



Effect of Organic Materials and Arbuscular Mycorrhizal Fungi on Growth of Green Aromatic Coconut Seedlings from Embryo Culture

Sirilak Kaewsuralikhit^{1*}, Supaporn Sachati², Nisarath Thaweenut¹ and Orathai Tananchai³



Abstract

This study was conducted from October 2022 to September 2023 at the Horticultural Research Center and Agricultural Production Science Research and Development Division, Bangkok. Its objective was to investigate the use of Arbuscular mycorrhizal fungi (AMF) to enhance the vigor and survival of green aromatic coconut seedlings derived from embryo culture. The protocol of an aromatic coconut embryo culture; The medium of the embryo germination phase used a Y3 solid medium supplemented with Gibberellic Acid (GA) at a concentration of 5 μ M, while the medium of the shoot formation phase used a Y3 liquid medium supplemented with Indole-3-butyric acid (IBA) at a concentration of 10 μ M. Seedlings of the coconut aged 8-9 months, with developed shoots and roots, were transplanted into various mixtures containing organic materials combined with AMF. The experiment was designed as a Completely Randomized Design (CRD) with 6 treatments and 5 replications. After 5 months of cultivation period, the results showed that seedlings planted in a mixture of dried Azolla and AMF exhibited the highest increase in average height and trunk diameter, which were 11.7 centimeters and 4.22 millimeters, respectively. Coconut seedlings grown in a mixture containing dried Azolla and dried Azolla with AMF had the highest increase in the average number of leaves, which was equal to 2 leaves.

Keywords: tissue culture plantlet, mycorrhizal inoculation, organic material, dry azolla

Introduction

Green aromatic coconut is an economically important crop in Thailand, but its low germination rate through seed propagation (~40%) has led to the use of embryo culture techniques. However, seedlings from tissue culture often struggle to survive after transplantation due to weak roots and low nutrient uptake. Improving growth media with suitable organic components is essential to support seedling acclimatization. Organic materials such as cow manure, leaf compost, and dried Azolla enhance the physical structure and nutrient content of the substrate. Additionally, AMF colonize roots and increase nutrient and water absorption. Previous studies have shown that AMF improves seedling vigor and reduces mortality. This study aims to evaluate the effects of different organic materials combined with AMF on the growth of green aromatic coconut seedlings derived from embryo culture.

Methodology

- Plant Material: Embryos from 10-month-old green aromatic coconut were cultured using Y3 medium: 1) Germination phase: Y3 solid medium + 5 μ M GA (dark for 2 months) and 2) Shoot/root formation: Y3 liquid medium + 1 μ M IBA (16 h light, 25 \pm 2°C, 3 months).
- Transplanting: Seedlings (8–9 months old) were transplanted into 6 treatments using: cow manure (+ / - AMF), legume Leaf compost (+ / - AMF), and Dried Azolla (+ / - AMF). All treatments included equal parts sand as a base and added 3% of organic material.
- Experimental Design: CRD, 6 treatments, 5 replications.
- Data Collection: Seedling height, stem diameter, and leaf number recorded at months 2 and 5.
- Statistical Analysis: ANOVA and DMRT at $p \leq 0.05$ (IRRISTAT software).

Results

Table 1 The height and average height increase of green aromatic coconut seedlings transplanted into mixed media with various organic materials combined with AMF at 2 and 5 months of age.

Treatment	Seedling Height (cm) ^{1/}		Height Increase (cm)
	Month 2	Month 5	
Manure (-)	36.4 ^b	47.5 ^b	11.1
Manure (+)	35.1 ^b	42.2 ^c	7.1
Leaf compost (-)	38.0 ^{ab}	46.8 ^{bc}	8.8
Leaf compost (+)	35.1 ^b	45.9 ^{bc}	10.8
Dried Azolla (-)	38.9 ^{ab}	44.7 ^{bc}	5.8
Dried Azolla (+)	41.6 ^a	53.3 ^a	11.7
CV. (%)	10.27	8.39	

^{1/} Means within the same column followed by the same letter are not significantly different at the 5% level by DMRT.

Table 2 Stem diameter and average increase in stem diameter of green aromatic coconut seedlings transplanted into mixed media with various organic materials combined with AMF at 2 and 5 months of age.

Treatment	Stem Diameter (mm) ^{1/}		Stem Diameter Increase (mm)
	Month 2	Month 5	
Manure (-)	8.85 ^a	11.80 ^a	2.95
Manure (+)	10.21 ^a	12.27 ^a	2.06
Leaf compost (-)	8.89 ^a	12.54 ^a	3.65
Leaf compost (+)	8.84 ^a	11.61 ^a	2.77
Dried Azolla (-)	7.46 ^a	11.51 ^a	4.05
Dried Azolla (+)	8.14 ^a	12.36 ^a	4.22
CV. (%)	12.19	12.28	

^{1/} Means within the same column followed by the same letter are not significantly different at the 5% level by DMRT.

Table 3 Number of leaves and average increase in number of leaves of green aromatic coconut seedlings transplanted into mixed media with various organic materials combined with AMF at 2 and 5 months of age.

Treatment	Number of Leaves (Leave) ^{1/}		Increase in Number of Leaves (Leave)
	Month 2	Month 5	
Manure (-)	3.5 ^a	4.8 ^{ab}	1.3
Manure (+)	2.5 ^b	4.0 ^c	1.5
Leaf compost (-)	3.3 ^{ab}	4.2 ^{bc}	0.8
Leaf compost (+)	2.7 ^{ab}	4.3 ^{abc}	1.6
Dried Azolla (-)	3.0 ^{ab}	5.0 ^a	2.0
Dried Azolla (+)	3.0 ^{ab}	5.0 ^a	2.0
CV. (%)	24.04	13.49	

^{1/} Means within the same column followed by the same letter are not significantly different at the 5% level by DMRT.

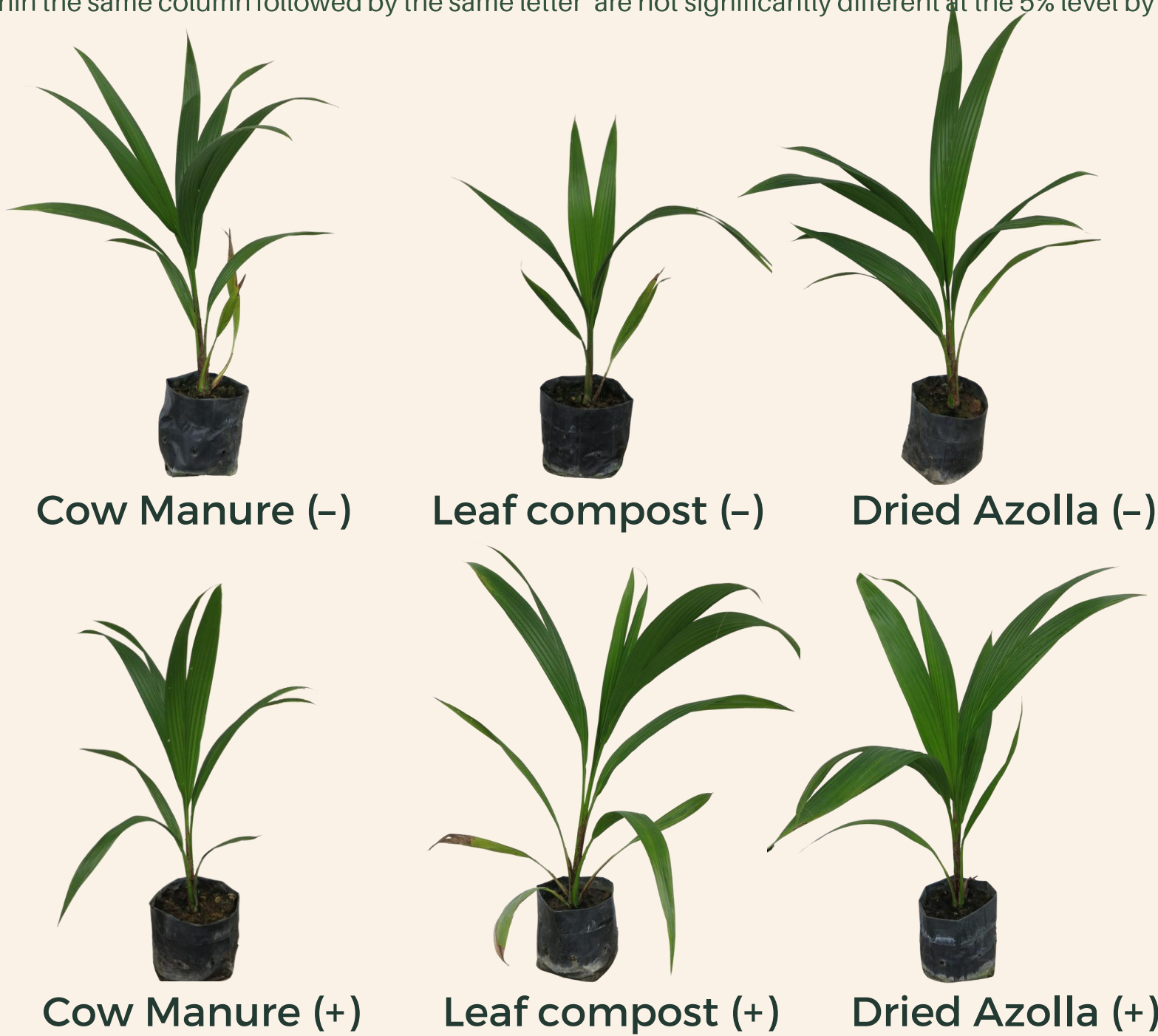


Figure 2 Green aromatic coconut seedlings transplanted into mixed media with various organic materials combined with arbuscular mycorrhizal fungi at 5 months of age. Note: (+) = Combined with AMF, (-) = Without AMF



Figure 1 Five and eight months old of green aromatic coconut plantlet from embryo culture.

Conclusion

After transplanting green aromatic coconut seedlings derived from embryo culture into mixed media containing various organic materials combined with AMF, following specified cultivation methods for 5 months, seedlings grown in media with dried Azolla combined with AMF showed the highest average increase in height of 11.7 centimeters, average stem diameter of 4.22 millimeters, and the greatest average increase in the number of leaves at 2 leaves. Therefore, the results indicated that dried Azolla, when used in combination with AMF, provides an effective growing medium that promotes vigorous seedling development during the acclimatization phase.

Reference

- Soil Science Research Group. 2023. Evaluation of Nutrient Release from Biomass. Soil Science Research Group, Agricultural Production Science Research and Development Division, Department of Agriculture, Bangkok. 10 pages.
- Ilangamudal, I.M.P.S. and Senarathne S.H.S. 2016. Effectiveness of Arbuscular Mycorrhizal Fungi based biofertilizer on early growth of coconut seedlings. COCOS. 22: 1-12.

