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Flowering of Two Cultivras of Durian (*Durio zibethinus* Rumph. ex Murray) Treated by Paclobutrazol

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Abstract

The research aimed to know the effect of application time of paclobutrazol on flowering of two cultivars of durian (Durio zibethinus Rumph. ex Murray). Experiement was conducted in Pageralang village, Kemranjen district, Banyumas regency Central Java, Indonesia by using durian tree of 10 y.o. The treatments were application time of paclobutrazol (June, July, and August) and cultivars (Kani, Monthong). Each treatment was replicated four times, so there were 24 trees of durian. Observed variables were time of flowering, percentage of flowery branch, total number of flower, number of flower panicle, number of young fruits, and fruitset. The results of research showed that application of paclobutrazol in August induced flowering faster than application in June and July. Application of paclobutrazol induced flowering of Kani faster than Monthong. 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 varieties.

Keywords: Application time, Cultivar, Durian, Flowering, Paclobutrazol

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1. Introduction

Durian (*Durio zibethinus* Rumph. ex Murray) is a tropical fruit with very specific aroma and taste. The importance of this fruit is mostly connected with its composition and antioxidant properties [1]. Every 100 g of edible durian fruit contain 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. Ashraf et al reported that caffeic acid and quercetin were the dominant antioxidant substances found in durian [1, 2].

In Indonesia, total consumption and price of durian fruit are predicted to increase continuously so it is prospective to cultivate commercially. Nevertheless, this “the king of fruit” is seasonary flowering and fruiting. This characteristic leads to limite the harvesting

period of durian. The harvesting period of durian fruit in Java, Indonesia was generally take place in December to March [3, 4]. In other months, durian plant is not flower, so there was very little supply of durian fruit in market. To sufficiency this fruit for consumers, durian fruits were generally brought about from other islands or other countries.

One of efforts to self sufficiency of durian consumption is by application of off-season fruit production technology. There are some methods to induce flowering durian plant for off-season fruit production, one of them is application of paclobutrazol. Paclobutrazol [(2RS, 3RS)-1-(4-chlorophenyl)-4-4-dimethyl-2-(1, 2, 4-triazol-1-yl) pentan-3-ol] is a potent growth retardant in many plant species [5]. Davenport said that paclobutrazol is considered as one of the important plant growth retardants which restricts vegetative growth and induces flowering in many fruit species [6].

Paclobutrazol has been found effective to induce flowering in Dashehari mango even in off year by inhibiting gibberellins biosynthesis pathway [7], namely by inhibition the conversion of ent-Kaurene to ent-Kaurenoic acid and without any negative effect on soil health [8]. This inhibition results in slow cell division and elongation without causing toxicity to cells [9].

Klinac et al. reported that all cultivars of nashi or Asian pear (*Purus serotina* Rehd) showed a significant reduction in vegetative growth with in the first season and for up to 4 yr after initial application of paclobutrazol [10]. Paclobutrazol is absorbed by roots and translocated in the xylem only, toward the branch tips, with little or no phloem mobility [9]. Application of this growth retardant can increase carbohydrate content of various plant tissues [11, 12]. Increasing paclobutrazol concentration resulted in significantly increased total leaf chlorophyll content [13].

Saxena et al. reported that application of paclobutrazol enhanced the catalase and peroxidase activities over the untreated control, so it induced flowering in mango [14]. Chandraparnik et al. reported that paclobutrazol application induced flowering in durian trees [15]. This growth retardant had effectively induced flowering in 3 y.o. immature durian trees. Sakhidin and Suparto reported that application of paclobutrazol cause durian plant to flower earlier, increase the number of flowers and young fruits [4]. Beside that, content of gibberrelin in leaf was lower by application of paclobutrazol but content of kinetin was higher.

Time of paclobutrazol application is a factor that determines the effectiveness of paclobutrazol application to induce the flowering of durian. This time is related with local climate particularly rain fall. Rain fall influence water content in soil and it determine water stress status in plant for inducing durian plant flowering. This research aimed to study the effect of application time of paclobutrazol on flowering of two varieties of durian.

2. Materials and Method

The experiment was conducted in Pageralang village, Kemranjen district, Bayumas regency, Central Java, Indonesia from March until November 2015. This experiment used 10 yr old durian trees. All of durian trees were get the same standard techniq cultivatiaon. The samples of durian trees have uniformity in trunk diameter, canopy size, and plant height. They have average trunk diameter, canopy diameter, and plant height of 22 cm $\pm$ 3 cm, 7 m $\pm$ 0.5 m, 9 m $\pm$ 1 m respectively.

There were two examined factors namely cultivars (Monthong, Kani) and application time of paclobutrazol (June, July, and August). First, paclobutrazol (traded as Cultar,) 6.0 mL was diluted in 6.0 L of sterile water then it was applied to the soil surface under the tree canopy. Paclobutrazol was applicated two times by time interval of 1 wk observed variables were flowering date, percentage of flowery branch, total number of flower, number of flower panicle, number of young fruits, and fruitset. Data was analysed by F test and HSD test 5 %.

3. Results and Discussion

Table 1 showed that application time of paclobutrazol influenced flowering date, total number of flower, number of flower panicle, number of young fruits, and fruitset. Application of paclobutrazol in August induced flowering of durian faster (34.4 d after paclobutrazol application = DPA) compared to application in July (42.9 DPA) and June (51.3 DPA). Tropical crops like durian need water stress for certainly period to induce the flowering. In August, durian plants have get more dry period compared to the previous months (Fig. 1), so application of paclobutrazol in August lead to induce flowering faster. This result is similar with what reported by Rushidah and Razak [5]. The most ideal time of paclobutrazol application is approximately 2 mo to 3 mo before actual flowering date. In mango, application of paclobutrazol should be carried out at least 3 mo before expected flowering season to get profuse flowering and fruiting [9].

Application of paclobutrazol in June showed the highest number of flower panicle. The highest number of flower panicle lead to the highest total number of flower and number of young fruits. The highest fruitset (17.00 %) is achieved by application of paclobutrazol in August. Rushidah and Razak said that there must be some other factors that can influence flower bearing and fruit development using paclobutrazol, such as climatic factors especially rainfall [5]. Environmental conditions can alter the effectiveness of paclobutrazol, particularly when applied as a soil treatment [16]. Kubota

et al. said that drought conditions are very important to increase C/N rato for promoting flower bud differentiation [17]. The similar statement was reported by Honsho et al., water stress may be essential for tropical and subtropical fruit to induce floral initiation [18].

Table 1: Effect of paclobutrazol application time on flowering of durian.

Treatments	Flowering date (DPA*)	Percentage of flowery branch	Total number of flower	Number of flower panicle	Number of young fruits	Fruitset (%)
Time of paclobutrazol application**						
June	51.3 a	44.5 a	299.13 a	25.88 a	36.13 a	11.78 b
July	42.9 b	30.9 a	217.88 b	20.88 a	17.75 c	8.00 c
August	34.4 c	40.1 a	143.25 c	18.75 b	24.63 b	17.00 a
Cultivars***						
Kani	40.0 b	48.0 a	313.92 a	28.83 a	35.25 a	11.02 a
Monthong	45.7 a	29.0 a	126.25 b	14.83 b	17.08 b	13.32 a
*= days after paclobutrazol application						
** = Means followed the same letter within each treatment are not significantly different (DMRT; 5 %)						
*** = Means followed the same letter within each treatment and cultivar are not significantly different (t-test; 5 %)						

Kani is induced by paclobutrazol application to flower faster than Monthong, so it can be recommended to use this cultivar for off-season durian production. Beside that, Kani showed higher number of flower panicle and total number of flower compared to Monthong. Higher number of total flower lead to higher number of young fruit, but fruitset is not significantly different. Sobir and Napitupulu stated that Kani and Monthong can produce 20 to 50 fruits per tree [19]. Beside that, both cultivars can flower sometimes in a year [3].

Kani and Monthong are two most familiar cultivars of durian particularly in Indonesia. They have good taste and flavor for Indonesian. These cultivars were well adapted and cultivated by farmers in Indonesia for along time. There are many trees that have about 20 yr old or more. They still growth, health, and produce durian fruits although the weight and number of fruits per tree is low compared to younger trees.

The result of this research give an alternative in durian cultivation. By application of paclobutrazol in appropriate time, durian plant can flower and fruit for off-season production. Off-season production will stabilize the price and supply durian fruit in market.

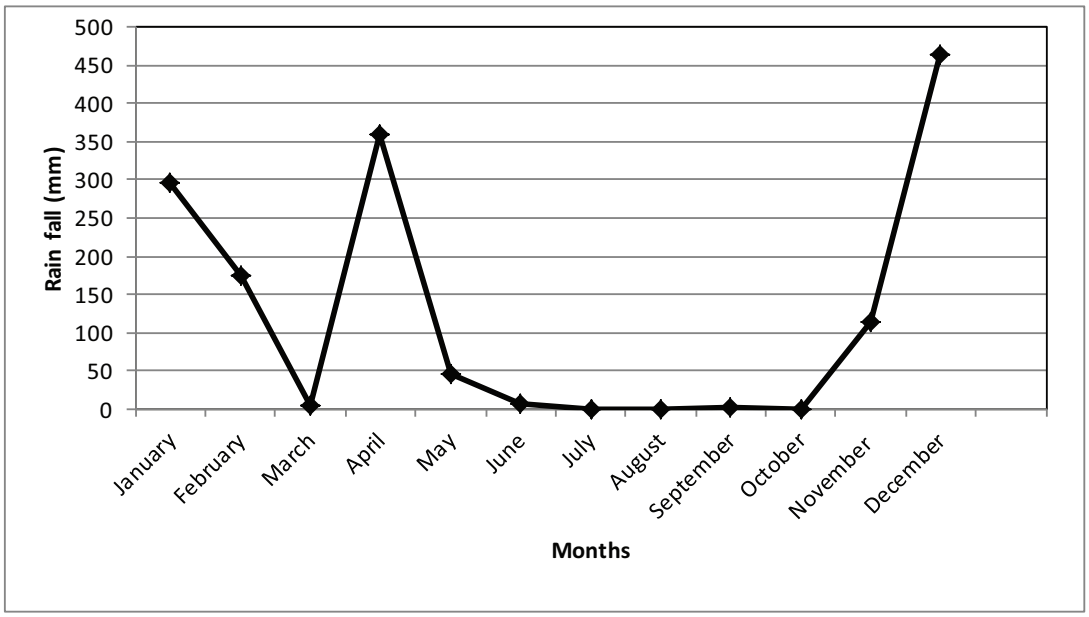

Figure 1: Rain fall at the location of research in 2015.

4. Conclusion

Application of paclobutrazol in August induced flowering on durian plant faster compared to application in June and July. Kani is a cultivar of durian that suitable for off-season durian production.

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