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# PROCEEDING INTERNATIONAL CONFERENCE ON CASSAVA
## (Sustainable Management of Renewable Resources in Tropics)
## Bandar Lampung, November 23rd - 24th 2017

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# PREFACE

This proceeding consists of the papers presented in international seminar on cassava conducted by University of Lampung on November 23, 2017. As the university located in Lampung Province, University of Lampung realized that Lampung as the biggest producer of cassava in Indonesia has many problems concerning how to increase the poverty of farmers through cassava. There are two factors related to increasing poverty, namely upstream technology and downstream technology of cassava. Upstream technology is how to increase productivity per hectare and how to get the best quality of harvested tuber. While, downstream technology is the technology developed to fulfill people's need on cassava based products. Globally those products is demanded more as the increasing population. Therefore, Lampung needs many innovations about cassava since the development of cassava-based economics in Lampung is quite significant to influence the whole economics development. To get such important technologies, University of Lampung conducted an international seminar on cassava by inviting keynote speakers from the countries such as Thailand and Japan that have best experiences on upstream technology and downstream technology of cassava, beside some Indonesian scientists sharing their research.

After conducting such a seminar, hopefully this proceeding will be able to inspire all parties coming from government, scientists, industries, and practices. The proceeding of a seminar is very useful to bring the papers into the usage of technology. If the results actually need to be developed further, the scientists can carry out perfecting research in the next seminar. Therefore, the seminar on cassava nationally or internationally will strengthen the role of technology in fastening the growth of cassava-based economics.

University of Lampung would like to appreciate the dedication of the staffs in Research and Community Service Institution of University of Lampung working hard to finish the publication of this proceeding. We also would like to address our appreciation to Sungai Budi Group, the honorable Keynotes Speakers from Japan and Thailand for their support to the seminar.

Rector,

Prof. Dr. Ir. Hasriadi Mat Akin, M.P.

# PREFACE

As the committee of The International Seminar on Cassava conducted in University of Lampung, we thanked you to all of the participants who has actively participated in that seminar. The participants consisted of researchers, students, staffs of cassava-based industries, and government officials of Lampung Province. The number of participants noted was 97 researchers and government officials and 33 students. The participants who submitted abstracts as the participants presenting their papers in the seminar were 35 people. After receiving the full papers, the committees reviewed all papers. As it was planned, if reviewers decided that the paper fulfilled the quality demanded by the journal, the paper would be forwarded to the international journal. Unfortunately, reviewers decided that there was no papers with proper in terms of subjects of research and grammar. Moreover, the committee faced the fact that not all participants sent their full papers, some of the participants chose to publish their papers in other journal. That was why this proceeding consisted of only 14 paper and took quite a long time to publish.

The committee would like to thank Rector of University of Lampung, the Head of Research and Community Service Institute of University of Lampung, Sungai Budi Group, and other institution that have support the publication of this proceeding.

Chairman,

Dr. Erwin Yuliadi, M.Sc.

# PREFACE

University of Lampung is facing challenges to make cassava as potential commodity to increase the poverty of the people. As it is well known, cassava has beneficial use to fulfill daily needs of the people as food, feed, fiber, and pharmacy. The demand of cassava as raw material of those needs will increase as much as the increase of population. The problems appear related to productivity of cassava in Indonesia which is relatively low and low performance of downstream technology. As a research institution, LPPM (Institution of Research and Community Service) of the University of Lampung should do the action how to improve the upstream technology that can increase the productivity and quality of harvest of cassava and to improve and diversify downstream technology that can increase the demand of cassava as raw material of industry. Only then the income of farmers and cassava-based industry can be increased to improve the poverty.

One activity that can fasten to solve the problems is to conduct an international seminar on cassava. Hopefully through the seminar there will emerge some papers as results of researches on cassava that have great value to improve technologies on cassava. To make the seminar qualified, LPPM of University of Lampung invited keynote speakers from Thailand as greatest cassava exporter country in the world and from Japan as the country popularly with downstream technology.

After the seminar finished, the submitted papers were reviewed according to the quality demand of a paper that appropriate to be submitted to international journal. After working sometime, the papers finally can be arranged in form of proceeding. Beside the papers in this proceeding there are some papers that are not included because the authors chose to publish their papers in other journals.

LPPM of University of Lampung would like to thank to every party who had actively participated in the seminar and in the process of arranging this proceeding.

Chairman,

Warsono, Ph.D

**CONTENTS**

# THE EFFECT OF *ZINCMICRO* NUTRIENT ON ROOT FUNGI DISEASE DEVELOPMENT OF CASSAVA (*Manihot esculenta* Crantz) IN SULUSUBAN, SUB-DISTRICT ANAK TUHA, LAMPUNG TENGAH

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**ABSTRACT**

The purpose of this study was to determine the effect of *Zincmicro* nutrient application on development of fungal disease in cassava root. The study was conducted in Sulusuban, Central Lampung Regency and in the Laboratory of Plant Pests and Diseases University of Lampung. The study consisted of 15 experimental plots with 3 treatments and 5 groups. Treatment was arranged in a randomized block design (RBD) with five groups based on the time of observation. Treatments consisted of control, fertilizer of 20 kg *Zincmicro*, and 40 kg *Zincmicro* per ha. The results showed that suspected pathogens fungal diseases that attack the roots of the cassava plant caused by the fungus *Neoscytalidium* sp. However, the nutrient application could increase plant height. Treatment of 40 kg *Zincmicro* per ha showed the highest occurrence of disease compared with controls and 20 kg *Zincmicro*/ha. Moreover, the effect of *Zincmicro* nutrient did not significantly affect the number of leaves and leaf greenness.

**Key words:** cassava, fertilizer *Neoscytalidium sp*, *Zincmicro.*

## INTRODUCTION

Indonesia self-sufficient of rice had been already declining resulted in rice dependent reached an alarming level. Rice has become a major supplier of carbohydrates for the majority even almost all Indonesians. The public perception is when people do not consume rice yet, to be told not eat in that day even though the stomach was full. Such perceptions could be a deviant concept of thinking. The government along with the scientists is now working hard to find new sources of food for Indonesian people on a single source of carbohydrates perse (Hendy, 2007).

Cassava (*Manihot esculenta* Crantz) is an important food crop commodity as producer of food source of carbohydrate and raw material of food, chemical and animal feed. Indonesia has the potential of tubers as a source of carbohydrates as well as local flour raw materials that are not inferior to flour, namely ganyong, gembili, sweet potato, garut, cassava and others.

In Indonesia, cassava is used as staple food number three after rice and corn. The spread of cassava is widespread to all provinces in Indonesia. The cassava production centers that enter the top five provinces with the highest harvest in 2015 are Lampung Province (7,387,084 tons), Central Java (3,571,594 tons), East Java (3,161,573 tons), West Java (2,000,224 tons ), and North Sumatra (1,619,495 tons). In Lampung Province, Central Lampung is the largest cassava production district with a total production of 2,523,230 tons (Center Bureau of Statistic, 2016).

Increasing the need for high utilization of processed cassava must be balanced with high production. There are many obstacles that cause the decrease of production that is the factor of seed and the area of cultivation land. In addition, there are also cultivation factors as well as attacks of pests and diseases (Adriani, 2016).

Based on data from the Central Bureau of Statistics (2016), a decline in cassava production in Lampung. In 2011 the production of cassava reached 9,193,676 tons, and decreased every year until the year 2015 reached 7,384,099 tons. One of the factors causing a decrease in production is suspected of a pathogen attack caused by root fungus.

One of the efforts in increasing the production of cassava is by fertilization. Nutritional needs of cassava plants are very high for the process of formation of tubers, stems, leaves, and resistance to pest and pathogen attacks. In the grouping, nutrient elements are divided into two, namely macro nutrients and micro nutrients. Micro nutrients that help in the process of plant metabolism element Fe, elements Zn, elements Mo, elements Cu, elements Mn, elements Boron (Mengel and Kirby, 1982).

## MATERIALS AND METHODS

The research was conducted in Sulusuban, Kecamatan Anak Tuha, Central Lampung District and in Pest and Disease Plant and Plant Biotechnology 2 floor of Lampung University. This research was conducted for 5 months starting from October 2016 until March 2017.

Materials used included cassava stem, Zincmicro fertilizer with content of Mg, Zn, Mn, B, Cu, Ca, Co, Mo, S, PSA media, alcohol. While the tool used is meter, hand counter, green leaf gauge (SPAD), paper label, plastic bag, stationery, petri dish, *bor gabus*, ose needle, plastic wrap, hoe, and others.

The study consisted of 15 plots of experimental plots consisting of 3 treatments and 5 groups. Each plot measured 10 m x 10 m. The treatments were arranged in a randomized block design (RAK) consisting of five groups based on observation time. The treatments were P0 (control), P1 (Zincmicro 20 kg fertilizer), P2 (Zincmicro 40 kg fertilizer) repeated as many as five replications. In this research, cassava planting is done by other parties that have been planted in July 2016.

Observations were made at 5-month-old after planting of cassava. Sampling was determined by 5 samples per plot diagonally. The data obtained in each observation was analyzed the variation and separation of the mean value using 5% BNT test.

### Land preparation

Before planting the land first done piracy twice and done renewal to smooth the chunks of soil.

### Preparation of stem cuttings and planting

Varieties of cassava used in this study are cassava varieties of Thailand. Cuttings grown using stem cuttings that have grown with size 25 cm. Spacing used 80 cm x 60 cm.

### Fertilization

The fertilizer used in this research is Urea 200 kg / ha, KCl 200 kg / ha, and SP-36 100 kg / ha. The application of Urea and KCl fertilizers was doubled with a dose of half the total fertilizer. While application of SP-36 fertilizer done at the same time at first fertilization. The first application of fertilizer was done when the plant was 1 BST and the second fertilization was done when the plant was 3 BST. Zincmicro application of fertilizer is given one time at the same time the first basic fertilizer by digging around the plant with a distance of 10 cm from the plant.

### Variable Observations

Plant height was measured from the height of the plant using a scale meter from the base of the stem to the end of the leaf on each sample. The leaf number was counting including the petiole of cassava in each sample full openly leaf. Additionally, observation of green leaf is done by using green leaf gauge (SPAD) that is by reprimanding green leaves as much as three replications and then averaged. In measuring greenish leaf, the measured leaves are in the middle of the leaf and three leaf lobes at random. At the time of measurement (using the SPAD tool) the measuring position should be back to the sun, so that the measurement results obtained more accurate because it is not disturbed by sunlight.

Observation of the incidence of root fungus disease is done by counting the plants infected by root fungi on each plot measuring 10m x 10m by using hand counter tool.
To calculate the incidence of disease can be calculated by the formula:

$Kp = n / N \times 100\%$

Kp = Disease incidence
n = Number of illnesses
N = Number of population observed

Observations in the laboratory aim to ascertain the root cause of roots in cassava with the following methods:

**Making PSA media.**

To make a PSA media as much as 1 liter required 200 grams of potatoes, 20 grams of sugar, 20 grams for stems, and 1 liter of distilled water. How to manufacture is as follows: the potatoes are cut into small disc and then boiled for 45 minutes using aquades until the potatoes become soft and exit extract, then boiled potato water is inserted into the tube Erlenmeyer then put sugar and so that the stem has been cut into small pieces autoclave for 60 minutes at 1210C and 1 atm pressure. After sterilization of the media left to warm the nails then added lactic acid as much as 1.4 ml using a micro pipette then stirred and the media is poured into a petri dish.

**Isolation of pathogens from plant tissues**.

Part of cassava plant stems symptom of root fungus is isolated in the laboratory. Isolation is done by cutting the line between the sick and healthy sticks of ± 2 x 2 mm, then washed with aquades then 1% NaOCl solution and rinsed with different aquades. After that it is dried on tissue paper and then isolated on the PSA media. The root mushrooms that have grown are then purified. To get a pure culture that is done by taking hyphae by using needle end then grown on PSA media.

**Inoculation of root fungus**.

Pure root mushroom isolate was inoculated with cultivation of cassava crops by wounding and then attached to pure cultures isolated from sick plant tissue and then observed whether to cause symptoms such as plants that have been isolated previously.

## RESULT AND DISCUSSION

Symptoms of root fungus disease began to be seen at the time of the five-month-old plant after planting (BST). Initial symptoms caused by root fungi are the occurrence of hyphae at the base of the stem of the cassava plant (Fig. 1A) and the leaves undergo chlorosis starting from the oldest leaves (Fig. 1B).

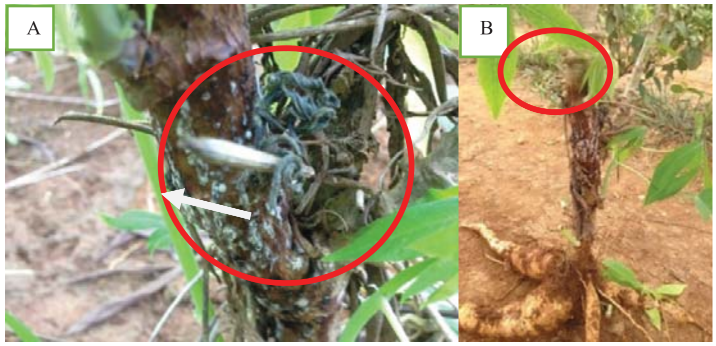


Figure 1. Symptoms of root fungus disease in cassava plants, there is hyphae at the base of the stem of cassava (A), and leaves have chlorosis starting from the oldest leaves (B).

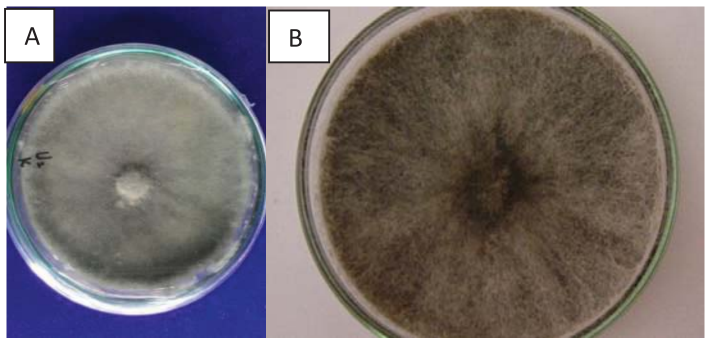


Figure 2. Pure culture of root fungus isolated at 7 days (A), culture of Neoscytalidium sp. according to Schechtman (2008) (B).

The base piece of the stem which is attacked by root fungi pathogens when grown on a PSA medium will result in a colony that is initially white and then slowly turns black (Fig. 2A). This is similar to the result of isolation obtained by (Schechtman, 2008) which has a *Neoscytalidium* sp. (Figure 2B).

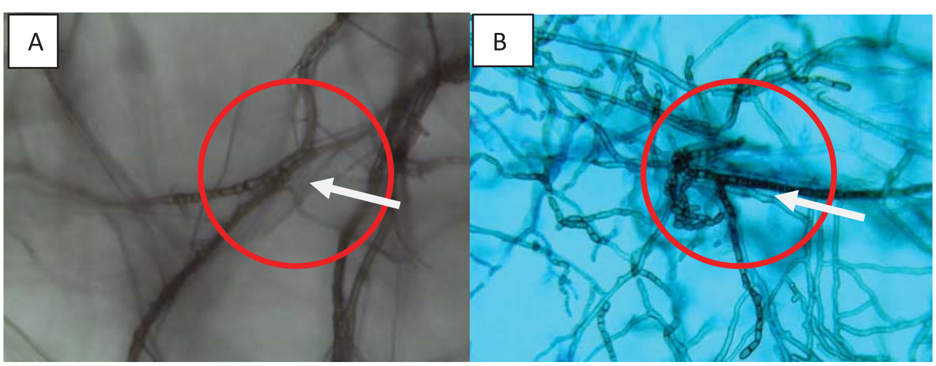


Figure 3. Arthrospora result of insulation of base of stem of cassava plant at magnification of 40x (A) Arthospora according to Tendolkar *et al*., (2015) (B).

Microscopic observations on pure cultures derived from the isolation of the base of the sick cassava stems indicate a special structure (Fig. 3A). The special structure obtained from the isolation of the base of the sick cassava stems is similar to the special structure possessed by the Neoscytalidium fungus which has arthospores (single-celled spores formed by discontinuation of hyphae cells) according to Ann *et al*. (2002).

Inoculation results have been done, plants that have been inoculated with a pure culture derived from the isolation of the base of the stem of sick cassava, showing the same symptoms with sick plants that are in the field. Early symptoms can be seen with yellowing of leaves starting from the oldest leaves, then at the base of the stem there are hyphae. Furthermore, the leaves begin to fall from the oldest leaves until eventually the plant becomes dead with the yams become rotten.

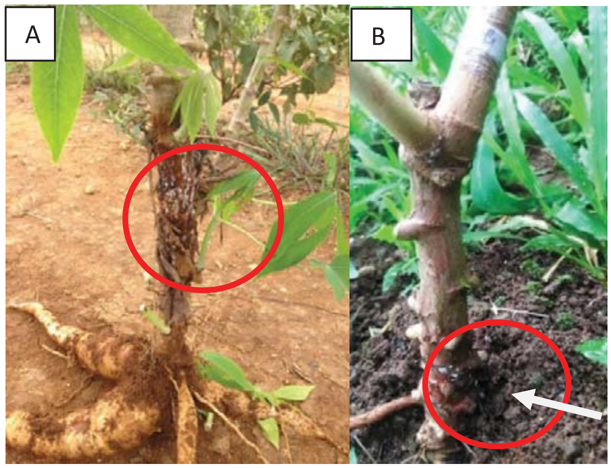


Figure 5. Symptoms present in the field (A), pathogenicity test results (B).

Based on similarities of data obtained from observation of symptoms in the field, macroscopic and microscopic observations, and pathogenesis tests have been done, suspected cause of root fungus disease that attacks cassava in Sulusuban, Sub-District Anak Tuha Central Lampung caused by fungus *Neoscytalidium* sp.

Field observation showed that the incidence of root fungus disease fluctuated in every observation. This is due to the humidity and temperature conditions that support the environment for the spread and development of root fungi. BNT test at 5% showed that the higher application of Zincmicro fertilizer given the higher the occurrence of cassava root fungus (Table 1). Treatment P1 showed that the level of fungus root fungus is lower than P2 treatment. However, treatment P1 showed no significant difference with P0 treatment.

Table 1. Effect of Zincmicro fertilizer on the incidence of root fungus cassava disease

| Treatment | Information | The Occurrence of Cassava Root Fungus (%) |
|---|---|---|
| P0 | Control | 2,80 b |
| P1 | Zincmicro fertilizer 20 kg / ha | 1,80 b |
| P2 | Zincmicro fertilizer 40 kg / ha | 6,00 a |
| BNT 5% | | 3,20 |

Information: values in the same column followed by the same letter show no significant difference (BNT test 0.05).

The results showed that Zincmicro fertilizer has an effect on plant height, but it has no effect on leaf number and greenishness of leaves. Table 2 shows that the best dose of fertilizer that can increase the plant height is the Zincmicro 40 kg / ha fertilizer (P2) fertilizer.

Table 2. Effect of Zincmicro fertilizer on plant height

| Treatment | Information | The Occurrence of Cassava Root Fungus (%) |
|---|---|---|
| P0 | Control | 106,72 b |
| P1 | Zincmicro fertilizer 20 kg / ha | 115,56 b |
| P2 | Zincmicro fertilizer 40 kg / ha | 162,60 a |
| BNT 5% | | 31,104 |

Information: values in the same column followed by the same letter show no significant difference (BNT test 0.05).

Microscopic observations on pure cultures derived from the isolation of the base of the stems of crops of sick cassava, indicate the existence of a special structure. The special structure obtained from isolation results is similar to that of the arthospores (one-celled spores formed by the breakdown of hypha cells). This is similar to Arthospora according to Tendolkar et al., (2015) obtained on the pure culture of Neoscytalidium sp fungi (Fig. 4B). Then inoculation of new plants. The inoculation results show the same symptoms as sick plants in the field. Early symptoms can be seen with yellowing of leaves starting from the oldest leaves, then at the base of the stem there are hyphae. Furthermore, the leaves begin to fall from the oldest leaves until eventually the plant becomes dead with the yams become rotten.

Results of field observations showed that Zincmicro fertilizer application did not affect the number of leaves and the greenishness of leaves. However, the application of such fertilizers can increase plant growth based on plant height. The results are in line with the results of research by Ershad (2017) which states that application of Bio-slurry fertilizer with micro nutrient content of Zn, Mn, Cu, Mo can stimulate the growth of plants. In Zincmicro fertilizer contain nutrients Mg, Zn, Mn, B, Cu, Ca, Co, Mo, S, One of the micro nutrients that serves to spur plant growth is Zn, which plays a role in enzyme activator, chlorophyll formation and help the process of photosynthesis .

Based on 5% BNT test showed that Zincmicro 40 kg / ha fertilizer dose was obtained by the highest disease incidence compared with control and 20 kg / ha. This means that the higher the dose of Zincmicro fertilizer applied, the more vulnerable plants to attack the root fungus of cassava. Therefore, plants need balanced nutrients to grow optimally. One of the micro nutrient content applied is the Mn element, which is a supporter of dehydrogenase enzyme activity, decarboxylation, kinase, oxidase, and peroxidase. Peroxidase enzyme activity can increase plant resistance to pathogen attack. This is in line with the research of Suswati et al. (2015) that peroxidase enzyme activity can increase banana fiber resilience against bacterial wilt disease caused by Blood Disease Bacterium (BDB) and Fusarium wilt by Fusarium oxysporum f.sp. cubense.

The disease caused by *Neoscytalidium* sp. tend to be found in tropical countries. This pathogen has the characteristics of a feathered colony or wool colony on day 2 to day 3, which gradually turns into gray colony on day 4, and dark gray to black pigmentation at day 7 (Rusmarini et al. 2017).

Root fungus disease can decrease the population because the wilted plant usually ends in death. When an attack on a plant has been berubi, many yams are rotten, easily loose and left in the soil when harvested so as to decrease the yield of sweet potato (Figure 6).

Figure 6. Tuber rot caused by root fungus attack

## CONCLUSION

*Zincmicro* fertilizer application can not suppress the incidence of root fungus disease in cassava plants caused by *Neoscytalidium* sp. Zincmicro fertilizer application can increase the height of the plant, but it does not affect the number of leaves and the greenness of leaves.

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