

The Effect of Photoperiod to Break Dormancy of Porang's (*Amorphophallus muelleri* Blume) Tuber and Growth

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ABSTRACT

The aim of the research was to obtain the method of porang's tuber dormancy breaking. The source of porang's tuber were obtained from Rejosari Village, Bantur Subdistrict, Malang Regency. The diameter and weight of porang's tuber were 5-7 cm and 100-150 g respectively. The research design was Completely Randomized Design. Porang's tubers were stored in the photoperiod cabinet during one month. The levels of photoperiod were 0, 8, 12, 16, 20, and 24 hours/day. The light intensity of TL lamp was 400 lux. As a control, it was used porang's tuber that it was placed in the dark cabinet without light. The study was repeated four times. The success of dormancy breaking was observed through the tuber capacity to grow that it was identified by bud emerged. Data were analyzed by ANOVA that it was continued by Duncan test ($\alpha=0.05$). The results showed that photoperiod 8, 12, 16, 20, and 24 hours/day during one month could stimulate porang's tuber dormancy breaking. Photoperiod 16 hours/day emerged the height of buds 4.97 ± 1.20 mm and the diameter of buds 7.28 ± 1.22 mm at photoperiod 24 hours/day. The growth of porang's tuber which is treated by photoperiod during one month were significantly different with control. Photoperiod 16 hours/day emerged the height of plants, and the diameter of petiole were 106.38 ± 15.11 cm and 2.90 ± 0.29 mm respectively, while the width of the canopy was 72.50 ± 22.17 cm at photoperiod 24

hours/day. Besides, the diameter and weight of harvest tuber were 7.93 ± 2.20 cm and 383.20 ± 23.58 g. The weight of harvest tuber increased 255% from the early weight of tuber. Photoperiod treatment promotes breaking of porang's tuber dormancy.

Keywords: *Amorphophallus muelleri*; bud; dormancy; photoperiod; tuber.

INTRODUCTION

Porang (*Amorphophallus muelleri*) or iles-iles is an annually plant that is grouped in Araceae. False stem is an upright, soft, smooth, green color and white spot. At the junction of false stem or petiole, appears brownish bulbils as a vegetative reproduction of porang (Anonymous, 2001; Jansen et al., 1996; Pitojo, 2007). Porang bulbs have high economic value due to its glucomannan; it is exported to Japan. In Indonesia porang wild growing in the forest, in East-Java porang are cultivated in Klangon Village, Saradan District, Madiun Regency and also in Nganjuk Regency. The price of porang's tubers is around IDR 10,000/kg, but in Japan, it is very expensive that can reach IDR 200,000/kg. Porang's tubers in Japan are processed to food such as nutritious noodle and gelatin. Based on research, porang's tubers contain high fiber, glucomannan (a substance which is derived from carbohydrate/polysaccharide) 20-65% which is excellent to dietary health (Anonymous, 2001; Anonymous, 2002).

The demand of porang's tubers is high, but it does not follow by the availability of porang's germs including seeds, bulbil, and tubers. The problem is the dormancy

phenomenon or rest phase in porang's seeds, bulbils, and tubers. After harvesting, porang's tubers can not grow emerging shoot immediately, it need 5-6 months after dormant to grow new shoot (Sumarwoto, 2004, 2005; Indriyani, 2011). Dormant phase in porang is a problem of porang cultivation, and cause low porang's tubers production. Tubers or bulbils or seeds can grow after they pass the specified season. Some of the environmental factors such as photoperiod can break dormancy of tubers, bulbils, and seeds, also plant's growth. Some research showed that photoperiod treatment promotes sprouting in bulbs of onion and potato.

Dormancy phase is caused by the physiology of porang that prevent to form new shoot. Breaking dormancy of grain is the effort to short the juvenile phase in plant through low-temperature treatment (vernalization), light intensity, and light day duration (photoperiod). According to Amasino (2010), the signal of photoperiod transfer to *Shoot Apical Meristem* (SAM) and it is responded as a florigen. So, the analogy is the photoperiod can use to break dormancy of porang's tubers. Hope, the application of light's day duration to porang's tuber can break porang's dormant phase. Then, porang's tuber can plant continuously without dormant phase, and there is a guarantee of availability of porang's tuber. As a results, the cultivation of porang will rise and the production of porang's tubers will be optimal.

MATERIALS AND METHODS

The experimental design was conducted by Completely Randomized Design, repetition was four times. Porang's tubers were treated by storage them in the

photoperiod cabinet. The photoperiod treatments were 0, 8, 12, 16, 20, 24 hours/day, light intensity was 400 lux, distance light source from research object was 50 cm. It was carried out during 1 month, and then it was planted along vegetative phase during 6 months until the plants fall. As a control (photoperiod treatment 0 hour/day), it was used porang's tubers that were stored in the dark cabinet. Growth variables including height and diameter of bud, the height of the plant, the diameter of the petiole, the width of the canopy, also diameter and weight of harvest tuber. Measuring variables by using digital caliper and roll meter at the end of observation, except the weight of harvest tuber using digital balance. Data were analyzed by ANOVA and were continued by Duncan test ($\alpha=0.05$).

RESULTS AND DISCUSSION

Effect of Photoperiod to Height and Diameter of Bud

Duration series of photoperiod can break dormancy of porang's tubers. Although the height and diameter of bud varies among duration of photoperiod treatments, but it was not significantly different. The treatment of photoperiod 16 hours/day emerged the highest height of bud, it was 4.97 ± 1.20 mm. The treatment of photoperiod 8, 12, 20, and 24 hours/day emerged height 4.07 ± 0.82 ; 4.59 ± 0.77 ; 4.18 ± 1.20 ; and 4.41 ± 1.16 mm respectively. The treatment of photoperiod 24 hours/day emerged the widest diameter of bud, it was 7.28 ± 1.22 mm. The treatment of photoperiod 8, 12, 16, and 20 hours/day emerged diameter 6.14 ± 1.10 ; 7.11 ± 0.95 ; 7.25 ± 1.54 ; and 6.28 ± 0.98 mm respectively (Figure 1 and 2).



Figure 1. Dormancy Breaking of Porang's Tuber on Several Duration of Photoperiod Treatment.

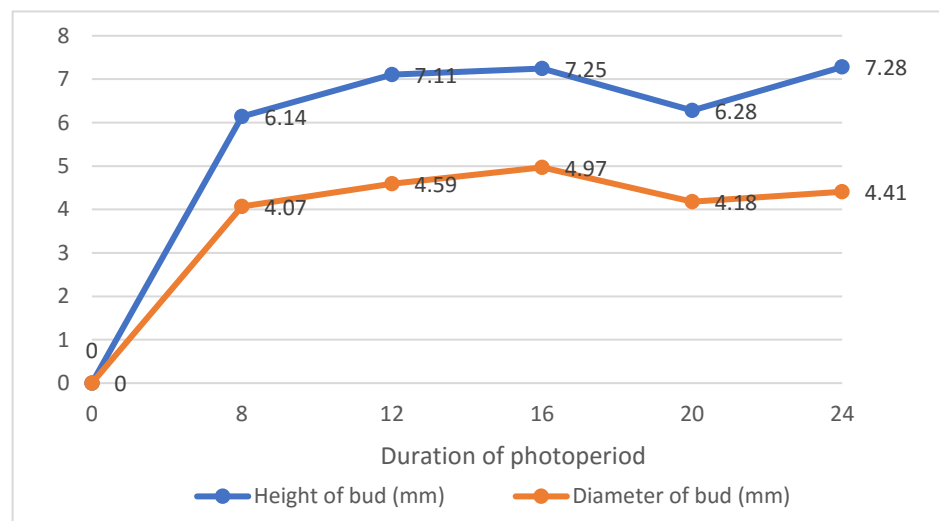


Figure 2. The Height and Diameter of Bud as A Respond of Dormancy Breaking of Porang's Tuber on Several Duration of Photoperiod Treatment.

Effect of Photoperiod on Diameter of Petiole, Height of Plant, and Width of Canopy.

The response of plant growth to the photoperiod were varied among the treatment. Although there was variation of diameter of the petiole, the height of the plant, and width of canopy among duration of photoperiod treatments, it was not significantly different. The treatment of photoperiod 16 hours/day emerged the highest height of the plant, it was 106.38 ± 15.11 cm, and the biggest diameter of petiole was 2.90 ± 0.29 cm. The treatment of photoperiod 24 hours/day emerged the largest width of the canopy, it was 72.50 ± 22.17 cm; the largest diameter of harvest tuber, it was 7.93 ± 22.17 cm; and the biggest weight of harvest tuber, it was 383.20 ± 23.58 g (Figure 3, 4, 5).

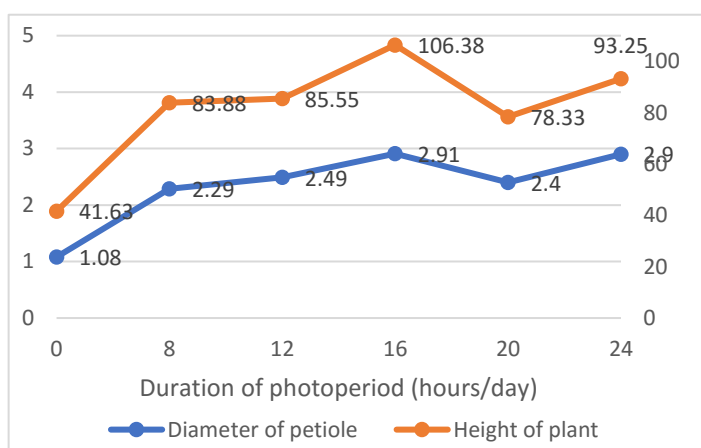


Figure 3. The Height and Diameter of Bud As a Respond of Dormancy Breaking of Porang's Tuber on Several Duration of Photoperiod Treatment.

In fact, the treatment of photoperiod 20 hours/day emerged the same growth performance among the variables, it slightly decreased than other photoperiod treatments. The response of control was the worst performance.

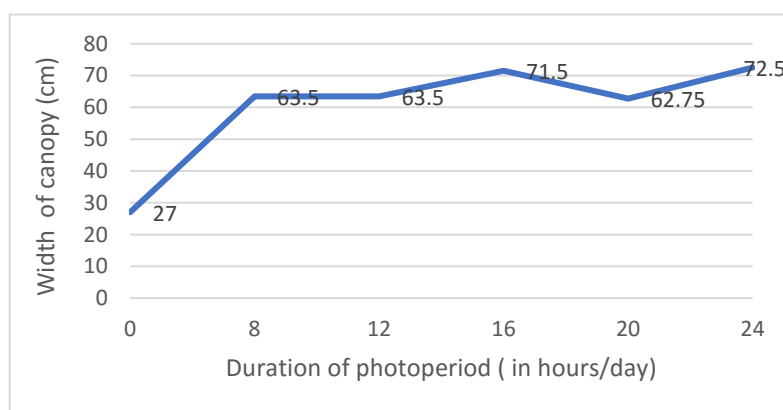


Figure 4. The width of canopy as a respond of dormancy breaking of porang's tuber on several duration of photoperiod treatment.

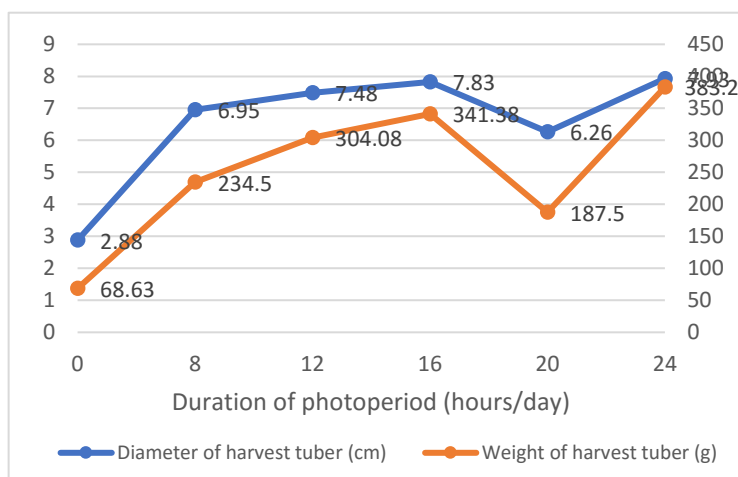


Figure 5. The Diameter and Weight of Harvest Tuber as A Respond of Dormancy Breaking of Porang's Tuber on Several Duration of Photoperiod Treatment.

Photoperiod influence vegetative grows of the plant, such as bulb formation, root branch formation, leaf shape, pigment formation, epidermal hair formation, root development, seed dormancy, and senescence (Stirling et al., 2002). In plant's organ, there is phytochrome, it is a protein which captures light called photoreceptor. Sunlight which is absorbed by phytochrome is red (De Jong et al., 1981). According to Sysoeva et al. (2010) that light influence the endogenous auxin metabolism, it is induced cells division and control plant growth and development via photosynthesis and photo morphogenesis regulation. Continuously photoperiod (24 hours/day) will decrease photosynthesis activity, producing oxidative stress on plant tissue, disrupting electron transport chain, and increasing reactive oxygen that damage chloroplast ultrastructure. Finally, this condition will cause antioxidant enzymes biosynthesis raise, such as peroxide and phenolic compound as a plant defence mechanism.

Then, application of photoperiod by using TL lamp in this research capable to activate phytochrome inside the plant's organ and it is influence tuber physiological process. This process stimulates the activation of related enzymes to break porang's tuber dormancy as a consequence tuber grow to form buds. Amylase hydrolyses amylum as a food source in tuber to simple substance such as sugar which is used by meristematic tissues to form a bud and grow.

CONCLUSIONS

The treatment of photoperiod 8, 12, 16, 20, and 24 hours/day during one month capable of promoting dormancy breaking of porang's tuber so that it can reduce dormancy phase of porang's tuber. The treatment of photoperiod 16 hours/day

during one month to porang's tuber emerged the best performance of bud. Besides, the treatment of photoperiod 24 hours/day during one month to porang's tuber emerged the best performance of porang growth and harvest tuber.

ACKNOWLEDGEMENT

Research was funded by DRPM Kemenristekdikti. We thank to Rikza Hakin for helping in the field and laboratory work.

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