THE 5TH. INTERNATIONAL SEMINAR
REGIONAL NETWORK ON PVERT ERADICATION (RENPER)
BANKING UNIVERSITY OF HO CHI MINH CITY, VIETNAM
22-24 OCTOBER 2014

Low Cost Nursery Technology for Mass Propagation of Banana Seedling by Small Scale Growers

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Abstract

Small scale growers of banana can minimize their operation cost of cultivating banana by producing their own banana seedling in their own farm. Without worrying about inconsistent supply from private nurseries and buying expensive quality banana seedling from tissue culture supplies. The small scale grower can produce their own quality banana seedling by using low cost nursery technology. Corm nursery technique (CormTech) does not require specific lab and it can be established on site at farm. By establishing low cost nursery technology in their own farm, the growers can have readily available and easily accessible of banana seedling. A part of it, reusing of own nursery material can help to reduce the operating cost throughout every cycles of nursery. Besides that, by reusing nursery material we are achieving green technology. Thus, UMK undertakes R&D on nursery technology and management focusing on low cost nursery technology to help the small scale growers of banana to reduce their operation cost to plant banana. A Knowledge Transfer Program (KTP) research grant has been awarded to UMK to help small scale growers establishing the low cost nursery technology for expansion of banana planting in the locality (Jeli).

Key words: conventional methods, tissue culture, planting material, banana seedling, banana corm, mass propagation, nursery technique, low-cost technique, green technology

Introduction

Banana is the fourth most important fruit crop in the world (Saha Roy.O *et al.*, 2010) which grown in 132 countries worldwide, more than any other fruit crop ever grow and it is believed to be originated from the Southeast Asia and is well known among tropical countries around the world through the trading activities (Kamaludin *et al.,* 2012). Banana is an important crop

cultivated in Malaysia. However, there are constraints in the cultivation of banana which had caused the reduction of banana production. The constraints are because of the diseases that caused damages to the banana tree. Generally, the diseases are transmitted from infected banana tree to the banana seedling such as banana suckers and it also can be transferred via pest. Besides that, naturally regenerated suckers often harbored pest and diseases (Njau *et al.*, 2011). Thus, a solution to the problem is that we need to produce free disease planting material or seedling. Currently, tissue culture is a well-known technique for mass propagation of banana free disease planting material. Tissue culture technique also known as micro propagation technique which is used to propagate free disease planting materials of banana (Kamaludin *et al.,* 2012) and also as a tool to mass propagate the banana planting materials in order to give consistent supply of banana planting materials. However, tissue culture technique required expensive instruments and required sophisticated technique, skill and cares to handle (Dayarani *et al.*, 2013). In Malaysia, cultivators of banana are mainly from smallholder. Smallholder always cultivate banana in small scale. Normally, they will get the banana seedling either from tissue culture seedling which is sometime expensive and depends on accessibility, because banana seedlings from tissue culture are fragile and susceptible to scorching under prolongs exposure to direct sunlight during the transportation and handling. Due to the requirement in the propagating banana planting material through tissue culture, the small scale growers need to spend a lot of money for the lab establishment and attending the training for the tissue culture practices. Thus, the farmers required affordable and easily accessible banana planting materials.

Because there are no formal standards to regulate banana planting material (Macharia *et al.*, 2010), the farmers use the conventional method to produce banana planting material using suckers as an alternative to reduce the cost of production rather than buying tissue culture banana seedlings. However, these suckers are prone to pest and disease attack although it is easily accessible. In conventional propagation there are two types of banana sucker being used; sword sucker and water sucker. Sword suckers are recommended because it has better output yield (Robinson and Sauco, 2010). However, water sucker is less suitable to be used as planting material because of its low quality. Thus, a simple and cheaper technique is needed to produce banana seedling that have equivalent quality to tissue culture planting material. Corm nursery

technique for mass propagation banana seedlings was innovated to overcome the above problems.

Corm nursery technique is a macro propagation method of banana which will not only help the smallholder to cultivate the banana but they also can generate their income from producing banana seedling. Corm nursery technique of banana can provide the smallholder with both availability and accessibility of banana seedling. This technique can be installed in their farm and by performing this technique they can mass propagate banana seedling in faster period. This macro propagation technology can use whole suckers, large pieces of parent corms or sword suckers to produce planting material (Dayarani *et al.*, 2013). In Corm nursery technique, the material used is banana corm. This technique consists of several parts; corm preparation (corm-prep), corm seedling in polybag (corm-poly) and stacking of corm-poly (corm-stad). In each technology, selection is made to grade a better quality of banana planting material. In conventional propagation of banana, whole one sucker is used while giving high growth rate but produce less. In corm nursery technique, a whole one sucker's corm is slice to produce more section. Thus, in this experiment is to evaluate whether corm nursery technique can mass propagate or not based on seedling emergence percentage and number of seedling produced, and to identify growth performance of new seedling from corm nursery technique based on plant height.

Technology Development

1. Selection of corm

The selection of banana corms started from the selection of farm, where banana corms were collected from the non-infected farm. Banana farms are normally infected by diseases such as Black and Yellow Sigatoka (Castelan *et al.*, 2012) and Panama disease caused by *Fusarium oxysporum* (Borges *et al.*, 2004), where these diseases are very dangerous and need to be avoided in order to produce high quality of banana planting materials. The symptoms of the diseases are clearly can be seen on the tree. Thus, healthy banana corms were selected from healthy banana trees or suckers without the symptoms of those diseases.

2. Cleaning and sterilization of the corm

The selected banana corms were sterilized in order to kill microorganism, insect, and nematode. The corms were soaked into sodium hypochlorite (Chikezie, 2012) with 50% concentration for 15 minutes and were washed with plain water. After the sterilization process, the treated corms were exposed to the sunlight for drying process for 1 day.

3. Corm nursery technique

a. Corm preparation (corm-prep)

Again the treated corms were graded according to size and then it was sliced horizontally from side of the corm. The treated corms then were layout on the bed with the mixture of coco peat and compost with the ratio of 3:1. Coco peat has good physical properties, high total pore space, high water content, low shrinkage, low bulk density and slow biodegradation (Evans *et al.*, 1996; Prasad, 1997; Jadwiga, 2008). The bed with the established treated corms was then covered with polyethylene tarp (PE) which it create the dark environment and retain the humidity and heat of the bed for early bud induction (Robin, 2010).

b. Corm seedling in polybag (corm-poly)

Again banana seedling that grows from banana corm was selected to consider the uniformity. Banana seedlings then were transferred into 9'' × 6'' inches polybag at the 21 days after layout. The same media was used, the mixture of coco peat and compost were used.

c. Stacking of banana seedling on cabinet (corm-stad)

After transferring seedlings into polybag, the seedlings were then prepared into stacking cabinet until it matured and ready to sell and deliver

4. Propagation banana seedling through conventional method

The sword sucker and water sucker were excised from the mother plant and the pseudostem was cut left out only corm of the suckers. The materials were then undergoing sanitization process to clean from soil and pest. Treated corm of sword and water sucker were then layout on the bed same as corm nursery technique. But in the conventional technique of propagating banana, soil is used as a med

5. Maintenance of the corm

The corms were let to grow for 7 weeks and along the weeks the beds were watered evenly with 1 liter water once every 2 days and if it is not raining, it was watered every day.

Technology Evaluation

1. Growth performance

From the study, corm nursery technique has higher number of seedling produced compared to conventional. According to Namuddu *et la.*, 2013, conventional method has low number of seedling is because this method is very difficult to breed banana seedling. Corm nursery technique can produce more seedlings because the corm was sliced the apical dominance of the corm was repressed and this is consistent with finding of Dayarani *et al.*, 2013 about that this technique in which apical dominance is repressed to stimulate lateral bud development and increased suckering rate.

However, undeniably tissue culture technique produce more seedling than both of the corm nursery and conventional way of propagating banana planting material. But because of the cost of production in tissue culture is high, then it is not preferably chose by the small scale growers. That is why, in the corm nursery technique can produce more seedlings compare to conventional and having low cost of production compare to tissue culture technique. Besides that, Kasyoka *et al.*, 2010 studies showed that, conventional method of propagation is a slow process and quite often does not yield adequate suckers of the desired varieties, where the results of this experiment also described the process of conventional method in the same manners. Whereas, corm nursery technique has better performance and faster in process this is probably because of the propagation media.

2. Comparative Benefits

Table 1. Description of nursery technique used in terms of propagation period, cost per seedling and remarks.

Nursery Technique	Propagation Period (Weeks)	Cost Per Seedling (Rm)	Remarks
Tissue Culture	12	2.80	Specialized Lab, Costly
Novel Nursery Technique	7	1.50	Supplier Nursery
Conventional Technique	?	1.20	Quality Assurance
Corm Technique	5	1.00	Grower Nursery

Technology verification

1. Usefulness and impact

The developed technology is not only simple and low cost production but also providing the small scale growers with reliable quality of banana planting material which free from disease and fast growth. Thus, the technique is just suitable to be introduced, especially to the third world countries as a technique which could help in the poverty eradication programs. For that reason, this project was funded by the Malaysia government under the Knowledge Transfer Program (KTP) for poverty eradication program for rural population with funding of RM 168,000.00. Moreover, a hands on training was carried out to help the small scale growers to introduce and improve the skill of practicing the corm nursery technique.

2. Accreditation

During the Malaysia Technology Expo (MTE) 2014, this technique was evaluated and was awarded silver medal of innovation award and international design award. For the next exhibition of International Technology Exhibition (I-TEX) 2014 on May, which held at Kuala Lumpur Convention Centre, this technique was awarded gold medal for the innovation award.

Conclusion

With this simple technique of corm nursery technique, it is a low cost technique which could help the small scale grower to produce their own banana planting material for banana cultivation without worrying to buy expensive and good quality banana seedling. Besides that, this

technique is the on farm planting material production system which it help the small scale growers in terms of readily available and easily accessible of the banana seedlings. Moreover, they create their own enterprise by selling the banana seedling apart from banana cultivation. Overall, this technique can implemented to help in poverty eradication program.

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