

Science and Technology for the Grassroots

**Helping Farmers Learn
Environment Friendly
Agricultural Technologies for
Inclusive Growth**

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**“Science should serve a human purpose”
NS Gelia T. Castillo**

TRAILBLAZERS IN SCIENCE LECTURE SERIES

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GDP 2nd quarter for 2017 recently released - 6.5%,


GDP 3rd Q 2017 - 6.9%

- 2nd only to China in terms of economic performance

- for the past 8 years we have maintained an annual GDP of about 6.0%,

Despite of this seemingly bright economic performance -

why does the Philippines remain poor, whereas our neighboring countries in Southeast Asia have moved up in the economic ladder?



-1950's - 1960's Philippines, 2nd to Japan in terms of economic development

Then, why is it that 5 out of 9 Filipinos in rural areas are poor?

This “good” economic performance of the country for the past years has not trickled down to the masses!

Economist Dr. Bernie Villegas, a professor at the University of Asia and the Pacific, said



"The biggest mistake of the Philippines is to ignore the countryside and agricultural development for the last 30 years".

Failure to develop agriculture is one leading cause of high poverty incidence in the country.

Poverty in the country is a rural phenomenon.

Poverty incidence

-fisherfolk is highest at 41.4 %

- farmers at 38.3

Data from - PSA - 2012

Socio economic condition in rural areas:

- low educational attainment of heads of family
- majority of our farmers have finished only basic ed

Contribution of agriculture to economic development of the country

1. major source of employment in the rural areas - employs around 30M

2. Contribution to GDP

2014 - 11.5%

2015 - 9% ; 2017 - 9.7%

1960's - 30% contribution

one recommendation -

Government should invest in human resource development, infrastructure, and productivity

My focus

- conduct researches and public service activities that can contribute to human development in rural areas
- helping farmers learn environment friendly agricultural technologies
- disseminate the technologies i developed

Why emphasize environment friendly agric technologies?

- adaptation to climate change
- conservation of resources
- farmers are resource poor

green revolution technologies ex. use mineral fertilizers and chemical pesticides

- expensive and have negative impacts on the environment

our approach

- reduced use of mineral fertilizers is emphasized
- encourage farmers to utilize materials within their surroundings

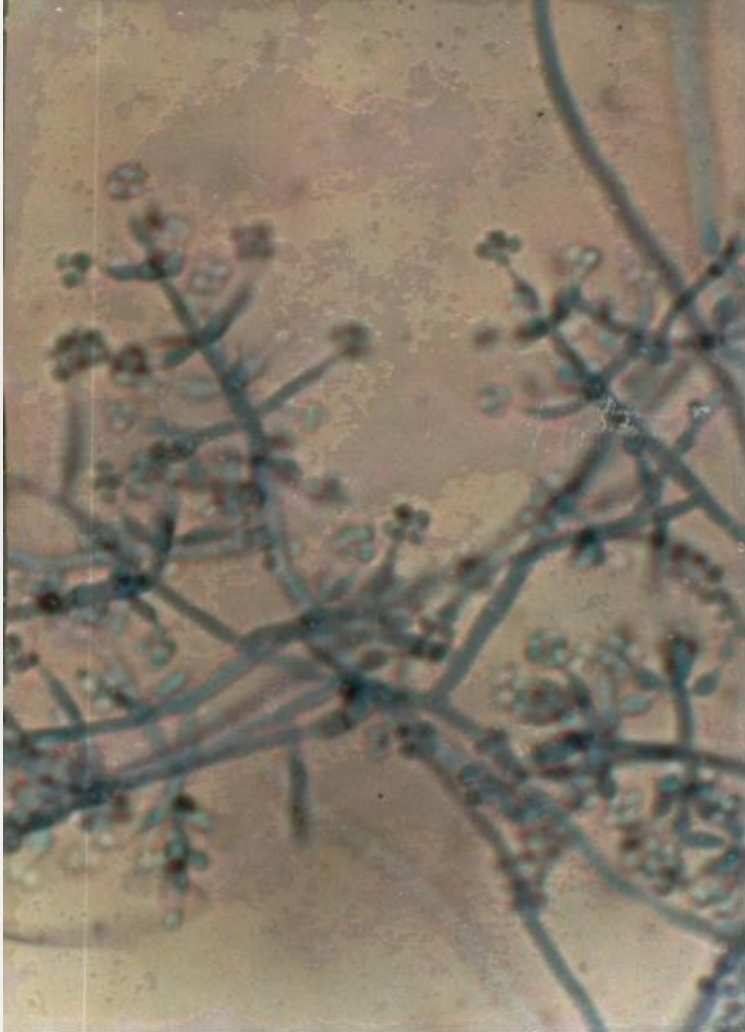
Reaching out to the needy -

1st approach - through research projects using these two technologies and funding from BAR and DOST

Project sites - environmentally degraded areas where the most vulnerable sectors of the Philippine society try to earn their livelihood

Background

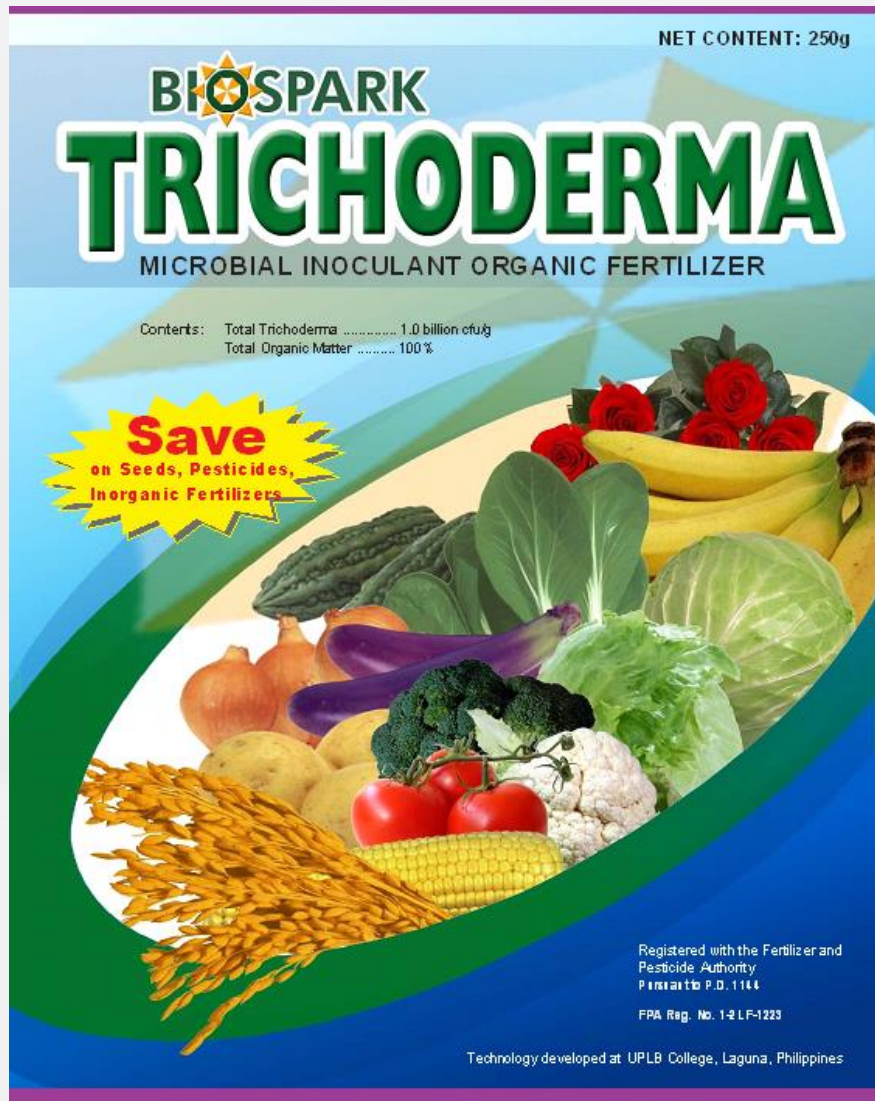
Developed two conventional biotechnologies



1. Rapid composting technology using *T. harzianum* as activator

Local isolate of *Trichoderma harzianum* used as activator of rapid composting, VCCuevas, 1990

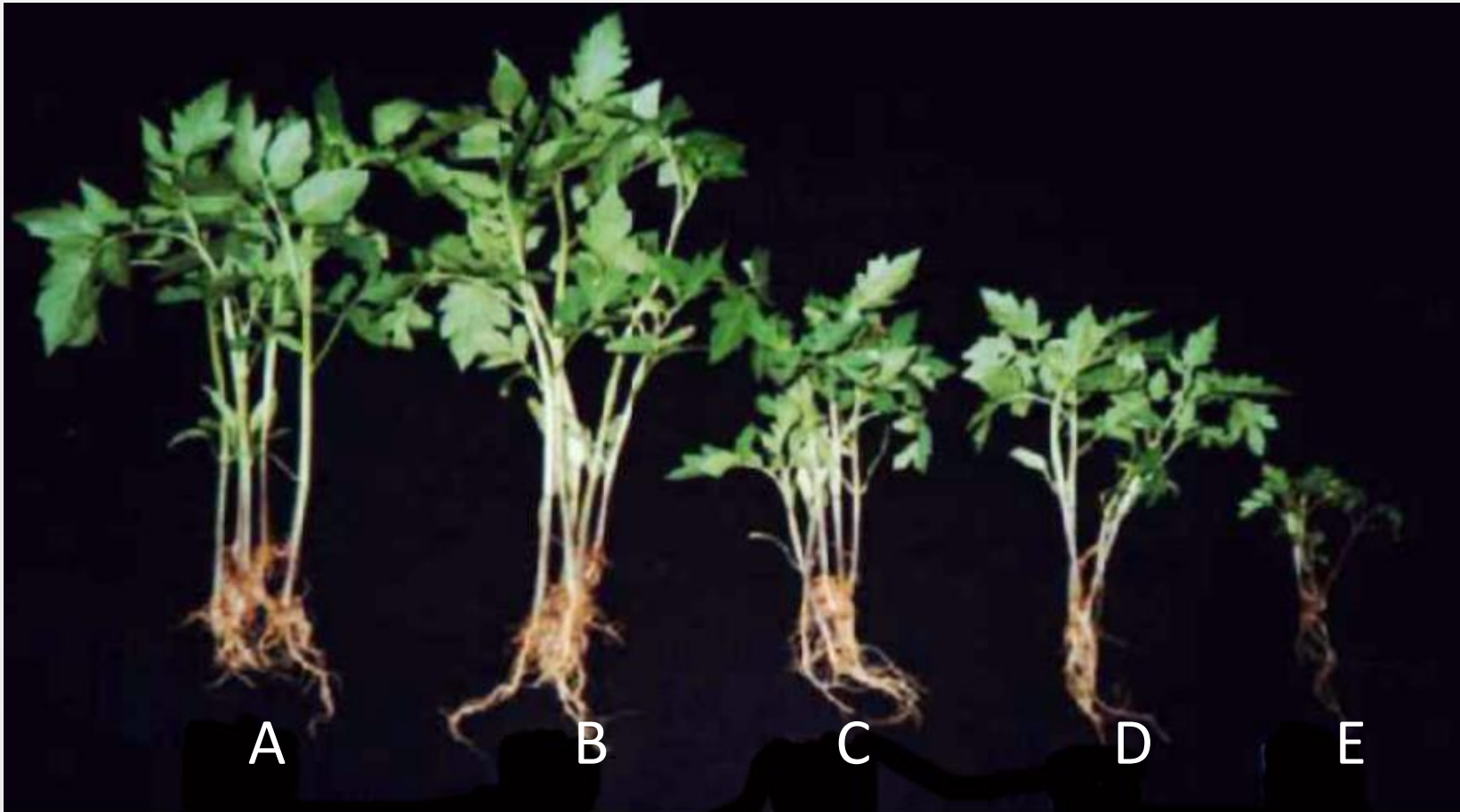
2nd Biotechnology - Trichoderma Microbial Inoculant (TMI)



**Biofertilizer,
Biofungicide,
Growth promoter**

One of the many contributions of UPLB toward attaining sustainability of agriculture in the Philippines

Components of Biospark Trichoderma and their growth promoting effect and biological control activity on tomato



- A- *T. ghananse* from NuevaVizcaya *T. ghananse* = *T. pseudokoningii*
B - *T. ghananse* from Mt. Kitanglad, Cag de Oro
C - *T. harzianum*, UV irradiated

Project 1 -Microbial Inoculants to Enhance Reforestation and Rehabilitation of the Forest Ancestral Land of Aytas (Magbukün Tribe) of Morong, Bataan 2013- 2015 - DOST- funded research



My model - NS Dr. Lourdes J. Cruz has been promoting the welfare of the Aytas since 1990s; just ride on with her projects for the Aytas

Aytas are IPs who belong to the poorest among the poor

What does IP stand for?

Kanawan, Binaritan, Morong, Bataan



Ayta reservation site-
mostly brushlands -only 28
ha sec. forest remain out
of the original 220 ha



30 minute walk going up and up

Gate way to the project site -
hanging bridge





Train farmer leaders who will help disseminate the technology

Demo on application of the Trichoderma activator; substrates for composting are within the immediate environment of the IPs



observing the mature compost, one month after



Discussing the treatments to be done - IPs are very knowledgeable on forest tree seedlings care and maintenance



Making sure treatments were properly done



Native tree species
planted in the
brushland - 50%
survival rate- twice
that of NGP



Why do we concentrate
on planting native
trees?



Mr. Dean Carlo F. Galias and kupang seedling he planted for his MS Thesis research on March 2014. The tree is about 2 m high as of 6/ 28/15 – 13 months after field transplant.

New Project - S& T Farm on the Use of Trichoderma Microbial Inoculant (TMI) for the Increased Survival and Early Establishment of Tree Crops in Cacao-Coffee Agroforestry System for the Aytas (Magbukun Tribe) in Kanawan Negritos Reervation Area (KNRA) in Morong, Bataan (2016- 2018) - DOST-PCAARRD-Funded



Participants to the training on rapid composting last May 22, 2017.

San Luis, Batangas

Public Service - community
bothered by foul smell
from piggeries





TMI + chem fert (reduced by half) = increased income

Summary of Cost of Production of Amplaya

Production: P117,600

Expenses: P15,930

Net Income: P101,670

Ron Lester Durante – Farmer, Pangil, Laguna Dry Season Cropping 2013

Palay Check Fert. Recommendation
Target – 7 tons/ha

Fertilizer	Bags/ha	kg/ha
14-14-14- 24S	5.00	250
16-20 - 0	2.00	100
0-0-60	1.00	50
Urea	1.50	75

With Biospark Trichoderma Technology
– 50% reduction in fertilizer use

Fertilizer	Bags/ha
14-14-14-24S	2.50
16-20-0	1.00
0-0-60	0.50
Urea	0.75

Actual Field size 3.5 ha

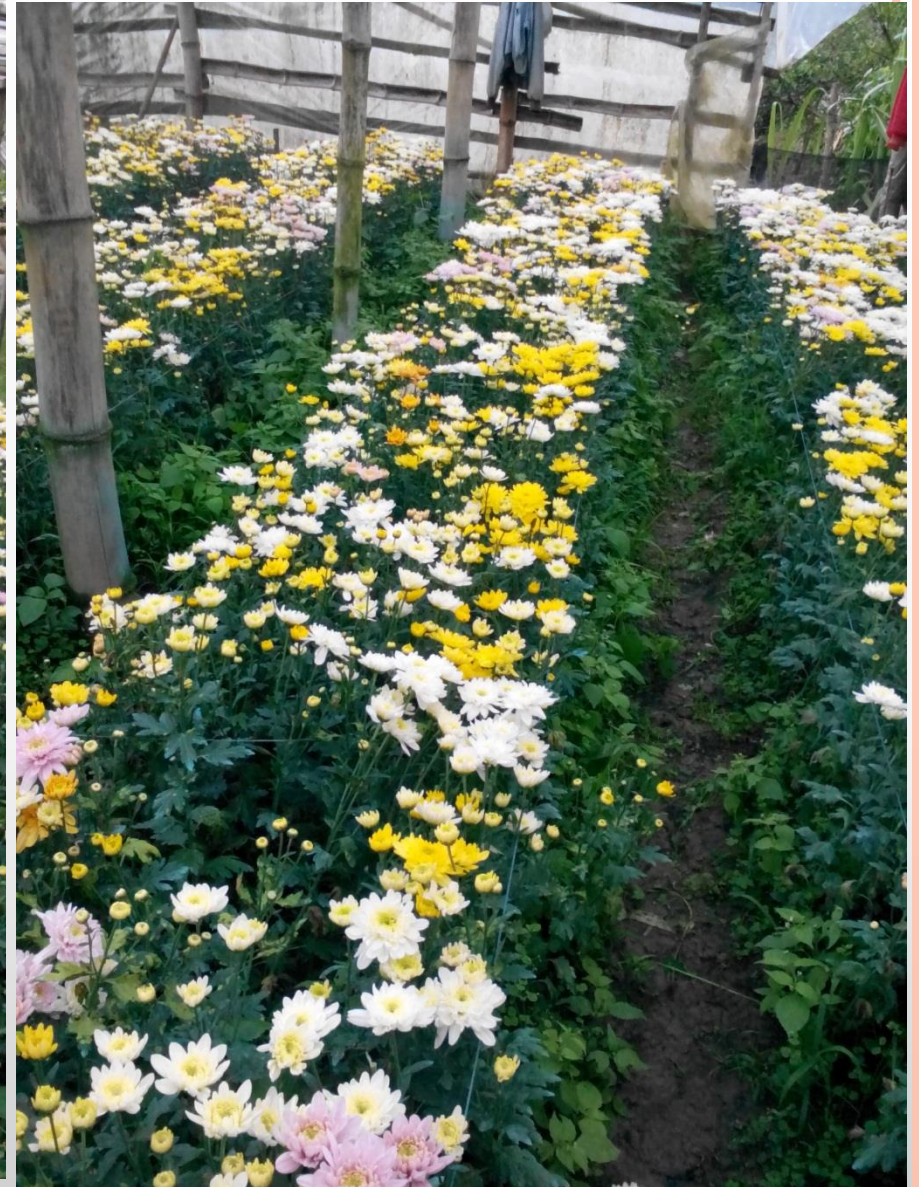
Yield – DS 2013

Fertilizer	Bags	Area (ha)	3.50
14-14-14-24S	8.75	Fresh wt (kg)	37,207.5
16-20-0	3.50	Ave. Moisture Content (%)	21.16
0-0-60	1.75	Unit Fresh Wt. (tons/ha)	34,109.76
Urea	2.63	Wt. @ 14%MC (kg)	<u>10.63</u>
		Unit Dry Wt. (tons/ha)	9.74

With Biospark Trichoderma Technology, Actual Yield exceeded target by 3tons/ha and 50% reduction of fertilizer use. Matipid na, maliit ang gastos, mataas pa ang ani!!

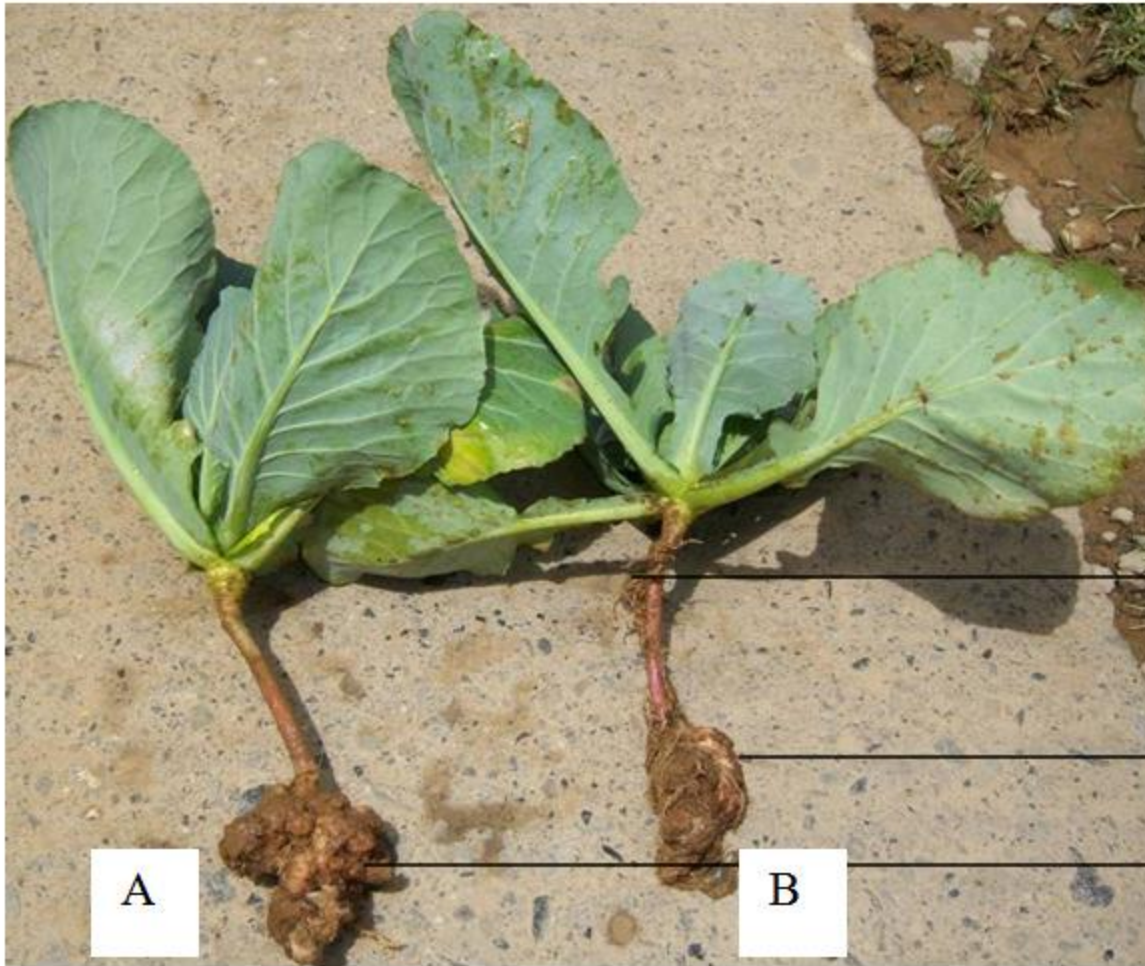


high yield - organically grown rice - 7.0 tons/ha



Induces early and uniform flowering of cut flowers

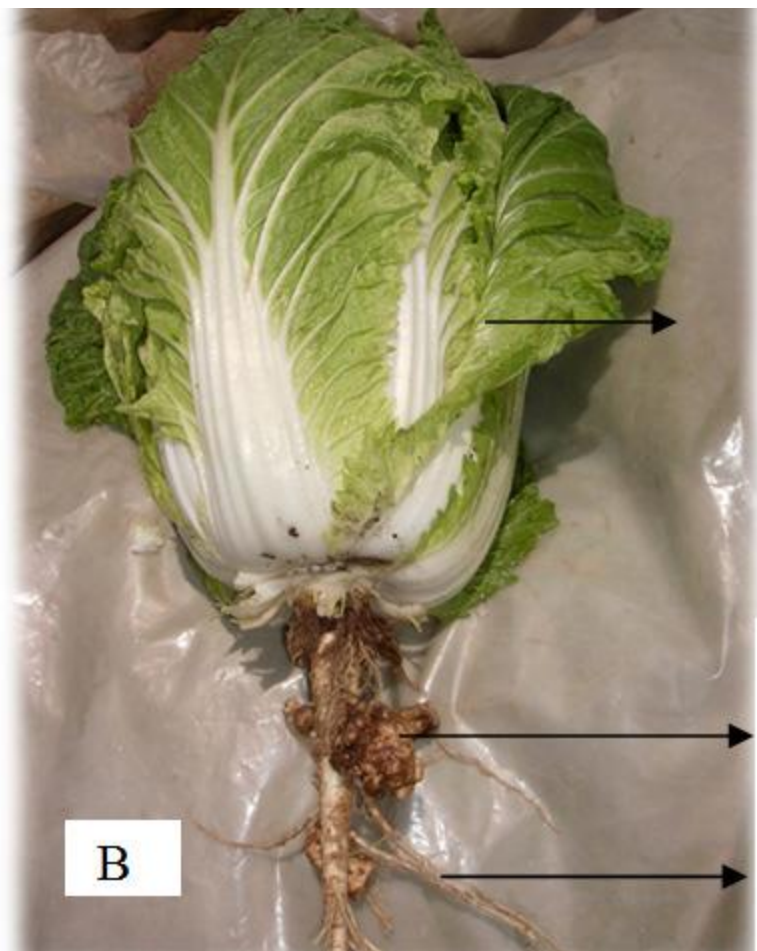
Control of Club root disease of Crucifers



New roots developed at the base of the stem

Much smaller, bulbous, mummified primary root

Bulbous primary and lateral roots soft, and succulent



Class A
marketable
head

Mummified
bulbous root

New
uninfected
lateral roots

Proposed mechanism of plant immunity as induced by *Trichoderma* - induced systemic resistance

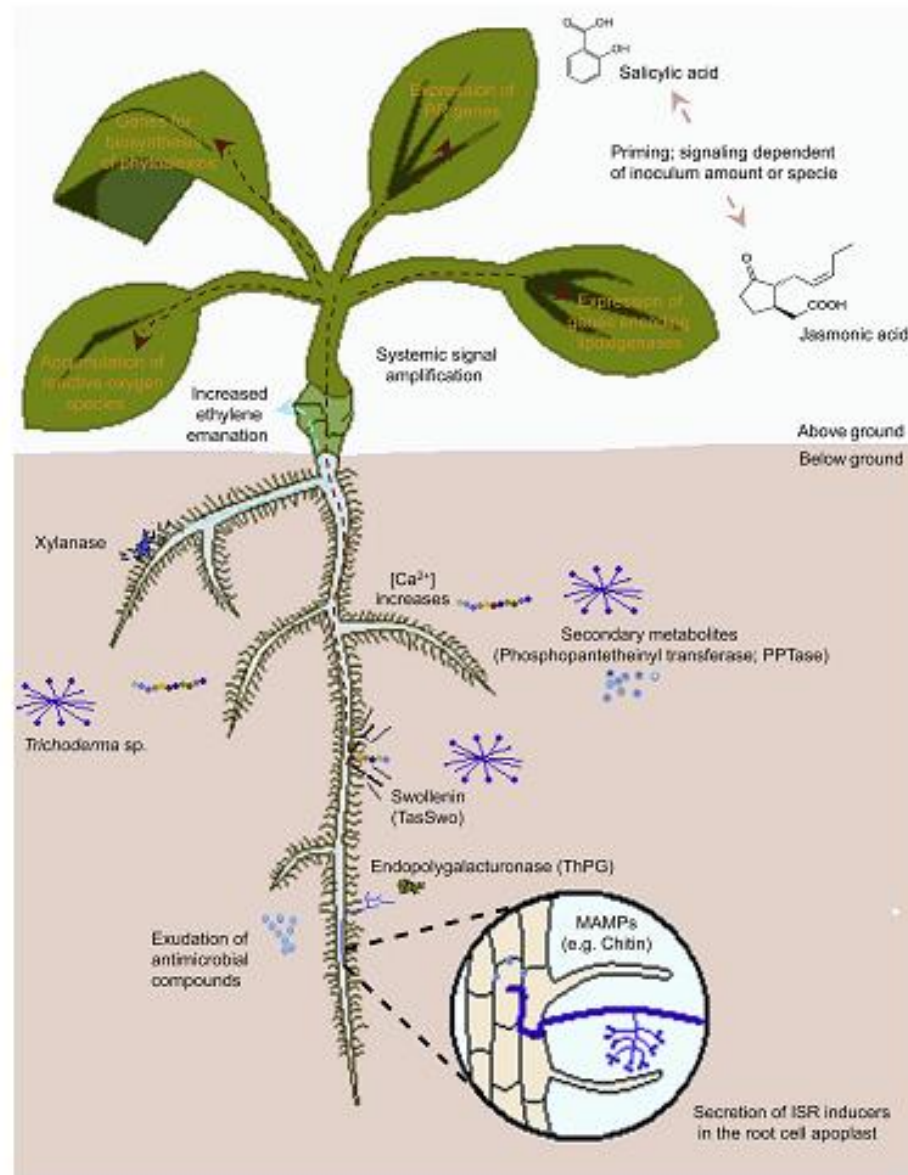


FIGURE 36.1 A simplified model for plant defense responses induced by *Trichoderma*. Host recognition of *Trichoderma* elicitors (MAMPs) such as xylanase, ThPG, TasSwo initiates early signaling events such as protein phosphorylation/ dephosphorylation, ion fluxes and oxidative burst. Subsequent events imply biosynthesis of phytohormones such as SA, JA and ET, the production of antimicrobial compounds and induction of plant defense genes such as LOX2 and PR1. Mutation of PPTase in *T. atroviride* affects defense responses induced by this fungus through the SA pathway. (For color version of this figure, the reader is referred to the online version of this book.)

From: Enhanced Resistance of Plants to Disease Using *Trichoderma* spp. Saldajeno et.al. 2014. Chap 36, in Gupta, et al. (eds) Biotechnology And Biology Of *Trichoderma*. Elsevier B.V.

BAR project - Agriwaste Compost as Soil Amendment for Rehabilitation of Agricultural Lands Contaminated with Mine Tailings in Mankayan, Benguet and Cervantes, Ilocos Sur, 2012- 15





Pilipil, Cervantes, Ilocos Sur- 2014;
Farmers' fields -contaminated with high level of Cu since
1986 from dam failure of Lepanto Consolidated Mines; mine
tailings inundated rice paddies along Mankayan River;
- rice yield decreased by more than 40%

Comparison of rice yield from Cu contaminated fields with and without TMI application

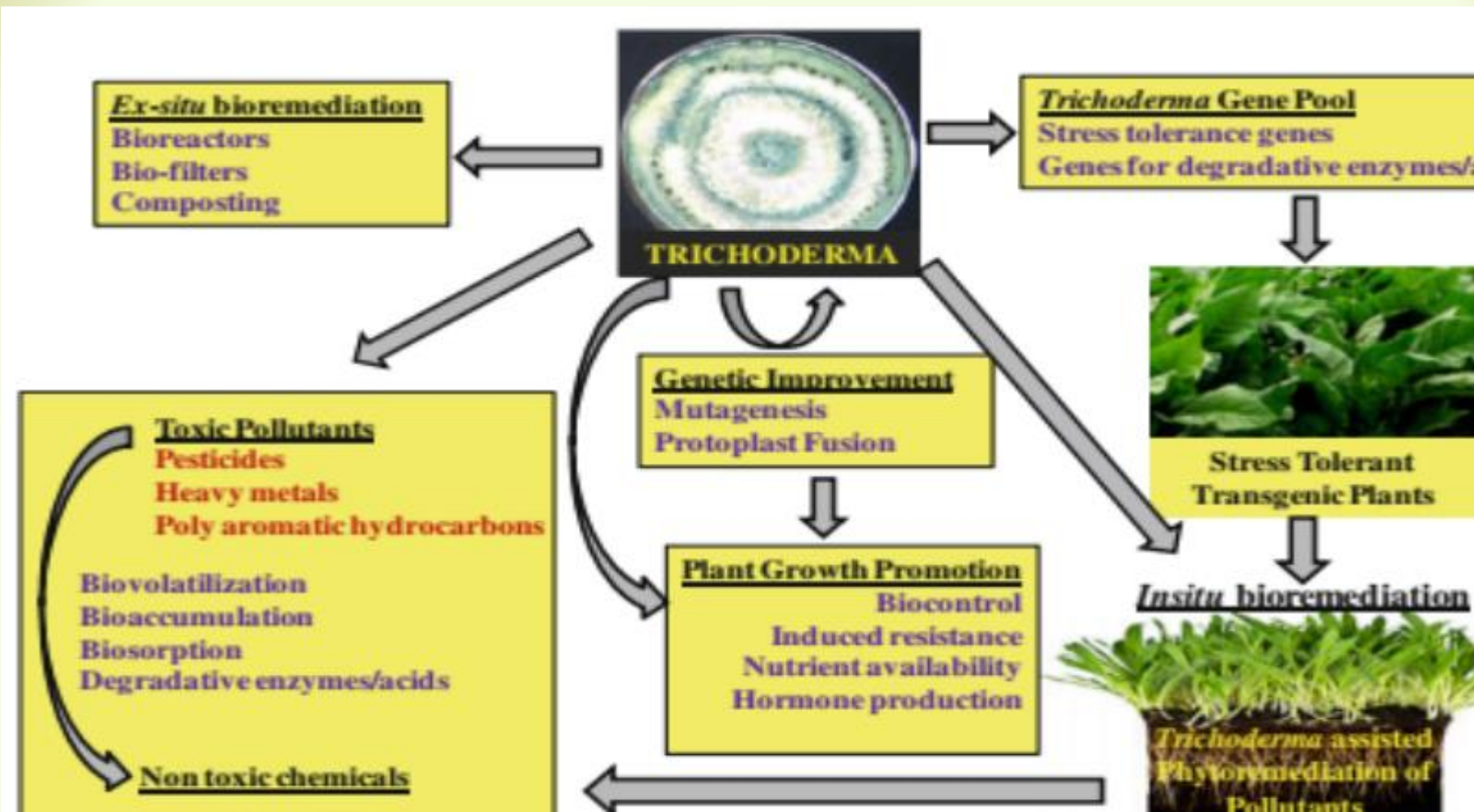
	Rice Yield Tons/ ha				% increase due to TMI	
	Site 2		Site 3			
	W/out TMI	With TMI	W/out TMI	With TMI	Site 2	Site 3
T0 - 0 compost	2.8	5.0	3.8	5.1	78%	34%
T1 - 2 kg compost	4.4	5.7	4.9	6.0	29%	27%
% increase due to compost	57%	24%	29%	17%		

Data on yield without TMI - Malamnao; MS Thesis

Data on yield with TMI - Cuevas, et. al. - Study 2, this presentation

Data compared were taken on the same cropping season- wet season'13; same rice variety were used; study sites were contiguous.

Soil copper concentration were close in the sites.



We believe we have demonstrated two beneficial effects of TMI:

- a. growth promoting effect including increase in yield
- b. TMI tolerant of toxic level of soil Cu

Outcome of all these studies;

BAR provided funds to us for a 3-year project in Mogpog, Marinduque

“Use of Agriwaste Compost and Trichoderma Microbial Inoculant (TMI) for LGU and Community-based Rehabilitation of Agricultural Lands Damaged by Mine Wastes in Mogpog, Marinduque”

VCCuevas - Project Leader

CGBBanaay - Study Leader

Situation - rice paddies in 8 barangays in Mogpog are contaminated with mine wastes

BAR Mandate to the project -

- a) demonstrate on 100 ha of rice lands for 4 croppings the efficacy of the strategy of using compost and TMI, complete with economic analysis

- b) establish protocol/guideline on rehabilitation of damaged agricultural lands using the recommended strategy

Remains to be seen, whether we will be able to fulfill the mandate.

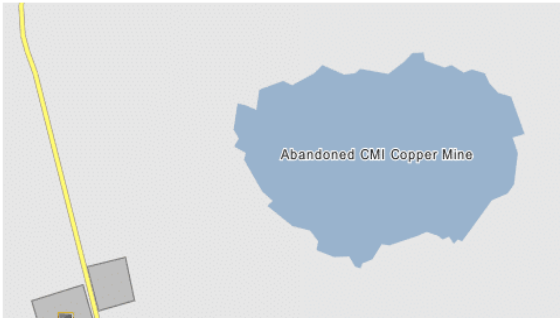
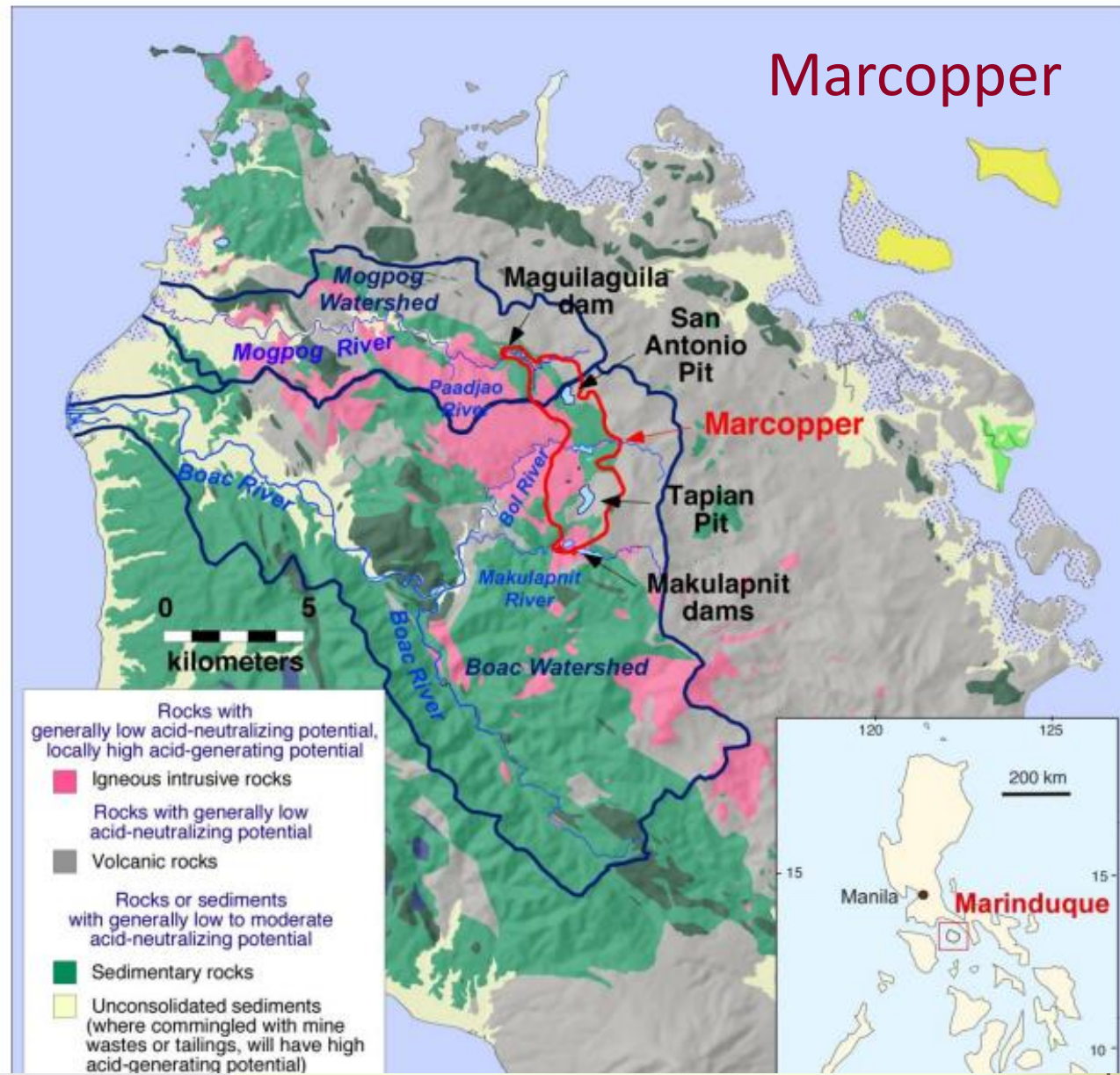
We just started this July 24, 2017.

- remains to be seen if we can fulfill the mandate



Map of Marinduque showing the location of Mogpog

two sources of rock mine wastes



This is the open pit area operated by Consolidated Mines Inc. located at Brgy. Ino and Capayang, Mogpog. Depth of the abandoned pit is around 40 meters. The area is a potential world class multi-level shooting range and mountain and motocross biking area. By: Jov M. Lilles



Rice fields below the
CMI open pit

Dumping ground of CMI mine
wastes - to be turned into an Eco
park - our assistance is expected



09/13/2017 08:38

**A VERY BIG
CHALLENGE!!!**

**Brgy Bintakay -Rice
fields heavily affected
by MARCOPPER MINE
TAILINGS**



09/13/2017 08:39

Thank you!!