and December 5, 2020, respectively.

The paclobutrazol application in treatment December5 had a significant effect in enhancing flower bud emergence than in treatment November5; the emergence duration was faster due to the experimental area at Rajamangala University of Technology Tawan-Ok Chanthaburi Campus in Chanthaburi, Thailand in December had a long dry period, or more dry period, which consequently led to induce flowering faster as indicated by the monthly amount of rainfall during the dry season. The results agreed with Sakhidin *et al*. (2019) who reported that the application of paclobutrazol in August induced flowering faster than in June and July accounting for the experimental area in Pageralang village, Kemranjen district, Banyumas regency Central Java, Indonesia having more dry period. This indicates that more, or long, dry period consequently lead

to induce flowering faster. Sakhidin *et al*. (2019) furthermore revealed that application of paclobutrazol induced flowering of Kani faster than 'Monthong' when the mature trees durian cvs. 'Kani' and 'Monthong' were at 10 years old. 'Kani' has higher total number of flower, number of flower panicle, and number of young fruits. The effect of application time of paclobutrazol on flowering of durian was not effected by cultivars though. Beside that, 'Kani' showed higher number of flower panicle and total number of flower compared to 'Monthong'. Higher number of total flower led to higher number of young fruit, but fruitset is not significantly different between 'Kani' and 'Monthong'. However, the fruit set of mango cv. 'Nam Dok Mai' only slightly increased by paclobutrazol treatments and no paclobutrazol chemical residues were detected in the mature fruits (Subhadrabandhu *et al*., 1999). Mabvongwe *et al*. (2016) discussed that the most ideal time of paclobutrazol application is approximately 2 to 3 months before actual flowering date. In mango fruits, application of paclobutrazol should be carried out at least 3 months before expected flowering season to get profuse flowering and fruiting. Similarly, paclobutrazol was found to be effective to induce flowering in 'Dashehari' mango even in off year by inhibiting gibberellins biosynthesis pathway (Singh and Bhattacherjee, 2005); by inhibiting the conversion of ent-Kaurene to ent-Kaurenoic acid and without any negative effect on soil health (Singh *et al*., 2005). This inhibition results in slow cell division and elongation without causing toxicity to cells (Mabvongwe *et al*., 2016).

Application of paclobutrazol both in November5 and December5 treatments had a very high percentage of flowering ranged from 93.6-97.0%. Similar to the findings of Subhadrabandhu *et al*. (1999), flowering ratio in the mango trees cv. 'Nam Dok Mai' subjected to all the paclobutrazol treatments was higher than that of the control. Jantee *et al*. (2017) adduced that the late flowering method in durian production delayed flowering by 28-43 days after the normal in-season flowering. Likewise, Hau and Hieu, (2017) cited that flowers of 'Monthong' cultivar appear from 30-35 days after floral induction or longer when farmers induce durian flowering by applying a combination of treatments including plastic mulching of the raised beds, ditch drainage within 30-40 days, and foliar spray of paclobutrazol (PBZ) at 1000 and 1500 ppm when the leaves turn from light to dark green (2-3 months old). The period of emergence of inflorescence buds and the flowering ratio vary depending on cultivar, climate, and the extent of drought conditions. Similarly, the effect of paclobutrazol application on six-year old durian trees clone D24, mature trees, with girth size of 50 cm were soil drenched with 4 g a.i. paclobutrazol. This application of paclobutrazol had significant effect in enhancing the flowering time and flower anthesis of mature trees (Rushidah and Razak, 2001). In

contrast, the application of paclobutrazol had significant effect in shortening flower bud emergence duration but no significant effect in enhancing anthesis duration of juvenile trees of durian cv. Monthong in both treatments in November5 and December5.

Application of paclobutrazol treatment in December5 on juvenile durian trees cv. 'Monthong' had slightly high number of flowered branches per tree, high fruit number per tree, high fruit weight per tree due to their slightly higher number of branches per tree before inducing flowering that resulted in a high yield after flower induction compared with treatment in November 5. Furthermore, through stepwise multiple regression analysis, the fruit weight per tree had the most significant influence on yield. The fruit weight per tree was the only parameter that significantly determined yield as explained by the following multiple regression equation.

$$\text{Yield} = 0.47131 + 5.819\text{E-}04\ (\text{fruit weight per tree}) \qquad (1)$$

$$R^2 = 1.00^*$$

Fruit weight per tree explains the 100% of the yield as indicated in equation (1). The positive coefficient value indicates that by increasing fruit weight per tree, yield also increases. Fruit maturity duration was not affected by the two application periods of paclobutrazol (treatment in November5 and treatment in December5). Rushidah and Razak (2001) supported that fruit maturity time, mean fruit weight, and incidence of uneven fruit ripening were not significantly affected by the time of paclobutrazol application. Jantee *et al*. (2017) also agreed that in the induction of late flowering the following treatment was applied 16-16-16 fertilizer in the dry period, continued watering over the in-season flowering period until physiological mature leaves were produced, which were foliar-sprayed with 1000 ppm PBZ, to induce flowering about 30 days after normal in-season flowering as compared with normal in-season flowering. The normal in-season flowering treatment had 4614 flowers/tree, 26 fruits/tree, 93.43 kg fruit/tree and fruit weight 3.86 kg/fruit. The late flowering method delayed flowering by 28-43 days after the normal in-season flowering. These results suggested that the marketable period of durian could be extended by 28-43 days by this flower induction method, which was later than the normal bearing time. Hau and Hieu (2017) relayed that durian can be induced to flower year-round.

Considering the 4-year and 7-month old 'Monthong' durian investment, the gross cost of production for treatment in December5 was slightly higher than that treatment in November5 by 369 USD/ha. However, the gross rate of return was significantly higher than treatment in November5 by 25,660 USD/ha. But because mature durian fruits of treatment in December5 were harvested in June, the peak season in Eastern Thailand, producers obtained a

selling price (4.59 USD/kg) appreciably higher than treatment in November 5 where mature fruits were harvested at the middle season in May. 'Monthong' durian producers therefore gained a net profit when the 4-year old juvenile durian trees were induced by paclobutrazol in treatment in December5. On the other hand, the selling price (3.37 USD/kg) was low in treatment in November5 due to the gross rate of return was consequently lower than the gross cost of production hence, producers were in loss or, investment was not feasible. Flowering induced by paclobutrazol for treatment in December5 was consequently better than treatment in November 5 as indicated by the value of the benefit-cost ratio (B/C ratio) that was greater than 1. Bangchaud (2001) and Wiangsamut *et al*. (2013) recommended that most investors would select a project that could gain net profit based on the value of B/C ratio. The value of B/C ratio determines the feasibility of the investment: more than 1 could mean that the project is more feasible; equal to 1 could mean that the project is still feasible; whereas the value is less than 1 could mean that it is not feasible for investment because of a possible loss.

In conclusion, the application of paclobutrazol 25% WP with foliar spray at 750 ppm or 60 ml/20 L water/tree on juvenile durian trees cv. 'Monthong' for treatment in December5 (paclobutrazol application) had a significant effect in enhancing flower bud emergence duration faster by 7 days than treatment in November5 (paclobutrazol application). There was a very high percentage of flowering in both treatments (November 5 and December 5) after flower induction. Application of paclobutrazol for treatment in December 5 was therefore better than treatment in November5 accounted for it having a high number of flowering branches per tree, high fruit number per tree, high fruit weight per tree, high yield, and high net profit. A high net profit was indicated by the value of benefit-cost ratio that was greater than 1 suggesting that the treatment in December 5 can deliver a positive net present value to the producers of the juvenile durian trees and its investors.

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