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Propagation technique system for the production of banana planting materials

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ABSTRACT

Small scale growers can diversify their income by not only cultivating banana but also as nursery propagators. They can reduce their capital by producing their own planting materials. UMK researchers have developed corm nursery technique (Corm-Tech) which help the small scale growers to mass propagate banana planting materials on-farm. Further research has been done where two components has been added into Corm-Tech which are Corm-shad and Corm-fert that help to improve the technique and also has developed a nursery propagation system (NUPSYS) so that the operation run mechanically and automatically. By doing that, multiple cycles of mass propagation of quality banana planting materials was achieved with the equivalent quality of tissue culture planting materials. Therefore, the combination of all technology has come out with a complete system called Propagation technique system (PROPA-TechSys) which eventually will help the small scale growers to produce more banana planting materials with more efficient and precision. Moreover, the system is a green technology, labour saving and cost-saving.

Keywords: enhancement, mechanization, automation, fast-track, precision

Introduction

Banana is one of the most important fruit crop in the world (Saha Roy.O *et al.*, 2010) and is well known among tropical countries around the world through the trading activities (Kamaludin *et al.*, 2012). Malaysia is one of the country that cultivate banana. Banana is cultivated either using naturally regenerated suckers or tissue culture planting materials (Njau *et al.*, 2011). Tissue culture planting materials are used because it is free from diseases and mass propagation of tissue culture planting materials can be done by using micro-propagation technique (Kamaludin *et al.*, 2012). By

mass produce the planting materials, a consistent supply of banana planting materials van be provided. However, at the small scale production of banana, using of tissue culture technique might not be appropriate because it is costly when it comes to instruments and required sophisticated technique, skill and cares to handle (Dayarani *et al.*, 2013).

Small scale farmers in Malaysia are the major cultivators of banana. Normally, they will try to get banana seedling from regenerated suckers, which is bound to diseases (Njau *et al.*, 2011). Therefore, the farmers required a simpler yet not expensive method that can mass produce banana seedlings on their own farm. This technique must has the ability to produce equivalent quality to tissue culture planting material. Another method that yet to be revealed in Malaysia, that will help the small scale farmers is the PROPA-TechSys.

PROPA-TechSys is the macro-propagation method of producing banana seedlings. It is the upgraded version of Corm-Tech (Ahmad Yusuf and Suhaimi, 2015) which has been presented in RENPER 5 last year. PROPA-TechSys is faster and precise than the previous technology, where the automation and mechanization element are added and also the enhancement method is implemented. In this new technology, we just added new components into the Corm-Tech which is corm-shad and corm-fert for the enhancemet by using shading and fertilizer treatment and Nursery propagation system (NUPSYS) for automation and mechanization. Currently in the Corm-Tech we have corm preparation (corm-prep), corm seedling in polybag (corm-poly) and stacking of corm-poly (corm-stad) (Ahmad Yusuf and Suhaimi, 2015). In conclusion, by using this new technology, an accessible, available and affordable quality planting materials can be produced and eventually will help those small scale farmers.

Technology Development

PROPA-TechSys is a combination or a package of technologies. The technologies are as followed:

1. Corm-Tech

The first technology is the technique of propagation through macro-propagation. In this technique, banana corm of mother plant, sword and water sucker were used. Through some techniques, banana corm can induce lateral bud development (Faturoti *et al.*, 2002; Dayarani *et al.*, 2013). Corm-Tech was divided into several stages as followed:

a) Corm preparation (corm-prep)

The corms were sliced horizontally from the side. The corm slices 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)

Corm-poly is the second stage after the emergence of seedlings in the corm-prep. In this stage, uniform growth of banana seedlings were selected and transferred into 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)

At the final stage of Corm-Tech, the selected seedlings were moved to the stacking cabinet before it ready to be sold or transplanted into the field. The stacking system is to optimize the space of nursery and ease of handling and delivering.

2. Upgraded version

The upgraded version of Corm-Tech is Corm-Tech version 2.0. In this new version, new components were added to boost the growth performance of the seedlings which eventually reduce the nursery period and increase number of production cycles. Thus, improved the quantity of seedlings, not only quantity but quality is also improved. The components are as followed:

a) Corm-shad

Corm-shad is the growth enhancement of seedling through shading treatment. Under the treatment, height of the seedling is the major parameter taken as priority in or order to shorten the nursery period. It is said that, several factors such as water, nutrients and sunlight trigger the metabolism of a plant, low light cause the plant become taller (Shirley 1929).

b) Corm-fert

However, in the corm-shad, not all plant attributes affected by the low irradiance and some said also caused reduction (Copeland, 1911). Therefore, corm-fert was developed to improve those other attributes by using fertilizer. Fertilizers are known to improve growth of a plant (Bolaños *et*

al., 2003) and this technique using foliar application to boost up the uptake of nutrients (Guvence & Baden, 2002).

3. NUPSYS

NUPSYS also called Nursery propagation system is the automation and mechanization of the technologies above. The technologies were engineered to precisely mass propagate quality banana seedlings using a compliances standard operating procedures of the previous technologies. This system definitely will help the nursery operator to have more seedlings and improved their income. The system has several components which are required in order to have quality banana seedlings, and the components are as followed:

- Slicer
- Sanitation
- Rinser
- Tray placement
- Filler-compacter
- Cabinet stacking
- Stacking and delivery

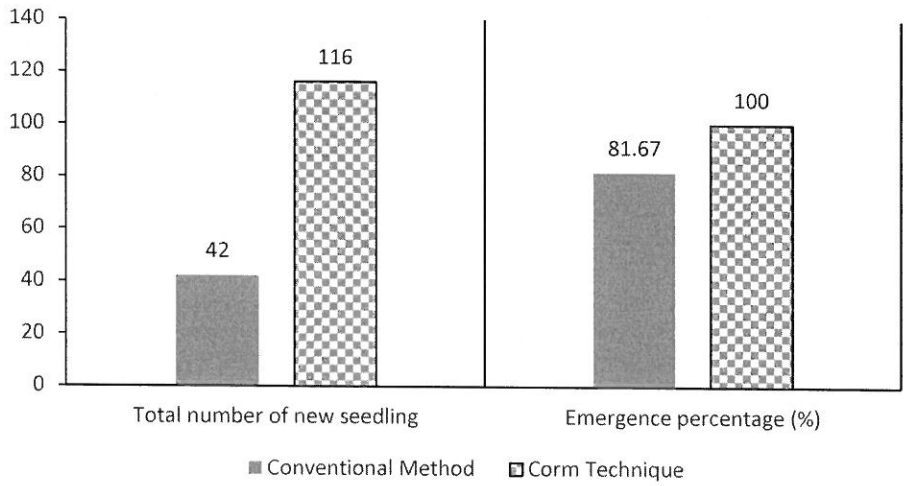
Technology Evaluation

1. Seedling number

According to Figure 1, Corm-Tech able to produce more seedling compared to the conventional method. Thus, the local farmers especially small scale growers do not have to worry anymore if there is inconsistent of banana seedlings, they can produce their own seedling using the Corm-Tech.

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.

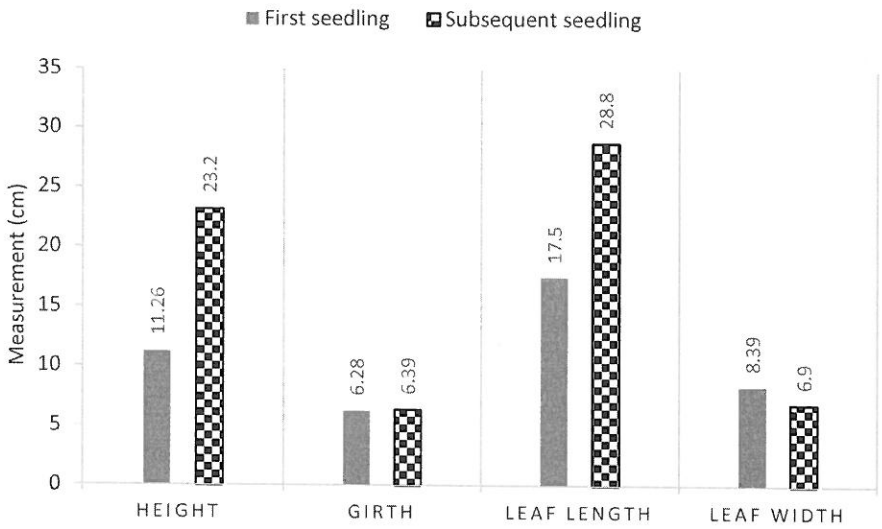


Significant value = 0.05

Figure 1: Total number of new banana seedling and mean emergence percentage from different methods of propagation at week's 7.

2. Growth performance

The seedlings were enhanced under corm-shad and corm-fert. Both showed a convincing results, where it showed that the enhancement treatment significantly improved the plant attributes in the Figure 2, where the first seedling represent without enhancement treatment and subsequent seedling is vice versa. As mentioned by Sarkar & Pal (2006) and Saifuddin *et al* (2010), fertilizer using foliar application shading treatment does improved the seedling growth performance.



Significant value= $p < 0.05$

Figure 2: Mean of the seedling height, girth, leaf length and width for first seedling and enhanced subsequent seedling.

3. 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	Uncertain	1.20	Quality Assurance
Corm Technique	5	1.00	Grower Nursery
Propa-TechSys	4	1.00	More Cycles, Mechanization

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 and using the Propa-TechSys.

2. Accreditation

During the Malaysia Technology Expo (MTE) 2014, this technique was evaluated and wasawarded silver medal of innovation award and international design award. For the next exhibition of International Technology Exhibition (I-TEX) 2014 and 2015, which held at Kuala Lumpur Convention Centre, this technique was awarded gold medal for the innovation award.

Conclusion

This technology is simple yet cheap compared to conventional and tissue culture technique. It is a low cost technique which could help the small scale grower to produce their own quality 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 to have readily available and easily accessible of the banana seedlings. Moreover, they can move up to the next stage to have their own enterprise by selling the banana seedling apart from banana cultivation. Overall, this technique can implemented to help in poverty eradication program.

References

Ahmad Yusuf. M. K., and Suhaimi. O., 2014, Corm Nursery Technique for Mass Propagation of Banana Seedlings, "Enhancing Strategic Plant Physiological Research and Technologies for Sustainable Resources", International Conference on Plant Physiology 2014 (ICPP 2014), Bali, Indonesia, 26- 28th August 2014, ISBN 978-967-10840-4-5, Proc. Int. Conf. Plt. Phy. 2014

Bolaños, M. M,, Morales, O., Celis, L. D. G. (2003). Fertilization (organic and inorganic) and production of 'Dominico hartón'. Inf. Musa, 12(1), 38-42.

Copeland, E. B. (1911). Abaca. Philipp Agricltrst Forester, 1, 70-78

Dayarani. M., Dhanarajan. M.S., Uma S., and Durai. P. (2013). Macro Propagation for Regeneration ofWild Bananas (Musa spp.). Advanced Bio Tech. Vol.12: 2319-6750

Evans M.R., Konduru S., Stamps R.H. (1996). Source variation in physical and chemical properties of coconut coir dust. HORTSCIENCE 31: 965-967

Faturoti, B., Tenkouano, A., Lemchi, J. and Nnaji, N. (2002). Rapid Multiplication of Plantain and Banana: Macropropagation Techniques. A pictorial guide. Ibadan, Nigeria: IITA.

Guvence, I., and Baden, H. (2002). Effect of foliar application of different sources and levels of nitrogen on growth and yield of tomato (*Lycopersicon esculentul1z*). Indian Journal of Agricultural Science, 72(2), 4-5.

Jadwiga Treder. (2008). The effects of cocopeat and fertilization on the growth and flowering of oriental lily 'star gazer'. Journal of Fruit and Ornamental Plant Research, Vol. 16: 361-370

Kamaludin, R., Arash, N., Rofina, Y. O., Nurul, A.I., Shamrul, A., Shahril, E. (2012). Micropropagation of Ornamental Plant *Musa Beccarii* through Tissue Culture Technique Using Suckers and Male Buds as Explants. Life Science Journal 2012, Vol. 9(4):2046-2053

Kasyoka, M.R., Mwangi, M., Kori, N., Gitonga, N. & Muasya, R. (2010). Evaluating the macropropagation efficiency of banana varieties preferred by farmers in Eastern and Central Kenya. Second RUFORUM Biennial Meeting

Namuddu, A., Kiggundu, A., Mukasa, S. B., Kurnet, K., Karamura, E., and Tushemereirwe, W. (2013). *Agrobacterium* mediated transformation of banana (*Musa* sp.) cv. Sukali Ndiizi (ABB) with a modified *Carica papaya* cystatin (*CpCYS*) gene. African Journal of Biotechnology Vol. 12(15):1811-1819

Njau. N., Mwangi. M., Kahuthia-Gathu. R., Muasya. R., & Mbaka. J. (2011). Macropropagation technique for production of healthy banana seedlings. African Crop Science Conference Proceedings, Vol. 10: 469 – 472

Prasad M. 1997. Physical, chemical and biological properties of coir dust. ACTA HORT. 450: 21-29

Robin Mittenthal. (2010) Using plastic mulch in the garden. www.eagleheightsgardens.org/tips/plastic_mulch_handout.pdf. *Accessed on 14 July 2014. Retrieved on 14 July 2014*

Saha Roy, O., Pranay, B., and Kumar S.G (2010). Micropropagation and Field Performance of 'Malbhog' (Musa paradisiaca, AAB group): A popular Banana Cultivar with High Keeping Quality OH North East India, Tree and Forestry Science and Technology, Global Science Book.

Saifuddin, M., Hossain, A. M. B., Normaniza, O. (2010). Impacts of shading on flower formation and longevity, leaf chlorophyll and growth of *Bougainvillea glabra*. Asian J Plant Sci, 9(1), 20-27

Sarkar, R. K., and Pal, P.K. (2006). Effect of pre-sowing seed treatment and foliar spray of nitrate salts on growth and yield of greengram (*Vigna radiata*). Indian Journal of Agricultural Sciences, 76 (1), 62-5.

Shirley, H. L. (1929). The influence of light intensity and light quality upon the growth of plants. American Journal of Botany 16, 354