Characteristics of growth, flowering and corm yield of iles-iles (*Amorphophallus muelleri*) genotypes at third growing period

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Abstract. *Tajuddin M, Santosa E, Sopandie D, Lontoh AP. 2020. Characteristics of growth, flowering and corm yield of iles-iles (*Amorphophallus muelleri*) genotypes in third growing period. Biodiversitas 21: 570-577.* Iles-iles (*Amorphophallus muelleri* Blume) is an emerging crop for producing glucomannan, and it is predominantly cultivated in agroforestry systems. The study aimed to evaluate characteristics of growth, flowering, and production of genotypes in the third growing period in order to develop new clones. The experiment used 2-year-old corm of ten genotypes, i.e. BKB, CF, CR, LSP, SB, SBM, SG-BKK, SGH, SR and STS. The corms were planted in June 2018 to May 2019 in the field under 45% artificial shading net. Plant growth was evaluated on weekly basis from bud emergence until dormant. Flowering rate was ratio the number of corms with flower to number of planted corms in each replication. Corm dry mass was measured after harvest, which was conducted at dormant stage at 46 weeks after planting. Candidate clone was selected from the highest total score of five criteria i.e. flowering rate, corm shape, corm healthiness, marketable yield, and total yield. Results demonstrated that genotypes exhibited variation in growth, flowering rates, and yield. Based on emerging time, three genotypes (SB, SGH, SG-BKK) were classified as early emergence, five genotypes (CF, CR, LSP, SBM, STS) as a medium, and two genotypes (BKB, SR) as the late emergence. All genotypes produced inflorescence at rate 1 to 52%, and 3 genotypes (CF, CR, STS) had flowering rate >20%. Five genotypes (CR, LSP, SBM, SGH, STS) had an average corm weight > 1500 g. CR and SBM genotypes produced the largest average corm weight, i.e., 2,509.33 g and 2,129.25 g, respectively, while the BKB produced the smallest one (912.94 g). All genotypes had similar dry mass content, i.e., 18.73-20.70%. The scoring evaluation recommended CR, SBM, and STS genotypes as candidates of new clones with productivity > 30 ton/ha. It needs further evaluation of selected clones in the farmer production field.

Keywords: Genetic improvement, inflorescence, marketable yield, *porang*, selection criteria

INTRODUCTION

Iles-iles (*Amorphophallus muelleri* Blume, Araceae) or called *porang* by Javanese is a tuberous crop native to Java (Jansen et al. 1996). *A. muelleri* produces yellow-color corm and aerial bulbils as the most practical identifier to the species; and sometimes the species is misunderstood with white-corm of *A. variabilis* (locally called *acung*) (Sumarwoto 2005; Sugiyama and Santosa 2008). The globose corm of *A. muelleri* is harvested for glucomannan production, as material for foods and other industries (Jansen et al. 1996).

The plant grows well under full sunshine and partial shading up to 75% reduced light intensity (Santosa et al. 2006; Gumbira-Sa'id and Rahayu 2009; Afifah 2014) leading to extensive introduction as understory crop in agroforestry plantations. In Indonesia, commercial areas for production distribute across regions with distinct dry seasons such as East Java, Bali, Nusa Tenggara islands, and South Sulawesi.

Propagation is predominantly made by using clonal of aerial bulbils and apomictic seeds, and corm skin buds (Jansen et al. 1996; Santosa and Wirnas 2009; Turhadi and Indriyani 2015), leading to the high maintenance of genetic uniformity. Nevertheless, morphological and genetic variations are apparent in *A. muelleri* (Poerba and Martanti 2008; Hu et al. 2011; Harjati and Mastuti 2014; Nikmah et al. 2016; Santosa et al. 2018). The variation is an important stepping stone for crop improvement (Santosa et al. 2016).

Recently, farmer cultivates wild landraces with low inputs of fertilizers and labor, and harvests corms at the third year after planting of small bulbil; and in each year is interrupted by a 6-months dormant period in the dry season (Sugiyama and Santosa 2008). Here, a 6-months for growing time is considered as a growing period in *A. muelleri*, therefore from planting to harvest of marketable corms requires three growing cycles. A farmer harvests about 2-4 tons of fresh corms from one hectare after three growing periods (Santosa 2014), which is considered as low production as compared to other root crops such as cassava, taro and sweet potato (O'Hair 1990). According to farmer experience, the third growing period is the most important because it determines the corm quality including marketable size, therefore, developing clones that have higher productivity in the third period is required. In the present experiment, ten genotypes are evaluated as the first effort to develop new high yielding clones. The genotypes historically were descendent from field selections conducted in Bogor Agricultural University that have distinct morphological characters. The study aimed to evaluate characteristics of growth, flowering incident and yield of *A. muelleri* from harvested corms of the third growing period in order to select better candidate clones.

MATERIALS AND METHODS

Field research was conducted at Leuwikopo Experimental Station, Bogor Agricultural University, Bogor, West Java, Indonesia, from June 2018 to May 2019. During the experiment, watering used precipitation, with average daily precipitation ranged from 0.3-19.5 mm. Monthly precipitation in July and August 2018 was 9 and 21 mm, respectively; while the precipitation in other months was 131-433 mm. The average daily temperature was 22.2 ºC (17.3-26.7 ºC), relative air humidity was 77.9-90.5% and average daily sunshine was 4.1 hours.

Ten genotypes i.e. BKB, CF, CR, LSP, SB, SBM, SG-BKK, SGH, SR, and STS were evaluated using randomized complete block design (RCBD) with four blocks as replications. The number of corms in a block of each genotype was 21-53, and ten plants were selected randomly for vegetative measurement. All procedures were carried out under shading net with 45% light intensity, following procedures by Sugiyama and Santosa (2008). Sunlight intensity was blocked using an artificial shading net.

Planting materials used were corms from the second growing period harvesting in May 2018. History of planting materials used is presented in Figure 1. Briefly, all seeds of selected genotypes (G1.0) were planted in August 2016 and corms were harvested in May 2017, as the first growing period. At 2017 rainy season, the corms (G1.1) were planted in August and the corms were harvested at end of the rainy season in May 2018, as the second growing period. Thus, the planting materials of the third growing period (775±220 g; G1.2) were biologically 2-year-old of age. In this experiment, all corms from the second growing period were used without selection.

Corms were planted in-furrow with equidistant of 75 cm on June 15, 2018. Furrow was 500 x 100 x 20 cm (length x width x depth), facilitating 16 corms in a furrow. Distant among furrows was designed as 50 cm. Each corm received 0.5 kg manure at a week after planting.

Corm was considered as germinated if bud elongated > 2 cm above soil surface. Emerging time of each genotype was determined based on number of the day required for bud emerging > 90% of corms. Based on average time to emergence, the genotypes were then classified into early, medium or late emergence. The average value of time to emergence of total genotypes was set as medium emergence. The genotype whose buds emerged ≥ 2-weeks earlier and later were classified as early and late emergences, respectively. The growing stage of each genotype was divided into emergence, steady, and senescence periods based on total data of corms irrespective replication. Total weeks required for a genotype to accomplish emergence or senescence was determined as emergence or senescence period. Total weeks between emergence and senescence period was steady period. Total growing period was calculated from the first week of corm emerged to the latest week corm senesced.

Vegetative and inflorescence growths were evaluated weekly. Plant height was measured from the soil surface to tri-partite branches, canopy width was measured from the distant tip of leaflets (Figure 1C). Inflorescence was measured at anthesis for characters of the peduncle, spathe, male and female zones, and appendix (Figure 1B), following Santosa et al. (2019). Peduncle length was measured from soil surface to stipule of spate, and its diameter was measured at the middle portion. Spathe length was measured from the base to spate apex. Spathe apex was classified into pointed, round and irregular by personal judgment. Appendix diameter was measured at the widest part; and the shape was classified into conical, deflated and irregular.

No additional watering and fertilizers were applied. Weeding was carried out manually by uprooting on a weekly basis. Available weeds were *Ageratum conyzoides*, *Borreria alata*, *Caladium bicolor*, *Physalis angulata* and *Rottboellia exaltata*. Pest control was carried out by manual controlling especially for leaf worm. Some plants were severely infected by petiole rot caused by *Sclerotium* sp., and the infected plants were removed from the field.
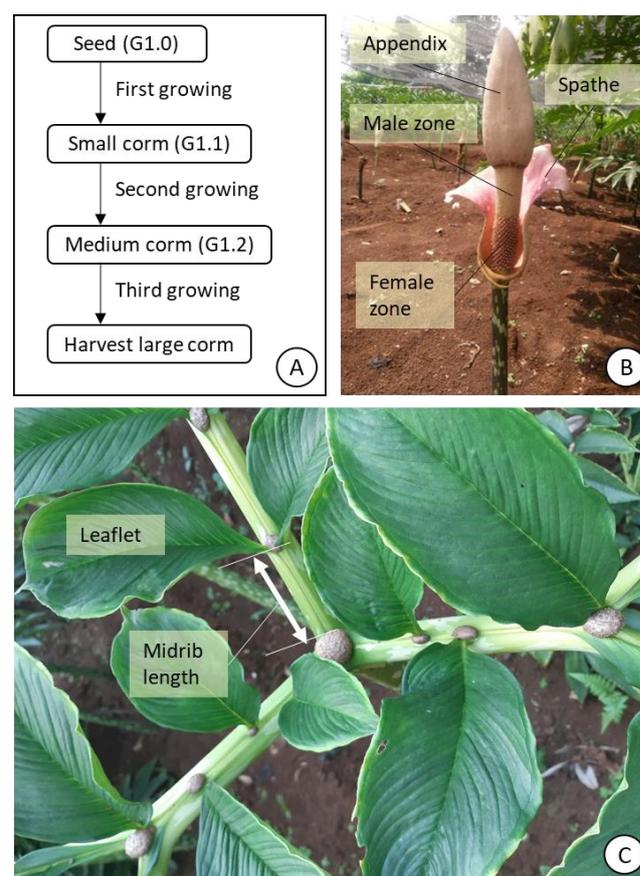

Figure 1. Planting material preparation of the experiment (A), typical inflorescence of *Amorphophallus muelleri* (B) and leaf midrib with many bulbils in the third growing period (C)
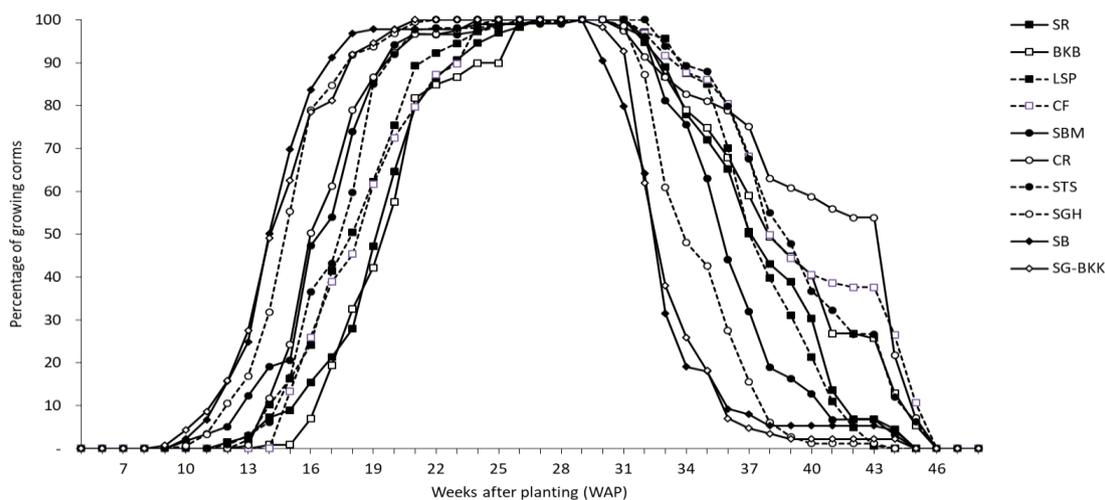
Figure 2. Percentage of growing corms among ten *Amorphophallus muelleri* genotypes

The corms were harvested at 46 weeks after planting (May 15, 2019). The harvesting time was determined after the last leaf senesced. Corm weight was evaluated after harvest. Candidate clones were selected using five criteria. Criteria_1 was the proportion of flowering corm ≤ 20%. Criteria_2 was the proportion of harvested-corm with shape of globose or depressed-globose ≥ 75%. Corm diameter was measured twice covering large and short diameters; if the ratio of the large to the short ≥ 1.5, the corm was noted as oval otherwise as round. Round corm was judged as globose or depressed-globose if the ratio of corm height to diameter was ≥ 0.80 or < 0.80, respectively. Corms other than oval, globose and depressed-globose was classified as irregular shaped.

Criteria_3 was the proportion of healthy corm at harvest ≥ 85%. Regular-shaped corms without any disease infection or damage were noted as healthy. Healthy corms had ≥1,500 g in weight were regarded as marketable yield following Sugiyama and Santosa (2008). Criteria_4 was the proportion of marketable yield ≥ 50%, and Criteria_5 was total yield ≥ 30 ton for one hectare. Corm productivity for a hectare was assumed by using 17,733 plants population. Peeled corms were oven-dried to measure the dry mass content after 60 ºC for 5 days. Flowering corms were excluded from dry mass evaluation.

Statistical analysis used analysis of variance (ANOVA), and any significant effect was further analyzed using the Least Significant Difference (LSD) at a level of confidence of 95%.

RESULTS AND DISCUSSION

Plant growth

Bud emerged from 9-14 weeks after planting (WAP) and leaf senesced 29-46 WAP (Figure 2). It seems that time to emergence depending on the genotypes. Irrespective of genotypes, a leaf required about one month from bud emergence to leaf full expansion. SB, SGH, and SG-BKK genotypes showed early emergence contrary to SR and BKB as the late emergence. The other five genotypes, i.e., CF, CR, LSP, SBM, and STS exhibited medium emergence. It is probable that variation in hormonal level and corm weight at planting may affect the emergence time rate. Previously Sugiyama and Santosa (2008) have noted that different corm weights express different emergence times in *A. paeoniifolius*, where large corms emerged later than that of smaller corms. Santosa et al. (2019) stated that the application of gibberellic acid on corm delays bud emergence. Unfortunately, both hormonal and corm weight were not evaluated in the present study.

Irrespective of genotypes, leaf started to senesce in 30 WAP (Figure 2). SB, SGH, and SG-BKK genotypes showed early senescence contrary to BKB, CF, CR, and STS as late senescence. Although genotypes exhibited different senescence calendar, however, the length of the growing period from emergence to senescence was mostly in the range 31-36 weeks (Table 1). Time to emerge and senesce consumed 74-91% of the growing period; left only short steady period for photosynthate accumulation. SB and SBM genotypes had the shortest steady period (3 weeks), while SGH and SG-BKK were the longest (9 weeks). According to Santosa et al. (2016), the long steady period is a desirable trait in *A. muelleri*. It means that an effort to increase uniformity on leaf emergence and senescence is important. Leaf senescence is a common indication for *A. muelleri* harvesting (Sugiyama and Santosa 2008; Chairiyah et al. 2014), which means that early senescence genotypes facilitate early harvesting. In general, more than half of plants had senesced at 37 WAP in all genotypes and had completely senesced at 46 WAP.

Period of plant establishment (emergence and senescence periods) significantly correlated with weekly precipitation intensity (Figure 3). Weekly precipitation gradually increased after planting and decrease close to harvesting time (Figure 3A). Monthly precipitation ranged from 310-410 mm at the steady growth of most genotypes, while it ranged from 45-222 mm and 185-304 mm during emergence and senescence, respectively (Figure 3B). Increasing weekly precipitation at planting period

stimulated leaf emergence (Figure 3C), conversely decreasing precipitation at the end of rainy season stimulated leaf senescence (Figure 3D). The effect of precipitation intensity on the growth of *A. muelleri* has also been noted by Jansen et al. (1996). In a greenhouse experiment using *A. paeoniifolius*, Santosa et al. (2006) revealed that less frequent watering stimulates early leaf senescence and the plant enters the dormant stage earlier. Thus, in the absence of water irrigation, proper planting date stimulate growth uniformity in *A. muelleri*.

Leaf production

One month after bud emergence, a leaf opened; and the leaf continued to expand and reached a constant size at two months after the emergence. Almost all genotypes produced single leaf during the growing period, except BKB, LSP, and SR (Table 2). LSP genotype produced the highest average leaf number, 1.2 leaves. Santosa et al. (2006) stated that the number of leaf in each growing season depending on the corm weight at planting, smaller corm (<500 g) produces more leaves than those of larger ones that commonly produce single leaf. Here, the higher in leaf number of LSP is likely due to high variation in corm weight; the corm weight at planting ranged from 552-935 g.

In LSP genotypes, the second leaf co-existed with the first one; and the second leaf had bigger petiole and wider canopy than those of the first one. However, final leaf size as indicated by petiole length, rachis length and canopy width were relatively uniform irrespective of genotypes, with exceptions for BKB, CF, CR and SBM genotypes (Table 2). Canopy width mostly was 107.80-120.25 cm, but BKB significantly had the narrowest canopy (100.81 cm) and CR had the widest canopy (157.63 cm). In *A. muelleri*, a plant with a larger canopy trait is desirable because it positively correlates with corm size at harvest (Sugiyama and Santosa 2008). It is well known that leaf size is determined by corm weight at planting, larger corm produces a larger leaf (Santosa et al. 2006).

The number of leaflets varied among genotypes (Table 2). BKB and STS genotypes had the lowest total number of leaflets (79.8-80.1 leaflets) while the SGH genotype had the highest total number of leaflets (115.4 leaflets). However, the number of leaflets was not in line with canopy size. The finding is contrary to Sugiyama and

Santosa (2008) where larger leaves produced more leaflets. It seems that the number of leaflets is a genotypic identity.

Flowering rate and its characteristics

After bud emerged, some buds developed into inflorescences. This phenomenon is common for the second and third growing period in *A. muelleri* (Sugiyama and Santosa 2008). The flowering rate ranged from 1-52%, irrespective of genotypes (Figure 4). CR genotype had the highest flowering rate (52%), while the LSP genotype had the lowest rate (1%). Three out of 10 genotypes had flowering rate >20% i.e. CF, CR and STS (Figure 4). According to Jansen et al. (1996) flowering incident in *Amorphophallus* is determined by corm weight, where >500 g tends to flower. According to Santosa et al. (2017; 2018), flowering is induced by corm weight and gibberellic acid (GA_3) level. In the present experiment, planting material used corm > 500 g in weight, thus different flowering rates among genotypes could be related to different hormonal levels.

Corm of all genotypes produced solitary inflorescence, meaning that a corm only produced leaf or inflorescence. Flower buds tended to emerge earlier than that of the vegetative buds; this phenomenon is common in *A. muelleri* (Sugiyama and Santosa 2008). In the present study, flower buds emerged at 10-17 WAP while vegetative emerged at 12-21 WAP. It is likely that the inflorescence growth required less water than the vegetative growth because the first rainfall occurred at 10 WAP.

Table 1. The average length of the growing stages of ten *Amorphophallus muelleri* populations

Genotype	Emergence period (weeks)	Steady period (weeks)	Senescence period (weeks)	Total growing time (weeks)
BKB	12	5	15	32
CF	10	7	14	31
CR	11	7	15	33
LSP	13	6	12	31
SB	17	3	15	35
SBM	19	3	13	35
SG-BKK	12	9	15	36
SGH	12	9	13	34
SR	15	5	12	32
STS	15	6	13	34

Table 2. Average vegetative variables of ten *Amorphophallus muelleri* genotypes at 28 weeks after planting

Genotypes	Plant height (cm)	Number of leaves	Longest rachis (cm)	Canopy width (cm)	Number of leaflets	Number of bulbils
BKB	95.0 a	1.1 ab	58.36 b	100.81 b	79.8 c	13.5 b
CF	111.3 a	1.0 b	70.64 ab	131.25 a	87.6 bc	13.6 b
CR	122.2 a	1.0 b	86.63 a	157.63 a	101.5 abc	21.3 b
LSP	108.9 a	1.2 a	70.88 ab	118.00 ab	94.3 abc	16.7 b
SB	102.7 a	1.0 b	69.65 ab	114.55 ab	110.9 ab	14.3 b
SBM	120.5 a	1.0 b	82.25 a	132.88 a	100.5 abc	11.1 b
SG-BKK	103.9 a	1.0 b	69.18 ab	117.55 ab	96.7 abc	13.2 b
SGH	108.8 a	1.0 b	72.25 ab	120.25 ab	115.4 a	14.7 b
SR	105.1 a	1.1 ab	70.76 ab	112.21 ab	87.6 bc	15.4 b
STS	98.9 a	1.0 b	68.10 ab	107.80 ab	80.1 c	16.8 b

Note: Values in a column followed by a similar alphabet are statistically similar after the LSD test at a level of confidence 95%
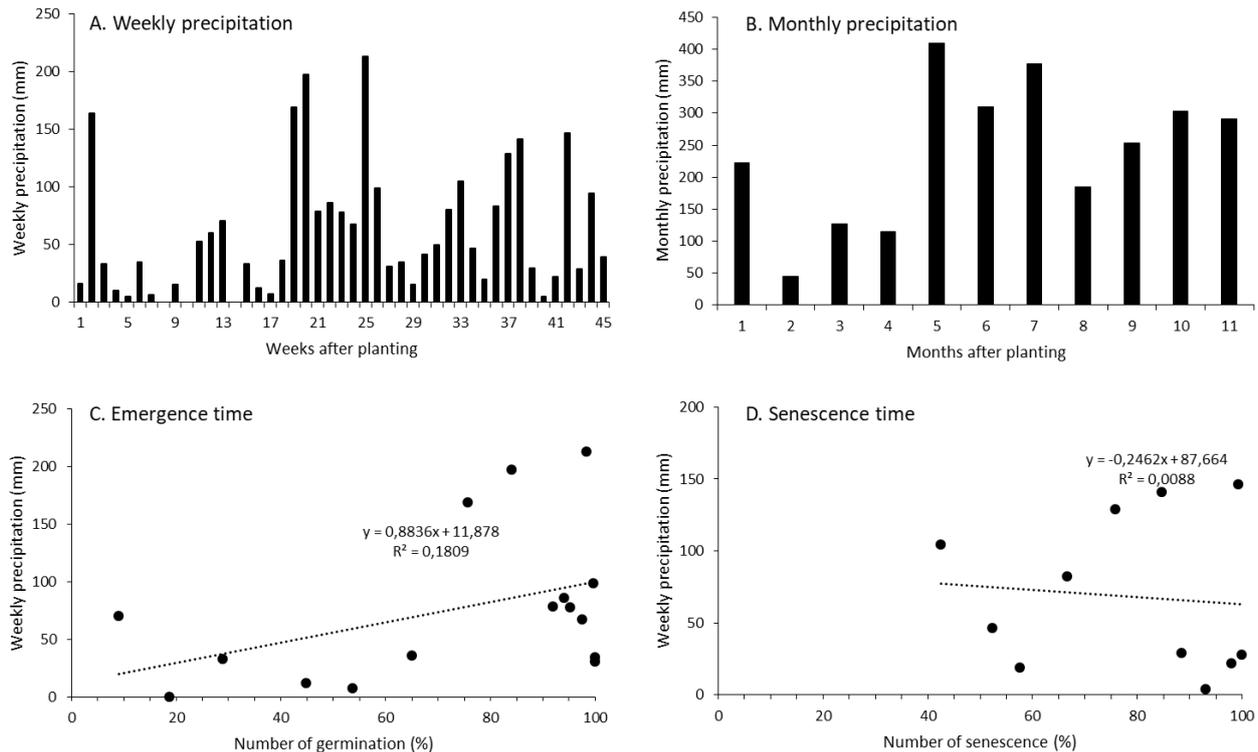
Figure 3. Weekly (A) and monthly precipitation (B) during the experiment, correlation between weekly rainfall and percentage of leaf emergence (C) and leaf senescence (D). The percentage was calculated from pools of ten *Amorphophallus muelleri* genotypes, data emergence of the first 16 weeks, and data senescence of the last 11 weeks

Table 3 shows that the size of the inflorescence part statistically is similar among genotypes, except the diameter of cone, male and female zones. Spate tip was mostly round, except for STS that had pointed tip. Appendix shaped two forms, i.e., conical (56.3-90.0%) followed by flat (10.0-43.8%) one.

Yield

A plant produced single corm without produced any cormlet. Corm from different genotypes had different sizes (height, diameter, ratio, weight) (Table 4). Irrespective of genotypes, average corm weight was 1,562.62 g. CR and SBM genotypes produced the largest average corm weight, i.e., 2,509.33 g and 2,129.25 g, respectively, while the BKB produced the smallest one (912.94 g). Table 5 shows that corm dry mass content was statistically similar among genotypes, 18.73-20.70%; thus, large corm was heavier, *vice versa*.

Although corm size varied among genotypes, the value of corm height to diameter ratio was below 0.70 (Table 4), corresponding to the depressed-globose shape (Table 5). Corms shape globose or depressed-globose is a desirable trait because of high efficiency in post-harvest handling like peeling and slicing (Sugiyama and Santosa 2008). Previously, Santosa et al. (2004) revealed that corm shape in *A. muelleri* is determined by planting depth, deeper planting stimulates corm elongation. In the present study, planting depth was designed as 10 cm below the soil surface and considered as proper planting depth according to Sugiyama and Santosa (2008). Variation in corm shape

among genotypes needs further study.

Table 3. Inflorescence characters of four *Amorphophallus muelleri* genotypes with flowering rate $\geq$ 20%

Inflorescence part	Genotypes [Y]			
	BKB	CF	CR	STS
Peduncle				
Length (cm)	28.10 a	26.98 a	28.60 a	24.78 a
Diameter (cm)	2.06 a	2.01 a	2.06 a	1.82 a
Spathe				
Length (cm)	22.53 a	21.72 a	21.82 a	20.98 a
Diameter (cm)	5.94 a	6.02 a	6.45 a	5.80 a
Spathe tip				
Round tip (%)[z]	62.5	53.6	57.1	25.0
Pointed tip (%)[z]	37.5	46.4	42.9	75.0
Male zone				
Length (cm)	7.23 a	7.11 a	7.17 a	7.05 a
Diameter (cm)	3.06 a	2.86 ab	2.97 ab	2.60 b
Female zone				
Length (cm)	7.50 a	7.35 a	7.85 a	7.20 a
Diameter (cm)	2.57 a	2.44 ab	2.49 ab	2.28 b
Appendix				
Length (cm)	18.20 a	17.70 a	17.92 a	16.53 a
Diameter (cm)	2.91 b	3.45 a	3.57 a	3.48 a
Appendix shape				
Conical (%)[z]	56.3	78.6	71.4	90.0
Flat triangle (%)[z]	43.8	21.4	28.6	10.0

Note: Values in a row followed by similar alphabet are statistically similar after the LSD test at a level of confidence 95%; [Y]Data of other genotypes is not presented due to insufficient replication; [z] Values are calculated from total corms thus not applicable for the statistical test

Table 4. Average corm size, ratio representing corm shape and dry mass content of ten *Amorphophallus muelleri* genotypes at 46 weeks after planting

Genotype	Corm height (cm)	Corm diameter (cm)	Ratio height to diameter	Corm weight (g)	Dry mass content (%)	Productivity (ton/ha)
BKB	8.24 c	13.4-14.5 b	0.61 b	912.94 d	20.51 a	16.19
CF	9.26 abc	14.4-15.3 ab	0.62 ab	1,309.44 c	18.73 a	23.22
CR	12.21 a	18.8-19.2 a	0.64 ab	2,509.33 a	19.25 a	44.50
LSP	9.70 abc	15.5-16.3 ab	0.61 b	1,545.25 b	19.52 a	27.40
SB	8.93 bc	14.5-15.1 ab	0.60 b	1,282.25 c	20.24 a	22.74
SBM	11.14 a	17.0-17.8 a	0.64 ab	2,129.25 a	19.85 a	37.76
SG-BKK	10.10 abc	14.8-15.5 ab	0.67 a	1,312.25 c	20.70 a	23.27
SGH	9.91 abc	15.4-16.3 ab	0.63 ab	1,584.38 b	19.47 a	28.10
SR	8.77 bc	14.6-15.5 ab	0.58 b	1,297.83 c	19.56 a	23.01
STS	10.30 ab	16.1-17.2 ab	0.62 ab	1,743.25 b	18.95 a	30.91

Note: Values in a column followed by a similar alphabet are statistically similar after the LSD test at a level of confidence 95 %.

Table 5. Percentage of healthy corm and corm shape of ten *Amorphophallus muelleri* genotypes at 46 weeks after planting

Genotype	Healthy corm (%)	The proportion of corm shape (%)			
		Depressed-globose	Oval	Globose	Irregular
BKB	82.50	76.92	0	0	23.08
CF	80.00	66.67	0	0	33.33
CR	97.50	85.71	0	0	14.29
LSP	97.50	95.00	2.50	0	2.50
SB	87.50	90.00	0	0	10.00
SBM	100.00	100.00	0	0	0
SG-BKK	87.50	92.50	0	0	7.50
SGH	82.50	90.00	2.50	0	7.50
SR	95.00	100.00	0	0	0
STS	100.00	95.24	4.76	0	0

Note: Values are calculated from total corms of genotypes thus not applicable for the LSD test; Corm with inflorescence was excluded

Irrespective of genotype, more than 80% of harvested corms were healthy (Table 6), and SBM and STS produced 100% healthy corms. Several unhealthy corms were infected by nematodes resulted in irregular-shaped corms. The infections located at the corm cavity near the growing point and at random position on the corm. The infected corm initially had bright-swelling like gall, then the mass enlarged and broke after a certain time causing a pothole in the corm. The gall formation is a common indication of nematode infection (Ralmi et al. 2016). However, not all irregular-shaped corm was due to disease infection, some corms had more than one growing points as a result of excessive growth of axillary buds on the corm skin.

The marketable corm is mainly determined by weight > 1,500 g (Sugiyama and Santosa 2008). Genotypes produced different corm weights (Table 6). Irrespective of genotypes, average corm weight that fit marketable criteria were 44.8%. CR, SBM, SGH, and STS genotypes had marketable corms above the average, i.e., 71.4%, 72.5%, 45.0% and 52.4%, respectively. Interestingly, CR genotype had 57.2% corms with individual weight > 2,500 g.

Candidate clone

The present experiment is the first time of genotype evaluation in *A. muelleri* in order to improve the quality of planting material. Unlike methodology to improve genetic on cereal crops that have commonly been established, improving methods on tuber crops is still rarely. Here, five scoring criteria to select candidate clone is proposed for genotype selection (Table 7). Criteria_2 (corm shape) exhibited the lowest polymorphisms among criteria, indicating the character was relatively uniform among genotypes.

The CR, SBM, and STS genotypes had the highest total score (Table 7), indicating these genotypes as the most prospective clones. It is important to note that SBM and STS had flowering rate > 20% (Figure 4), unlike CR genotype. Nevertheless, the inflorescence could be removed easily as cutting inflorescence before anthesis is a common practice in the farmer fields to maintain high corm productivity (Santosa et al. 2003). It needs further studies on the economic benefit of the use of low and high flowering rates in terms of labor requirements.
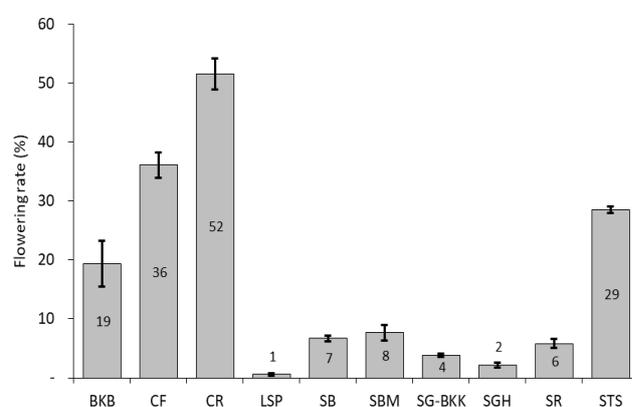

Figure 4. Percentage of flowering rate among ten *Amorphophallus muelleri* genotypes. Value±S.E.

Table 6. Distribution of corm weight of ten *Amorphophallus muelleri* genotypes at 46 weeks after planting

Genotypes	Distribution of corm weight (%)						
	< 500 g	501-1000 g	1001-1500 g	1501-2000 g	2001-2500 g	2501-3000 g	> 3000 g
BKB	23.08	46.15	11.54	15.38	0	0	3.85
CF	25.00	25.00	8.33	25.00	0	0	16.67
CR	0	14.29	14.29	14.29	0	14.29	42.86
LSP	7.50	25.00	20.00	20.00	15.00	7.50	5.00
SB	15.00	30.00	30.00	7.50	10.00	0	7.50
SBM	0	20.00	7.50	17.50	27.50	12.50	15.00
SG-BKK	0	42.50	20.00	25.00	7.50	5.00	0
SGH	7.50	15.00	32.50	20.00	7.50	12.50	5.00
SR	17.65	32.35	14.71	17.65	11.76	2.94	2.94
STS	0	9.52	38.10	14.29	19.05	14.29	4.76

Note: Values are calculated from total corms of genotypes thus not applicable for the LSD test; Calculation was based on pooled data (BKB=78, CF=54, CR=46, LSP=116, SB=134, SBM=80, SG-BKK=202, SGH=129, SR=129, STS=119 corms). Corms with inflorescence were excluded from the calculation.

Table 7. Scoring criteria for selecting candidate clone of high yielding in *Amorphophallus muelleri*

Genotype name	Score value					Total scores
	Criteria_1	Criteria_2	Criteria_3	Criteria_4	Criteria_5	
BKB	1	1	0	0	0	2
CF	0	0	0	0	0	0
CR	0	1	1	1	1	4
LSP	1	1	1	0	0	3
SB	1	1	1	0	0	3
SBM	1	1	1	1	1	5
SG-BKK	1	1	1	0	0	3
SGH	1	1	0	0	0	2
SR	1	1	1	0	0	3
STS	0	1	1	1	1	4

Note: Criteria_1: Proportion of flowering corm $\leq$20% (1: yes, 0: No); Criteria_2: Proportion of globose or depressed globose $\geq$ 75% (1: yes, 0: No); Criteria_3: Healthy corm $\geq$ 85% (1: yes, 0: No); Criteria_4: Marketable yield $\geq$ 50% (1: yes, 0: No); Criteria_5: Yield $\geq$ 30 ton (1: yes, 0: No)

In conclusion, genotypes evaluation revealed SB, SGH and SG-BKK as early emergence, CF, CR, LSP, SBM and STS as medium emergence, and BKB and SR as late emergence. All genotypes produced inflorescence, but the rate varied between 1-52%, and 3 genotypes i.e. CR, CF and STS had flowering rate >20%. Based on yield evaluation, 5 genotypes had an average corm weight > 1500 g; CR and SBM genotypes had the largest weight, i.e., 2,509.33 g and 2,129.25 g, respectively. There was no variation in dry mass content among genotypes (18.73-20.70%). The scoring evaluation concluded CR, SBM, and STS genotypes as prospective new candidate clones with productivity > 30 ton/ha. It needs further evaluation of selected clones in the farmer production field.

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