SELECTING SEEDING TECHNIQUES AND PLANT MEDIA TO PRODUCE GENERATION ZERO (G0) TUBERS OF PORANG (*Amorphophallus muelleri* Blume)

Imaniah Bazlina Wardani[1], Nunung Harijati[2]

[1]Postgraduate Program in Biology, Faculty of Mathematics and Natural Sciences, University of Brawijaya, Malang, Indonesia.
[2] Department of Biology, Faculty of Mathematics and Natural Sciences, University of Brawijaya, Malang, Indonesia
Email: [1]imaniahbazlinawardani@gmail.com, [2]nharijati@gmail.com

ABSTRACT

Provision of seedlings *A. muelleri* in bulk can be done using seeds. The problem is seeds *A. muelleri* will be die if planted directly in the field. That caused seeds losing competition with weeds. So needs a treatment to grow the seeds until zero generation (G0) tubers is formed. The technique used to maximize the formation of G0 tubers *A. muelleri* is selection of seed types and planting media. There are 3 types of seeds used, namely R (red fruit seeds), Y (yellow fruit seeds) and G (green fruit seeds) where each type has a different level of maturity. Meanwhile there are 4 types of planting media used, namely M1 (soil: husk charcoal), M2 (soil: cocopeat), M3 (soil: cocopeat: husk charcoal) and M4 (soil). Every R, Y and G seeds were planted on M1, M2, M3 and M4 media. The parameters observed were weight, thickness and diameter of the G0 tubers. The data obtained were analyzed with 5% ANOVA and if there were differences followed by the 5% Tukey test. The results showed that the best G0 tubers were produced from planting R type seeds on M3 (RM3) media weighing 3.63 grams but were not significantly different from the treatment of planting R type seeds on media M1 (RM1) which was weighing 3.06 grams.

Keywords: *A. muelleri seeds, G0 tubers, planting media*

1. INTRODUCTION

Porang (*Amorphophallus muelleri* Blume) is a native Indonesian tuber plant which is included in the genus Amorphophallus. *A. muelleri* contains the highest glucomannan among other Amorphophallus species in Indonesia and has been widely used as a source of carbohydrates or raw materials in the food industry (Hidayah *et al*, 2018).

The last ten years there has been an increase in the demand for *A.muelleri* from various countries such as Japan, Hong Kong and Australia. However, this demand has not been matched by the production of plants *A. muelleri* in Indonesia, so it is necessary to increase the number of plants beginning with the provision of seeds *A. muelleri* in bulk.

There are three types of *A. muelleri* seedlings, they are seeds from bulbil, tubers and seeds. On an area of 1 hectare of land, seedlings planted from bulbil require around 170 -175 pieces and if it comes from tubers requires ± 20 pieces while if from seeds it can be up to 900 pieces (Porang Research Center, 2013). Based on this, planting porang using seeds is more effective to support efforts to multiply porang plants. But, the problem faced by farmers where seeds cannot be directly planted in the field because they will lose competition with weeds (Perskom, 2017). So that it needs to be treated separately in the field to grow seeds becomes tubers. The first tubers formed from a plant are called zero generation tubers (G0) which can later be used as seeds.

Tubers that will be formed depend on the vegetative growth of the plant. Improved plant growth tends to produce bulbs with a larger size (Arifin *et al*, 2014). Previous studies have reported that the growth of porang seedlings and plants is influenced by the planting medium and seed type. Seeds derived from red, yellow and green fruits (then each called red, yellow, and green seeds) in one cob turned out to have a different level of maturity while the planting media used also affects the humidity and weakness of the planting media that will have an impact on seed germination and growth of seedlings *A. muelleri* (Wardani *et al*, 2019).

2. MATERIAL AND METHOD

2.1 Sampling of Porang Fruit

Fruit was obtained from the porang garden in the village of Rejosari, Bantur District, Malang Regency. The fruit that is used is that has three colors in one cob, namely red in the distal, yellow in the middle and green in the proximal. The difference in the color of the fruit is used as a sign of differences in the level of maturity of the seeds inside.

2.2. Preparation of Seed

Each seed of fruit is released from the cob and grouped according to the color fruit. Then the fruit is peeled to take the seeds. The seeds are then washed with running water and dried. Selected seeds that have relatively the same size and are healthy (not moldy).

2.3. Media Planting Preparation

There are 4 types of planting media used in this study, namely M1, M2, M3 and M4 (Table 1). Each planting medium is inserted in a 15 cm polyback.

Table 1. Composition of Planting Media

Type of Planting Med	Composition (%)
M 1	Soil 70 + husk charcoal 30
M 2	Soil 70 + Cocopeat 30
M 3	Soil 70+ husk charcoal 15 + Cocopea 15
M 4	Soil 100

2.4. Seeds Planting

Seeds cleaned and then grouped according to the color of the fruit are red, yellow and green. Seed from red-skinned fruit is called red seed (R). while seeds from yellow and green skinned fruit are called yellow seed (Y) and green seed (G). Each of color seeds planted on four types of planting media (M1-M4). There are twelve treatments which each treatment consists of 15 polybags with 3 replications. Where each polyback planted one seed.

2.5. Observation of G0 Tubers

G0 tubers are harvested when the plant has fallen (± 6 months old)**.** G0 tubers obtained are first cleaned from the planting media that is still attached by washing. Then dried with tissue. Each tuber is measured:

a. weight (gram) using analytical balance
b. thickness and diameter (mm) using calipers.

The thickness of the tuber is measured from the top surface to the bottom of the tuber while the diameter of the tuber is measured in the widest part of the tuber.

2.6 Data Analysis

All data obtained were analyzed using ANOVA, if there is a difference then proceed with the Tukey 5% test to compare all pairs of the average treatment .

3. RESULT AND DISCUSSION

Morphologically the G0 tubers of porang originating from round to oval seeds, when harvesting looks the presence of roots attached to the skin of the tubers (Figure 1A and B). The inside of the tuber is light yellow with a dark yellow in center (Figure 1C). These conditions are consistent with the tubers obtained in previous studies where the middle part of the tuber is dark yellow (Gusmalawati, 2013).

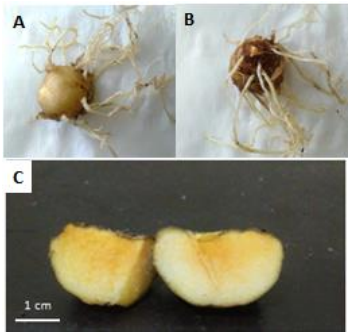

Figure 1. G0 tubers after harvesting. A. Roots on the bottom of the tuber skin, B. Roots on the top of the tuber skin, C. The inside of the tubers

The results of the analysis of the variants showed that the wet weight, thickness, and diameter of the resulting tubers was influenced by the type of seeds from the color of the fruit and its planting media. Seeds of red fruit when planted on medium 3 (RM3) produce tubers with the heaviest wet weight of 3.63 grams (Figures 2A and 3A) although not significantly different from the RM1 treatment. The RM3 treatment also showed the best results on the tuber thickness parameter although it was not significantly different from the treatment between seeds from other red fruits (Figure 2B)

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and the tuber diameter parameters were not significantly different from RM1 and RM4 (Figure 2C).

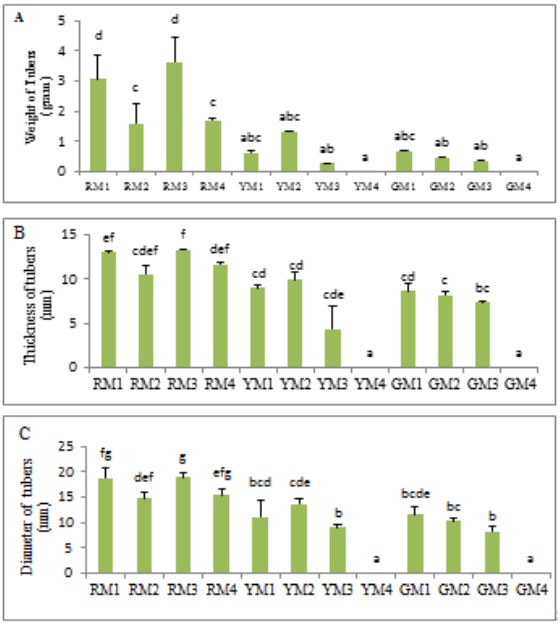

Figure 2. Effect of seed types of different fruit colors and planting media on tuber yields of *A. muelleri* at harvest age 196-240 HST, A. height of petiol, B. diameter of canopy, C. diameter of petiol. R = Seeds of red fruit, Y = Seeds of yellow fruit, G = Seeds of green fruit, M = growing media, M1 (soil: arangsekam), M2 (soil: cocopeat), M3 (soil: arangsekam: cocopeat), M4 (land). Note: numbers followed by the same letter in the same column show no significant difference in the Tukey 5% test.

RM3 is a treatment in which seeds from red fruit (mature physiological) are planted on medium 3, which are media composed of soil, husk charcoal and cocopeat. Husk charcoal and cocopeat are organic materials that are able to create good conditions for the growth and development of tubers in this study.

Husk charcoal is one component of a mixture of growing media that can bind water from natural materials and is a soil amendment material that is able to improve soil properties. Rice husk charcoal is 'porous' so that drainage and aeration in the soil is good (Ongo *et al*, 2017). Cocopeat (coconut fiber powder) is an organic material that can be used as a mixture to produce more pores, and has a very high water absorption so that it can absorb water more optimally (Miranda *et al*, 2017).

Previous study stated that seeds derived from red fruit (called red seeds) planted on media consisting of soil, husk charcoal and cocopeat showed the best results on the growth parameters which included height of petiol, crown diameter and petiol (Wardani *et al*, 2019). The higher the petiol and the width of the crown of a plant it will make it easier for plants to capture sunlight, where the function of the leaves is as the main organ in the process of photosynthesis. When the leaf size is getting wider the capture of sunlight and fixation CO_2 will be more which will maximize the photosynthesis process and have an impact onresults photosynthesis (asimylate). The assimilate is then stored as a food reserve which will determine the tuber weight per plant. Improved plant growth tends to produce tubers with a larger size because crop production is largely determined in the vegetative growth phase (Arifin et al., 2014).

Plants from physiologically immature seeds, which are seeds from yellow (yellow seeds) and green (green seeds), do not show significant differences in tuber weight. Among the yellow seeds that produce the heaviest weight tubers are those planted on medium 2 (YM2), 1.33 grams (Figure 2A and 3B), while the green seeds that produce the heaviest weight are GM1 treatment (Figure 2A and 3C), i.e. 0.66 gram.

The results showed that there were treatments that failed to form tubers, namely yellow (Y) and green (G) seeds on M4 media (YM4 and GM4 treatments). This is allegedly due to two things, the first is immature seeds and the second is M4 (soil) planting media which are unable to support tuber formation.

Previous research stated that yellow and green seeds (physiologically immature) planted on soil-containing media only produced poor vegetative growth (Wardani *et al*, 2019). These conditions turned out to have an impact on the formation of G0 tubers *A. muelleri*.

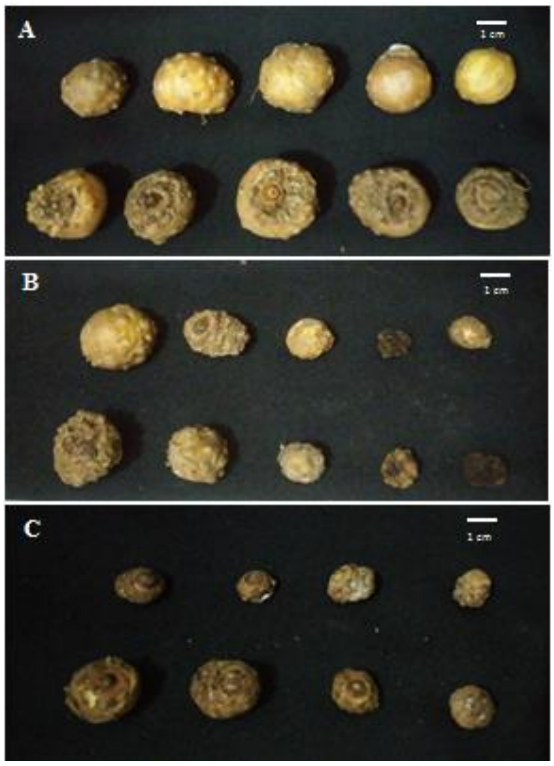

Figure 3. G0 tubers of porang plants from various seed maturity levels. A. Seeds of red fruit on medium 3 (RM3). B. Seeds of yellow fruit on medium 2 (YM2) C. Seeds of green fruit on medium 1 (GM1).

M4 media which only consists of soil causes the planting media to have a low level of humidity and weakness so that the root development is inhibited which has an unfavorable impact on vegetative growth of seedlings. Vegetative growth of seedlings that are not optimal causes G0 tubers not to form or remain to be formed but not to the maximum. These results are in accordance with Rosliani's (2014) study which states that planting media which have a solid structure such as soil cannot produce tubers in onions which is in line with their vegetative growth.

Planting media is a place where roots develop in absorbing nutrients and water and plants can grow upright. Each plant has its own media planting criteria so that there are differences in the composition of the media for each type of plant. One ingredient that can be added to get good media criteria is by adding organic material (Lingga and Marsono, 2013).

Organic matter has an important role in maintaining soil fertility, because the provision of organic material not only adds nutrients to plants, but also creates conditions suitable for plants and is able to increase the amount of water available to plants (Sudomo and Santoso, 2011). Therefore it is evident that the planting media which is only composed of soil is not good for plant growth which impacts on the G0 tubers produced.

Seeds *A. muelleri* are seeds poliembrio, where in one seed contains more than one embryo. This statement was proven through previous research which explained that embryos from seeds were *A. muelleri* located proximal to their distribution in groups (Dewi *et al*., 2015). Cutting seeds *A.muelleri* in a variety of cuts that aim to separate the embryos in it shows that each cut results can produce shoots (Turhadi, 2015). Both studies confirm that in seeds *A.muelleri* there are more than one embryo.

So that, this study also observed the relation of the number shoots with the weight of G0 tubers *A.muelleri*. The results showed that the average tuber weight of G0 was not directly proportional to the number of shoots produced in planting media M2 and M4. While in M1 and M3 the more number of shoots cause the average of tubers produced was greater (Figure 4). The number of shoots produced by a polyembryo seed in general can not be used as a determinant of the tuber weight to be produced because there are other factors that influence the development of the tuber one of which is the composition of the planting media.

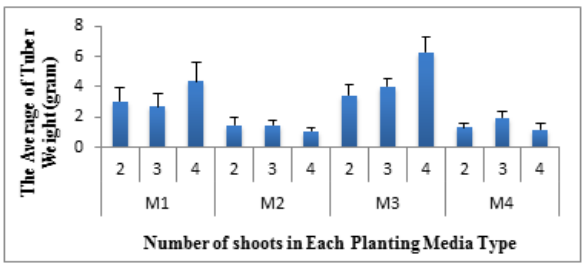

Figure 4. The average tuber weight of G0 is based on the number of shoots in each type of media. M: planting media. M1 (soil: husk charcoal), M2 (soil: cocopeat), M3 (soil: husk charcoal: cocopeat), M4 (soil)

The nature of the growing media that must be had to support the development of G0 tubers *A. muelleri* is crumb media. The weakness of the planting media can be regulated by adding organic material in the form of husk charcoal. In addition to crumbs, the media must also have sufficient moisture by adding cocopeat, so that the M3 media which is composed of soil, husk

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charcoal and cocopeat is the best composition to support the development of G0 tubers *A. muelleri* compared to other planting media.

4. CONCLUSION

The best treatment that is able to produce the heaviest tubers is RM3, which is a seed from a red fruit planted on M3 (soil: husk charcoal: cocopeat) weighing 3,63 gram.

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