

# Soil Properties in Relation with the Incidence of Heart Rot Disease in Pineapple due to Phytophthora sp. in Humid Tropical Climate of Lampung, Indonesia

*By Afandi P. Cahyono;G.alang I. Jaya;M.A.S. Syamsul Arif;lvayani;Auliana Afandi*

<sup>1</sup>  
**PROCEEDINGS OF  
INTERNATIONAL SYMPOSIUM  
ON SOIL MANAGEMENT  
FOR SUSTAINABLE AGRICULTURE  
2017**



**-PART 1 -  
INTERNATIONAL SYMPOSIUM ON SOIL  
MANAGEMENT FOR SUSTAINABLE AGRICULTURE  
2017**

ORGANIZER:  
THE UNITED GRADUATE <sup>1</sup>SCHOOL OF AGRICULTURAL SCIENCE,  
GIFU UNIVERSITY

**-PART 2 -  
UGSAS-GU & BWEL JOINT POSTER SESSION  
ON AGRICULTURAL  
AND BASIN WATER ENVIRONMENTAL SCIENCES**

<sup>1</sup> CO-ORGANIZER:  
GIFU UNIVERSITY REARING PROGRAM  
FOR BASIN WATER ENVIRONMENTAL LEADERS



<sup>9</sup>  
**AUGUST 28 - 30, 2017  
6<sup>TH</sup> FLOOR, UGSAS BLDG. GIFU UNIVERSITY, JAPAN**

## LEMBAR PENGESAHAN

Judul : <sup>1</sup> Soil Properties in Relation with the Incidence of Heart Rot Disease in Pineapple due to Phytophthora sp. in Humid Tropical Climate of Lampung, Indonesia

Penulis : Afandi, P. Cahyono, G. alang I. Jaya, M.A.S. Syamsul Arif, Ivayani, and Auliana Afandi

NIP : 19610419198503 1004

Institusi : Fakultas Pertanian, Universitas Lampung


Publikasi : <sup>6</sup> Proceedings of International Symposium on Soil Management for Sustainable Agriculture

Impact Factor : -

Penyakit : Gifu University, Japan

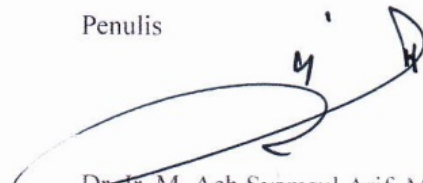
URL/ web : -

Mengetahui:  
Dekan Fakultas Pertanian  
Universitas Lampung

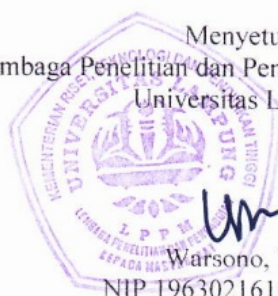
  
Iwan Sukri Banuwa, M.Si.  
NIP 20198603 1002


Bandar Lampung, 5 Agustus 2019

Penulis

  
Dr. Ir. M. Ach Syamsul Arif, M.Sc.  
NIP 19610419198503 1004

Menyetujui:  
Ketua Lembaga Penelitian dan Pengabdian Kepada Masyarakat  
Universitas Lampung



  
Warsono, Ph. D  
NIP 196302161987031003

KEMENTERIAN PENELITIAN DAN PENGABDIAN KEPADA MASYARAKAT UNIVERSITAS LAMPUNG	
NO	9-8-2019
WAKTU	176 / P/B/E / IFP / 2019
JAWAB	Prosiding
PARAF	St



## Soil Properties in Relation with the Incidence of Heart Rot Disease in Pineapple due to *Phytophthora* sp. in Humid Tropical Climate of Lampung, Indonesia

O Afandi\*, P. Cahyono\*\*, Galang I. Jaya \*, M.A.S. Syamsul Arif\*, Ivayani\*, and Auliana Afandi\*\*\*

(\*Faculty of Agriculture, Lampung University, Indonesia

\*\*Research & Development PT. GGP, Indonesia

5  
\*\*\*United Graduate School of Agricultural Sciences, Gifu University, Japan)

### SUMMARY

1  
This study examined the relationship between soil properties, especially pH and C-organic soil with the incidence of heart rot disease due to *Phytophthora* in pineapple plantation. The heart rot disease which was caused by *Phytophthora* sp. was studied in small scale plot experiment. To simulate the amount of C-organic in soil as well as pH, the experiment was done by applying compost with the following treatments: 0 t/ha, 100 t/ha, and 200 t/ha of compost with 5 replicate. Three months after planting, the incidence of disease was very severe in application of 200 t compost per ha, and all the plants were nearly dead 5 months after planting in 100 and 200 t/ha of compost application. Application of compost increased C-organic soil and soil pH in, especially treatment 200 t/ha followed by the increasing disease incidence due to *Phytophthora*. The species of *Phytophthora* sp was identified as *Phytophthora nicotianae*.

**Keywords:** pineapple, compost, heart rot disease, *Phytophthora*

### Introduction

The soil developed under humid tropical climate generally is characterized with low pH (acid soil), low chemical fertility as well as poor soil physical properties. Farming in such soil conditions have many obstacles, mainly getting high yield of agricultural crop and maintaining the soil health. Application of organic matter or compost and liming usually applied to encounter these problems. However, in pineapple cultivation, increasing pH above 5 would promote disease in the form of heart rot and root rot disease due to *Phytophthora* sp. (Rohrbach and Johnson, 2003; Pegg, 1993; Mite et al., 2010). On the other hand, if the pH is very low, the availability of macro nutrient will be limited.

Understanding the living environment of *Phytophthora* sp. in pineapple could control the incidence of diseases which caused by this microorganism. In Hawai'i, pineapple heart and root rots are most severe in high-rainfall areas and irrigated soils with poor soil drainage (Green and Nelson, 2015). Corcobado et al., (2013) reported that the occurrence of infected trees by *Phytophthora cinnamomi* was higher in soil low bulk densities, fine textured soils and in thick Ah horizons. Morgan and Shearer (2013) showed that the capacity of *P.cinnamomi* to sporulate and release zoospores significantly greater in the jarrah forest soil and Bassendean sand than the mining soils. Shearer

(2014) also reported that sporangia of *P. cinnamomi* grew well in temperatures were between 26 °C to 30 °C. Afandi et al. (2016) reported that the heart rot disease due to *Phytophthora* started attack at pH above 4.4 and soil organic matter above around 1%.

The objective of this research is to investigate the relationship between soil properties, especially pH and C-soil organic with *Phytophthora* incidence in pineapple in Lampung, Indonesia.

### Material and Method

Research conducted in pineapple plantation, Central Lampung, Lampung, Indonesia, from June 2016 until March 2017. The experiment was done by applying compost with the following treatments as follows :0 t/ha, 100 t/ha, and 200 t/ha compost with 5 replicate planted with pineapple. The plot size was 3 mx 2.5 m with planting distance 56 between rows and 20 cm in row. Planting material of pineapple was sucker with clone GP3. Prior to planting, the base fertilizer were applied with 100 kg Urea/ha, 150 kg KCl/ha, and 250 kg DAP/ha. The disease incidence were investigated 3, 4, 5 month after planting on January, February and March 2017. Chemical soil properties, including in pH and C-organic soil were analyzed 5 months after planting.

The soil used in this experiment was classified as Ultisols or Red Yellow Podzolic Soils with have the following soil fraction composition: sand 53.8%, silt

8.6%, and clay 37.6% and categorized as sandy clay in USDA Soil Texture Classification. The initial chemical properties of soil have the following values: pH 4.7, C-organic 1.5, and CEC total 19.7 meq/100 g. Compost consisted of 20% cow dung, 20% bamboo chops, and 60% of pineapple bagasse, which already composting and mature. The content of compost were as follows: pH 7.2, C-total 21.59%, N-total 1.68%, C/N ratio 12.89 and CEC total 56.48 meq/100 g.

Result and Discussions

Climate condition

The average rainfall during 1981-2012 was around 2452 mm per year. The dry season, which the rainfall below 100 mm per month, occurred in June until September. The rainy season start on November until April. The monthly rainfall distribution is shown in Fig.1.

The average air temperature as shown in Fig.2 was around 22.5°C to 32.6 °C throughout the year. The maximum temperature occurred in October, while the minimum temperature occurred in July.

This climate character was ideal with phytophthora growth which high rainfall and warm temperature.

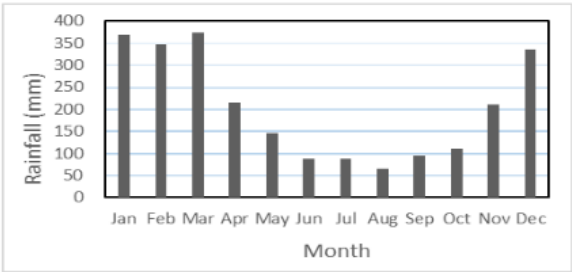


Fig.1 Monthly rainfall in Central Lampung

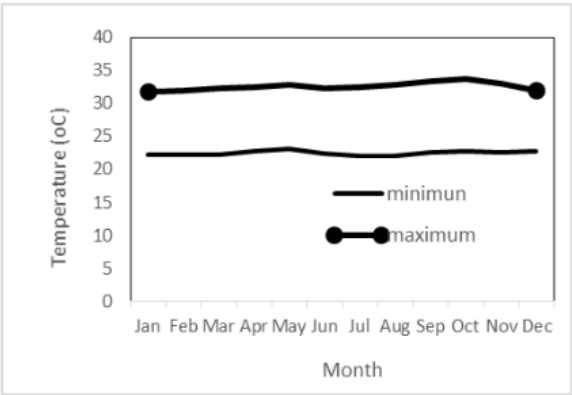


Fig.2 Monthly minimum and maximum temperature

Disease Incidence

The diseases incidence caused by phythophthora was characterized by the leaves which easily pulled from the plant, with foul smell and the plant would finally be dead. Identification of the species in this location by Auliana Afandi in Gifu University showed that the species of Phytophthora is *Phytophthora nicotianae*.

The disease incidence which was observed from 3 after months planting is shown in Fig 3.

Figure 3 showed that 3 months after planting, the incidence of disease was very severe in application of 200 t compost per ha, and all the plants were nearly dead 4 and 5 months after planting in 100 and 200 t/ha of compost application.

pH, C-organic and disease incidence

Application of compost increased C-organic soil in, especially treatment 200 t/ha. Compost application also increased pH. Increasing pH and C-organic were followed by the increasing of disease incidence (Table 1).

Since compost has high pH, the application of compost would increase pH in soil. In this experiment, the treatment with 0 t/ha of compost has already pH >5, the ideal condition of the Phythophthora, so until five month after planting, the incidence of phythophthora disease was around 53%. Combination of high pH and high organic soil in treatment 100 and 200 t/ha compost made almost the all pineapple plant died five months after planting.

Other experiment using 50 t/ha of compost, the disease incidence was not significantly reduced the pineapple population as well as yield.

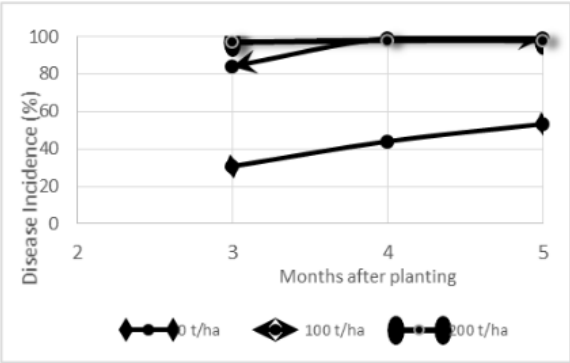


Fig.3 Disease incidence after planting

Table 1 Disease incidence and soil properties

Compost (t/ha)	C-soil organic (%)	pH	Disease incidence (%)
0	1.72a	5.47a	53a
100	2.35ab	5.71a	99b
200	3.16b	6.25b	98b

\*) Means followed by same letters within a column do not differ statistically

### Conclusion

Application of high dosage compost with high pH has induced phytophthora attack in pineapple. Five month after planting, all pineapple plant (98-99%) almost died due to heart rot disease caused by *Phytophthora nicotianae*. Compost application below 100 t/ha and liming application not more than until pH 5, is better for pineapple.

### Acknowledgement

The authors thanked to PT. Great Giant Pineapple, Central Lampung, Lampung, Indonesia, for facilitating this research.

### Reference

Afandi, Martin DAN, Suharjo R, Niswati A, Loekito S, and Afandi A (2016) Soil Properties under Heart Rot Disease of Pineapple due to Phytophthora Incidence, in Lampung, Indonesia. Proceeding *The 5th UGSAS-GU Roundtable & Symposium* 2016:29–31, August, 2016, Gifu, Japan.

Corcobado T, Solla A, Madeira MA, and G. Moreno.

(2013) Combined effects of soil properties and Phytophthora cinnamomi infections on Quercus ilex decline. Plant Soil. 373:403–413.

Green J and Nelson S (2015) Heart and Root Rots of Pineapple. Plant Disease July 2015 PD-106. College of Tropical Agriculture and Human Resources, University of Hawai'i at Manoa:1-7.

Mite F, Espinosa J, and Medina L (2010) Liming Effect on Pineapple Yield and Soil Properties in Volcanic Soils. Better Crops Vol.94 (1):7-9.

Morgan, B.R., and B. L. Shearer. (2013): Soil type and season mediated Phytophthora cinnamomi sporangium formation and zoospore release. Australasian Plant Pathol. 42:477–483.

Pegg KG (1993). Diseases. In Pineapple Pest and Disorder (eds. R.H. Broadly, R.C. Wassman III and E. Sinclair). DPI Queensland:11-32.

Rohrbach KG and Johnson MW (2003) Pests, Diseases and Weeds. In *The Pineapple: Botany, production and Uses* (eds. D.P. Bartholomew, R.E. Paull and K.G. Rohrbach), CAB International:203-252.


Shearer BL (2014) Time course studies of temperature and soil depth mediated sporangium production by Phytophthora cinnamomi. Australasian Plant Pathol. 43:235–244.

19

**LEMBAR**  
**HASIL PENILAIAN SEJAWAT SEBIDANG ATAU PEER REVIEW**  
**KARYA ILMIAH : PROSIDING DAN MAKALAH YANG DIPRESENTASIKAN**

Judul Makalah/ Poster : Soil Properties in Relation with the Incidence of Heart Rot Disease in Pineapple due to Phytophthora sp. In Humid Tropical Climate of Lampung, Indonesia

Penulis Makalah/ Poster : Afandi, P.Cahyono, G. Alang I. Jaya, M.A. Syamsul Arif, Ivayani and Aulia Afandi

Identitas Makalah/ Poster : a. Nama Prosiding : Proceedings of International Symposium on Soil Management for Sustainable Agriculture  
c. ISBN :   
d. Tahun Terbit : Agustus 2017  
e. Penerbit : Gifu University, Japan  
f. Jumlah Halaman : 3 Halaman

Kategori Publikasi Jurnal Ilmiah : ☐ Prosiding Forum Ilmiah Internasional (Dipresentasikan secara Oral Dimuat dalam Prosiding)  
(beri tanda V pada kategori yang tepat) ☐ Prosiding Forum Ilmiah Nasional (Dipresentasikan secara Oral Dimuat dalam Prosiding)  
☐ Prosiding Forum Ilmiah Internasional (Poster/ Tidak Disajikan tetapi Dimuat dalam Prosiding)  
☐ Prosiding Forum Ilmiah Nasional (Poster/ Tidak Disajikan tetapi Dimuat dalam Prosiding)  
☐ Makalah Forum Ilmiah Internasional (Disajikan tetapi Tidak Dimuat dalam Prosiding)  
☐ Makalah Forum Ilmiah Nasional (Disajikan tetapi Tidak Dimuat dalam Prosiding)

Hasil Penilaian Peer Review :

Komponen yang dinilai	Nilai Maksimal Prosiding/ Makalah Dipresentasikan :						Nilai yang Diberikan Penilai (NP)
	Dipresentasikan secara Oral Dimuat dalam Prosiding		Disajikan dalam Bentuk Poster/ Tidak Disajikan tetapi Dimuat dalam Prosiding		Dipresentasikan tetapi Tidak Dimuat dalam Prosiding		
	Internasional	Nasional	Internasional	Nasional	Internasional	Nasional	
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
a. Orisinalitas (20%) (Memperlihatkan keaslian dan kebaruan gagasan)	3	2	2	1	1	0,6	3
b. Kedalaman Kajian (40%) (Melakukan analisis, eksplorasi, dan elaborasi terhadap masalah yang dibahas berdasarkan kaidah-kaidah ilmiah yang berlaku dalam penelitian dan pengkajian; mengandung kebenaran ilmiah, ketuntasan kajian, kesistematian pembahasan, dan didukung dengan pustaka yang relevan)	6	4	4	2	2	1,2	6
c. Kebermanfaatan (10%) (Memberikan manfaat bagi kemajuan ilmu dan solusi bagi masalah yang dihadapi masyarakat)	1,5	1	1	0,5	0,5	0,3	1,5
d. Relevansi karya dengan keahlian (20%) (Memiliki keselarasan antara karya ilmiah dengan penelitian magister/ doktor dan bidang penugasannya)	3	2	2	1	1	0,6	1,5
e. Kelengkapan unsur Prosiding (10%) (Mencakup prakata, daftar Isi, editor, ISBN, dan kelengkapan lain)	1,5	1	1	0,5	0,5	0,3	0,5
Total (100%)	15	10	10	5	5	3	12,5


Nilai Pengusul = BP x NP =  $(40\% : 5) \times 12,5 = 1,0$

Ket : Bobot Peran (BP) : Sendiri = 1; Ketua = 0,6; Anggota = 0,4 dibagi jumlah anggota

link web-np harap tampilkan!  
tdk ber ISBN

Batas Kepadatan :  
Prosiding Forum Ilmiah Nasional dan Poster paling banyak 25 % dari angka kredit unsur penelitian yang diperlukan untuk pengusulan ke Lektor Kepala dan Profesor

Bandar Lampung 20 Oktober 2019  
Penilai Sejawat I / II / III (Lingkari salah satu)



NIP. \_\_\_\_\_  
Unit Kerja: Fakultas Pertanian Unila

**LEMBAR**  
**HASIL PENILAIAN SEJAWAT SEBIDANG ATAU PEER REVIEW**  
**KARYA ILMIAH : PROSIDING DAN MAKALAH YANG DIPRESENTASIKAN**

Judul Makalah/ Poster : Soil Properties in Relation with the Incidence of Heart Rot Disease in Pineapple due to Phytophthora sp. In Humid Tropical Climate of Lampung, Indonesia

Penulis Makalah/ Poster : Afandi, P.Cahyono, G. Alang I. Jaya, M.A. Syamsul Arif, Ivayani and Aulia Afandi

Identitas Makalah/ Poster : a. Nama Prosiding : Proceedings of International Symposium on Soil Management for Sustainable Agriculture  
c. ISBN :  
c. Tahun Terbit : Agustus 2017  
d. Penerbit : Gifu University, Japan  
e. Jumlah Halaman : 3 Halaman

Kategori Publikasi Jurnal Ilmiah : ☒ Prosiding Forum Ilmiah Internasional (Dipresentasikan secara Oral Dimuat dalam Prosiding)  
(beri tanda V pada kategori yang tepat) ☐ Prosiding Forum Ilmiah Nasional (Dipresentasikan secara Oral Dimuat dalam Prosiding)  
☐ Prosiding Forum Ilmiah Internasional (Poster/ Tidak Disajikan tetapi Dimuat dalam Prosiding)  
☐ Prosiding Forum Ilmiah Nasional (Poster/ Tidak Disajikan tetapi Dimuat dalam Prosiding)  
☐ Makalah Forum Ilmiah Internasional (Disajikan tetapi Tidak Dimuat dalam Prosiding)  
☐ Makalah Forum Ilmiah Nasional (Disajikan tetapi Tidak Dimuat dalam Prosiding)

Hasil Penilaian Peer Review :


Komponen yang dinilai	Nilai Maksimal Prosiding/ Makalah Dipresentasikan :						Nilai yang Diberikan Penilai (NP)
	Dipresentasikan secara Oral Dimuat dalam Prosiding		Disajikan dalam Bentuk Poster/ Tidak Disajikan tetapi Dimuat dalam Prosiding		Dipresentasikan tetapi Tidak Dimuat dalam Prosiding		
	Internasional <input checked="" type="checkbox"/>	Nasional <input type="checkbox"/>	Internasional <input type="checkbox"/>	Nasional <input type="checkbox"/>	Internasional <input type="checkbox"/>	Nasional <input type="checkbox"/>	
a. Orisinalitas (20%) (Memperlihatkan keaslian dan kebaruan gagasan)	3	2	2	1	1	0,6	3
b. Kedalaman Kajian (40%) (Melakukan analisis, eksplorasi, dan elaborasi terhadap masalah yang dibahas berdasarkan kaidah-kaidah ilmiah yang berlaku dalam penelitian dan pengkajian; mengandung kebenaran ilmiah, ketuntasan kajian, kesistematian pembahasan, dan didukung dengan pustaka yang relevan)	6	4	4	2	2	1,2	5
c. Kebermanfaatan (10%) (Memberikan manfaat bagi kemajuan ilmu dan solusi bagi masalah yang dihadapi masyarakat)	1,5	1	1	0,5	0,5	0,3	1,5
d. Relevansi karya dengan keahlian (20%) (Memiliki keselarasan antara karya ilmiah dengan penelitian magister/ doktor dan bidang penugasannya)	3	2	2	1	1	0,6	3
e. Kelengkapan unsur Prosiding (10%) (Mencakup prakata, daftar Isi, editor, ISBN, dan kelengkapan lain)	1,5	1	1	0,5	0,5	0,3	1,5
Total (100%)	15	10	10	5	5	3	14

Nilai Pengusul = BP x NP =  $\frac{0,4}{5} \times 14 = 1,12$

Ket : Bobot Peran (BP) : Sendiri = 1; Ketua = 0,6; Anggota = 0,4 dibagi jumlah anggota

Bandar Lampung,  
Penilai Sejawat I / II / III (Lingkari salah satu)

Batas Keputusan :  
Prosiding Forum Ilmiah Nasional dan Poster paling banyak 25 % dari angka kredit unsur penelitian yang diperlukan untuk pengusulan ke Lektor Kepala dan Profesor

  
NIP. 106305081988112001  
Unit Kerja: Fakultas Pertanian Unila

# Soil Properties in Relation with the Incidence of Heart Rot Disease in Pineapple due to Phytophthora sp. in Humid Tropical Climate of Lampung, Indonesia

ORIGINALITY REPORT

18%

SIMILARITY INDEX

PRIMARY SOURCES

1	<a href="#">repository.unand.ac.id</a> Internet	159 words — 11%
2	<a href="#">www.growables.org</a> Internet	22 words — 2%
3	<a href="#">www.hydrol-earth-syst-sci-discuss.net</a> Internet	16 words — 1%
4	<a href="#">lipipress.com</a> Internet	12 words — 1%
5	<a href="#">repository.lib.gifu-u.ac.jp</a> Internet	10 words — 1%
6	<a href="#">repository.lppm.unila.ac.id</a> Internet	9 words — 1%
7	Teodor Rusu. "Energy efficiency and soil conservation in conventional, minimum tillage and no-tillage", International Soil and Water Conservation Research, 2014 Crossref	8 words — 1%
8	<a href="#">link.springer.com</a> Internet	8 words — 1%
9	<a href="#">www.ugsas.gifu-u.ac.jp</a> Internet	8 words — 1%
10	Xiaodan Zhang, Ray Ming. "Chapter 16 Genomics of Pineapple Disease-Resistance Genes", Springer Science and Business Media LLC, 2018 Crossref	7 words — < 1%

EXCLUDE QUOTES ON  
EXCLUDE BIBLIOGRAPHY ON

EXCLUDE MATCHES OFF