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Influence of minisett size of purple yam (*Dioscorea alata*) towards the seedling emergence and growth rate in production of seed yam

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Abstract
Dioscorea alata is one of the yam species commonly known as purple, winged or water yam. It has huge beneficial value due to high nutrition and durability, and contains anthocyanin pigment which can be extracted as food colourant. In yam plantation, farmers are required to set aside 10 to 30% of their harvest as planting materials. To solve this problem, minisett technique was practiced to produce large number of healthy seed yams. However, conventional farmers have vague knowledge regarding minisett technique. There is a dearth information of minisett technique on cultivating *Dioscorea alata*. Therefore, this research was carried out to: (i) determine the seedling emergence and growth rate of minisett yams, and (ii) compare the seedling emergence and growth rate between minisett and macrosett techniques of yams cultivation. Four minisett weight-classes of purple yam, namely 20-29, 30-39, 40-49, 50-59 g and one macrosett weight-class of seed yam 150-200 g were prepared for this study. The macrosett tuber was prepared as a standard to compare with the minisett tuber. The trial was conducted in Agropark of Universiti Malaysia Kelantan Jeli Campus in a completely randomised design. Six parameter namely number of days required for sprouting, shoot height and girth, number of leaf and internode, and leaf width were observed. The data were collected to identify the growth rate of the tuber. Results showed that largest minisett yam (50-59 g) showed similar growth performance on shoot height and girth, number of internode and width of leaves with the macrosett yam (150-200 g). As a conclusion, 50-59 g minisett yam showed great potential to cultivate larger yam seed which may be used for larger yam production or direct consumption.

Keywords: *Dioscorea alata*, minisett, macrosett, shoot emergence, growth rate

1. Introduction

Dioscorea family or yam tuber consists of approximately 600 species with 50-60 species of them cultivated as food or medicine [1]. It is the third global agro-economic product after cassava and sweet potato [1]. *Dioscorea alata* is one of the yam species commonly known as purple yam, winged yam or water yam. It contains anthocyanin pigment in its bright lavender colour tuber which can be extracted as food colourant [2]. The tuber is also used as diuretic, aphrodisiac, anthelminitic and antidiabetic in Indian traditional medicine [3]. On the other hand, *Dioscorea alata* contains a lot of vitamin C and vitamin B. It is an energetic and nutritious vegetable that could store well on long trips especially for fishers and sailors at sea [4]. Due to all the beneficial values in *Dioscorea alata*, it is widely propagated around the world, mostly in West Africa [2].

Researchers had discovered that larger seed yam produced better quality yam [5]. However, if every farmer grows yam according to this standard, they will encounter shortage of yam planting material [6]. About 10,000 of seed yams will be required for a hectare of yam plantation [5]. They must set aside 10 to 30% of their harvest as planting materials [7]. Due to this problem, some farmers started to separate the yam tuber into smaller part for yam plantation [8]. Soon, they discovered minisett technique where yam can be cultivated even with a very small size of tuber [8]. The purpose of minisett technique is not to produce large tuber but to produce large number of healthy planting seed yams. Research showed that minisett technique is profitable due to lower materials cost and higher yield [8]. In this technique, a small part of a non-dormant tuber (20-50 g) is separated and will be utilised as planting material [8]. Many minisett technique was applied and researched on *Dioscorea rotundata*. The growth parameters increase when the size of the seed yam increases [5].

Conventional farmers have a lot of doubts and vague knowledge regarding minisett technique. Thus, they still practiced macrosett technique (>100 g) even for the purpose of producing seed yam [9]. Besides, there is a dearth information of the application of minisett technique on *Dioscorea alata*. Therefore, this research was carried out to: (i) determine the seedling emergence and growth rate of minisett yams, and (ii) compare the seedling emergence and growth rate between minisett and macrosett techniques of yams cultivation.

2. Materials and Methods

(a) Samples preparation and experimental setup

Five raw *Dioscorea alata*, each has average of 800 g were obtained from a farmer at Pasir Mas, Kelantan. They were separated into the different treatment sizes using a fruit knife. The samples were then treated with the mixture of fungicide and burnt ashes to prevent fungus infection. All the treated seed yams were left dried for two days before planting. This research was conducted in Agropark of Universiti Malaysia Kelantan Jeli Campus. This experiment consisted of four minisett weight-classes and one macrosett weight-class seed yam treatment. The minisett yam treatments are: T1 = 20 – 29 g, T2 = 30-39 g, T3 = 40 – 49 g, T4 = 50 – 59 g. The macrosett yam treatment, T5 = 150 – 200 g, which was served as a control. Each of the weight-classes has three replications. The experiment was arranged in a completely randomised design (CRD) where all the treatments were completely randomised to the independent experimental subject.

An area of 40 x 60 cm was ploughed and lifted for 5 cm height to prepare as seed bed. Then, burnt rice husk was applied on the seed bed as starter fertilizer at the ratio of 1 burnt rice husk: 20 soil. The seed yam was planted 5 cm apart each other at within the same plot and 5 cm between plots. Daily maintenance such as irrigation and weeding were carried out during the trial. As water is one of the main factor for plant growth, watering was done morning and evening to initiate the sprout of seedling. Manual weeding was carried out to maintain the site hygiene and to eradicate all unnecessary competition.

The duration of the trial was 4 weeks (28 days). The growth of the seed yam was recorded followed the growth parameters: (1) Once the shoot sprout, the day of emergence was recorded; (2) Plant height was measured using a tape measure from the soil level to the shoot tip; (3) Shoot girth was measured at the middle of the plant using a small tape measure; (4) In between of every segments, number of internode was recorded; (5) Number of functional leaf that has more than 50% of green area was counted and recorded; (6) Horizontal diameter of leaf width that observed to be longest distance was measured with a measuring tape.

(b) Data analysis

Statistical analysis of data including analysis of variance (ANOVA) and comparison of means was performed using Statistical Analysis System (SAS) version 9.2. ANOVA was used to detect treatment effects while Tukey's test was used to compare treatment means at $P \leq 0.05$.

3. Results and Discussion

Figure 1 shows that T5 had the shortest number of days required for sprouting, which is 5 days after the planting date, followed by T3 and T4 which are slightly delayed. T1 and T2 showed the slowest sprouting date, around 15 days delayed from T3 and T4. Water is one of the main factor caused yam to sprout. Larger tuber has larger surface area to retain water, this contributed to it to sprout faster compare to smaller tuber [10]. Besides, larger tuber also enable more roots to arise from the tuber. This enhanced its ability to obtain nutrients and enable it to grow faster.

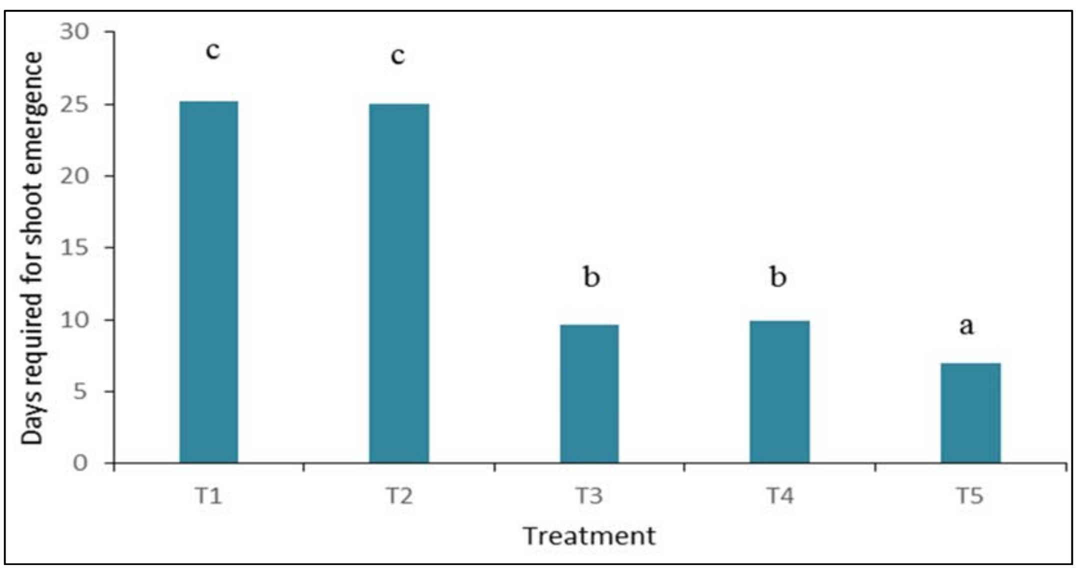

Fig 1: Effect of slicing size of yam on days required for shoot emergence.

Figure 2 shows that larger tuber had higher mortality. All of the macrosett yams sprouted. T4 showed 88% of mortality where only one out of nine seed yams failed to sprout. In T2 and T3, both have 67% of mortality where three out of nine seed yams did not show any result. T1 has the lowest mortality among the seed yams, only five out of nine seed yams grew shoot. Small tuber contains less water and has poor water retention capability. This caused them to dry up faster than the large tuber. It is very difficult for dried tuber to break dormancy, in the worst scenario, the dried tuber will lose fertility [11].

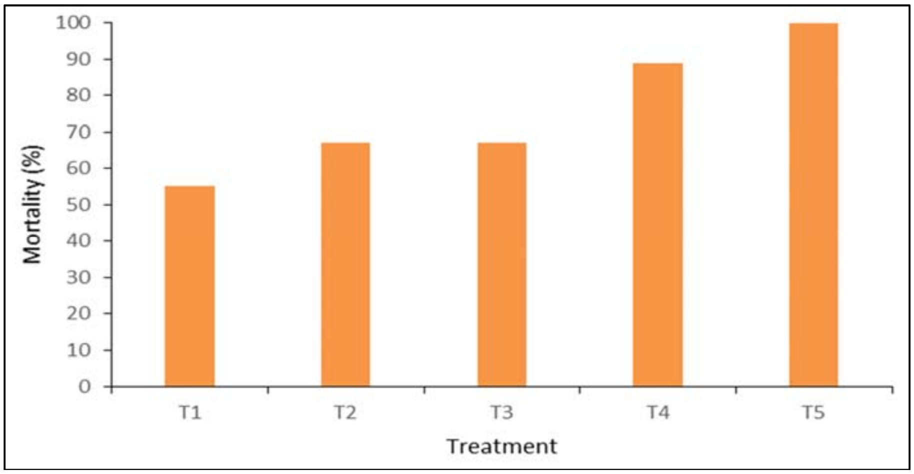

Fig 2: Effect of slicing size of yam on mortality.

Table 1 shows that there was no significant difference in term of shoot height among the minisett yams after 4 weeks of planting. However, there was significant differences between the macrosett and minisett yams. Due to faster sprouting days, larger tuber produces leaf faster and undergo photosynthesis earlier than the smaller tuber. This could further pace up their growth rate in shoot height. There was no significant difference in term of shoot girth for all the setts (Table 1). Shoot girth was smaller when it first sprouted from tuber and it showed no much changes along its growth. There were also no significant difference for the growth of number of internodes too (Table 1). The shoot of *Dioscorea alata* are segmented [6]. Thus, an increase in shoot height will directly increase in number of internode.

Table 1: Effect of slicing size of yam on shoot height, shoot girth, number of internodes, number of leaves, and width of leaves.

Treatment	Shoot Height (cm)	Shoot Girth (cm)	Number of Internodes	Number of Leaves	Width of Leaves (cm)
T1	70.36^{a}	1.90^{a}	13^{a}	19^{a}	8.72^{a}
T2	75.57^{a}	1.91^{a}	13^{a}	19^{a}	9.02^{a}
T3	76.70^{a}	1.88^{a}	14^{a}	17^{a}	8.87^{a}
T4	99.51^{b}	2.04^{b}	19^{b}	20^{a}	10.86^{b}
T5	126.24^{b}	2.03^{b}	24^{b}	26^{b}	11.86^{b}

Note: Means within column with different superscript alphabets indicate significant difference by Tukey's test at $P \leq 0.05$.

At the 28th day, the number of leaves in all minisetts were no significantly different from each other but all of them showed significant different with the macrosett, T5. The shoot of *Dioscorea alata* are segmented and each segment will generally grow leaves [6]. Thus, increase in shoot height will directly increase in number of leaves. The width of leaves of the minisetts, T1, T2 and T3 were significantly different from T4. Yet when compared with macrosett, only T4 was no significantly different from T5. Plant's leaves constantly grows larger to ensure there is a larger surface area to absorb sunlight and convert the sunlight into food. Larger tuber is capable in storing more food and will induce the plant system to absorb more sunlight [11]. This directly caused the leaves to grow larger for greater photosynthesis.

Minisett yams had relatively smaller surface area compared to macrosett yams. The disadvantage in retaining water and a poorer rooting system caused inefficiency in growth [12]. At some stages, macrosett tuber showed insignificant growth rate compared to smaller tuber. Researches showed that larger tuber would face greater soil resistance to penetrate deeper into the ground [5]. This can disturb the growth of tuber when trapped in compact or hard soil. Tuber growth might be depressed for a short period. In overall, 50-59 g (T4) yam showed great potential to cultivate larger yam seed which may be used for larger yam production or direct consumption. The largest minisett yam (T4) showed similar growth performance on shoot height and girth, number of internode and width of leaves with the macrosett yam (T5).

4. Conclusions

T4 showed great potential to produce large yam. It showed close performance with the macrosett yam, T5. However, it sprouted slower than T5. There are variety of planting media that could enhance the sprouting date of yam. Future farmer or researcher may mix the soil with saw dust to enhance the soil ability to retain water and nutrients. This may close up the number of days required for sprouting with the macrosett tuber. Further research regarding the tuber growth is necessary to determine the growth of tuber between different slicing sizes beneath the ground. This can accurately determine which weight-classes have the best performance for yam plantation.

5. Acknowledgement

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6. References

1. Harijono TE. Physicochemical and bioactives characteristics of purple and yellow water yam (*Dioscorea alata*) tubers. International Journal of PharmTech Research. 2013; 5(4):1691-1701.
2. Jose A, Muhammed R. Extraction and evaluation of anthocyanin from *Dioscorea alata* (l.) for its

application as a natural food colour. The International Journal of Science & Technoledge. 2015; 3(9):41-47.
3. Kirtikar KR, Basu BD, an ICS. Indian Medicinal Plants (2nd ed.,). Allahabad, India: Lalit Mohan Basu. 1980, 1.
4. Botanical-online. Retrieved from Cultivation of Yam (*Dioscorea* spp.). 2016, http://www.botanical-online.com/english/yam_cultivation.htm#. 1999.
5. Law-Ogbomo KE, Remison SU. Influence of minisett sizes on dry matter accumulation and fresh tuber yield of white Guinea yam (*Dioscorea rotundata*). Annals of Applied Biology. 2009; 155(2):201-206.
6. Behera KK, Sahoo S, Prusti A. Relative Agronomic performance of different *Dioscorea species* found in different parts of Orissa. Nature and Science. 2009; 7(3):23-35.
7. Wilson JE. Rapid multiplication of yams (*Dioscorea* spp.). Institute for Research, Extension and Training in Agriculture (IRETA). 1989; 3(88):0-11.
8. Eyitayo OA, Anthony TO, Theresas I. Economics of seed yam production using minisett technique in Oyo State, Nigeria. Field Actions Science Reports 4. 2010.
9. Okoli OO, Ene LSO, Ikbowe MC. A Review of Seed Yam Production by The Minisett Technique. 12th Symposium of the International Society for Tropical Root Crops, Gosier, 1988, 426-437.
10. Onwueme I Yam. In: Goldsworthy PR, Fisher NM (Ed.) The physiology of tropical field crops. Wiley, 1984, 569-588.
11. National Advisory Board on Climate Change & Disaster Risk Reduction (NAB). Retrieved, 2016, from Yam Minisett Technique. www.nab.vu. 2015.
12. Delebo Z. Minimizing postharvest losses in yam (*Dioscorea* spp.). In: Using food science and technology to improve nutrition and promote national development. Robertson GL, Lupien JR (Eds), International Union of Food Science & Technology, 2008.