Application of humic amendments in tropics: achievements and problems (case study on Bali island)

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LIGNO HUMATE CONCENTRATED HUMIC PRODUCT

ANNEX 1

ASEAN-RUSSIA *JOINT PROJECT*

Project classification code:

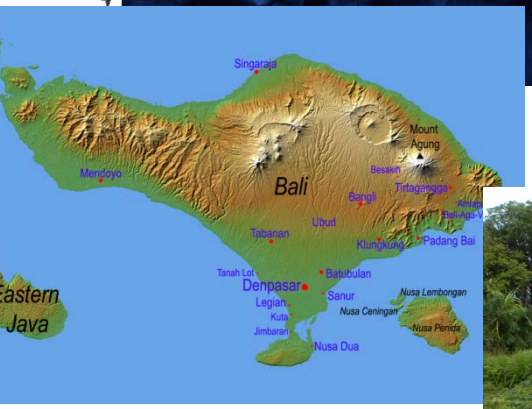
AGF/ARD/16/003/REG

Project title: Research and Development Cooperation Russia-ASEAN on Development and Implementation of Innovative Agricultural Technologies to Increase Sustainability of Agro-Ecological Systems"

RESEARCH SITE

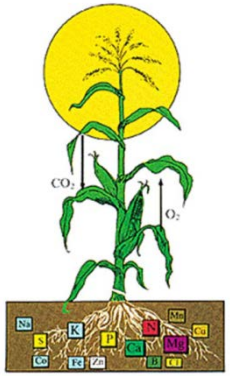
Indonesia, Bali

- 8°39’S 115°13’E
- Climate: warm and humid all year around with two distinctive seasons: dry and rainy
- Rice, vegetables, greens
- Pests

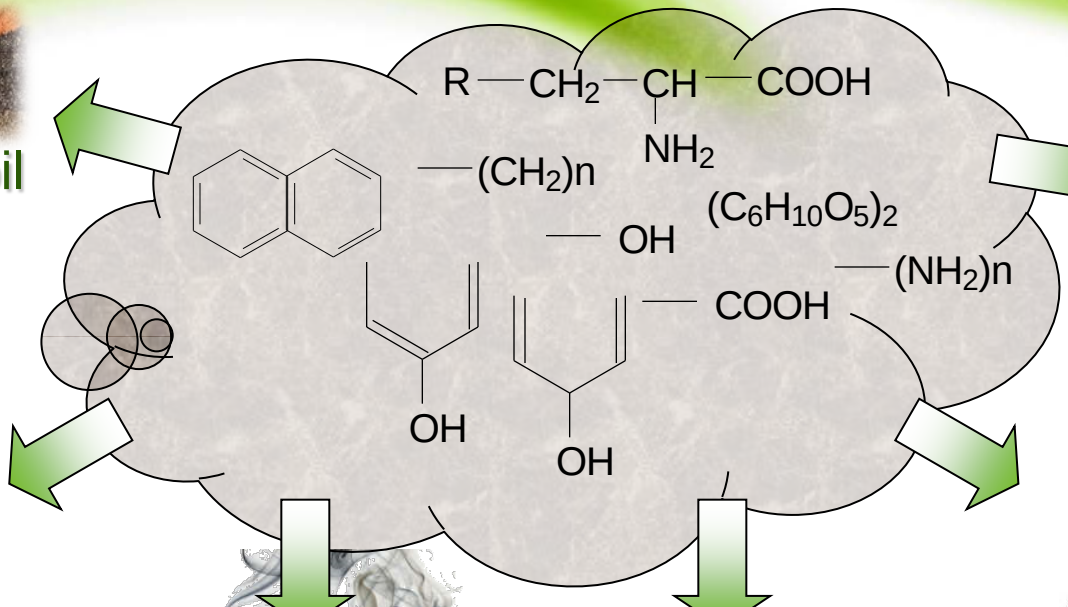


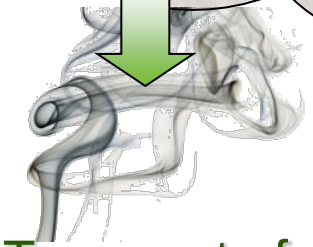
BENEFITS OF HS

Effect on soil properties



Accumulation of nutrients and energy





Transport of elements

Protection against unfavorable factors

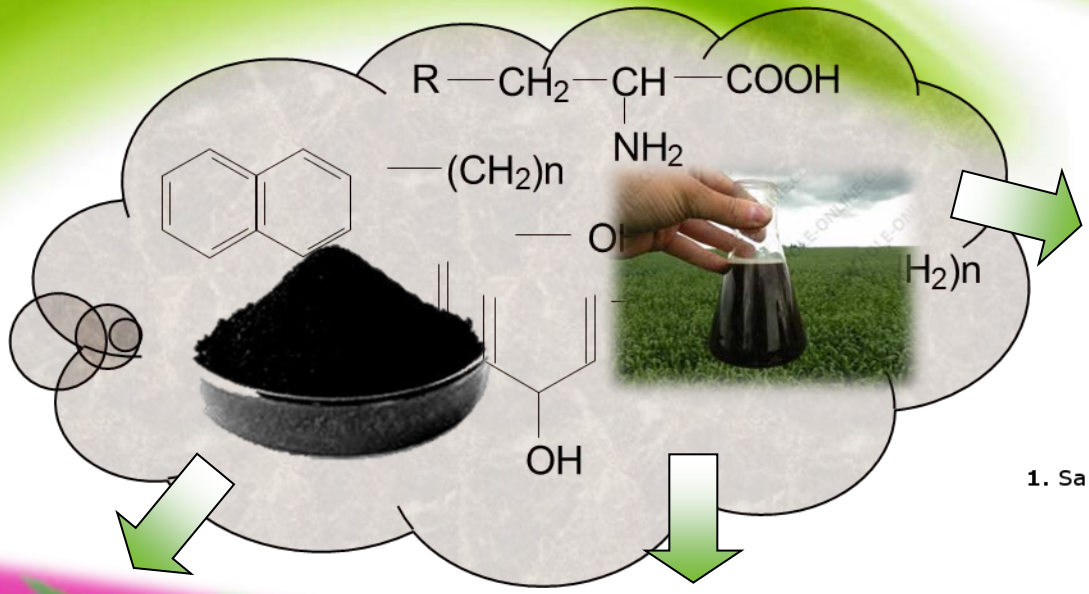
1+1=3

Sinergy in compositions with chemicals

Physiological effects and anti-stress activity

HS possess a wide variety of properties that are of interest for agricultural and environmental technologies

APPLICATION MODES

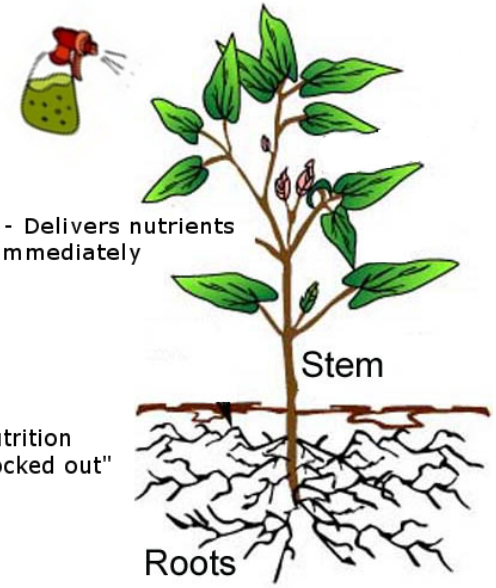


Foliar Spray

Benefits of Foliar Feeding

1. Saves Money - Reduces need for conventional fertilizers

2. Fast Acting - Delivers nutrients to the leaves immediately



3. Provides nutrition if roots are "locked out"

4. Helps break through nutrient lockout

Soil

Seeds Treatment

FIELD TRIAL OF LIGNOHUMATE PRODUCT UNDER CONDITION OF BALI ISLAND

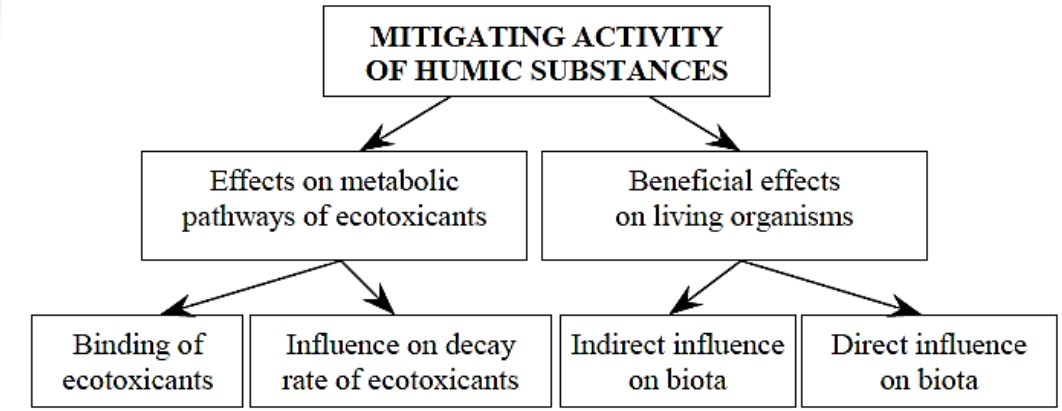


Figure 1. Principal components of mitigating activity of humic substances.

Credits to: Kulikova et al, 2005

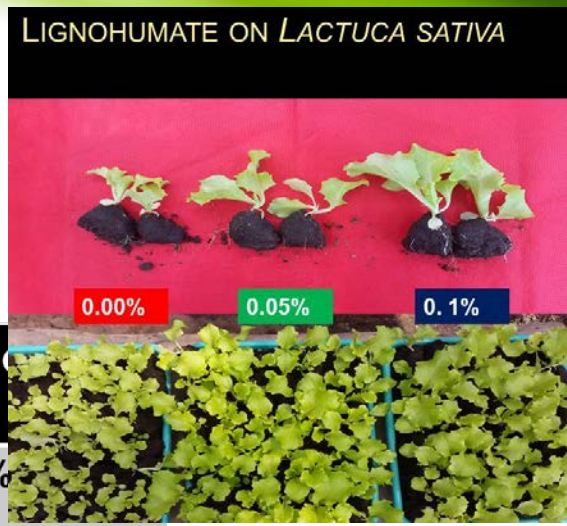
Objectives:

To evaluate effects:

- on greens;
- on rice *both along and at combined application with pesticide;*
- on cabbage *in combination with biological agent to control clubroot and promote plant growth*

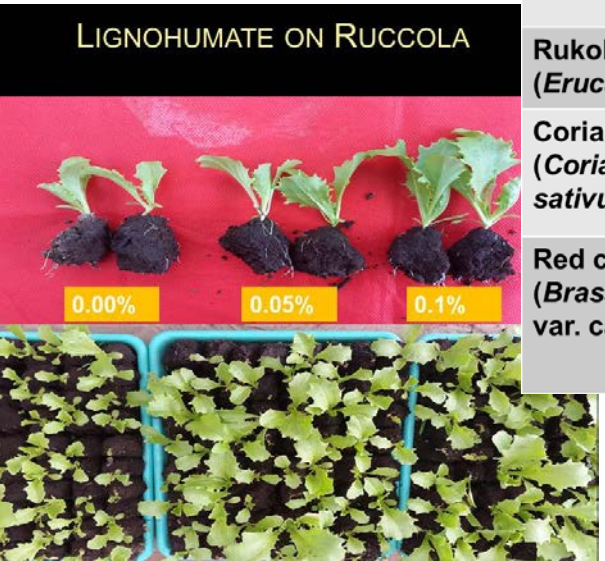
- HS can either enhance or reduce toxicity of xenobiotics/availability of chemicals, exerting synergistic or antagonistic effects on plant growth, depending on chemical and physiological mechanisms involved

EFFECT ON GREENS, BALI



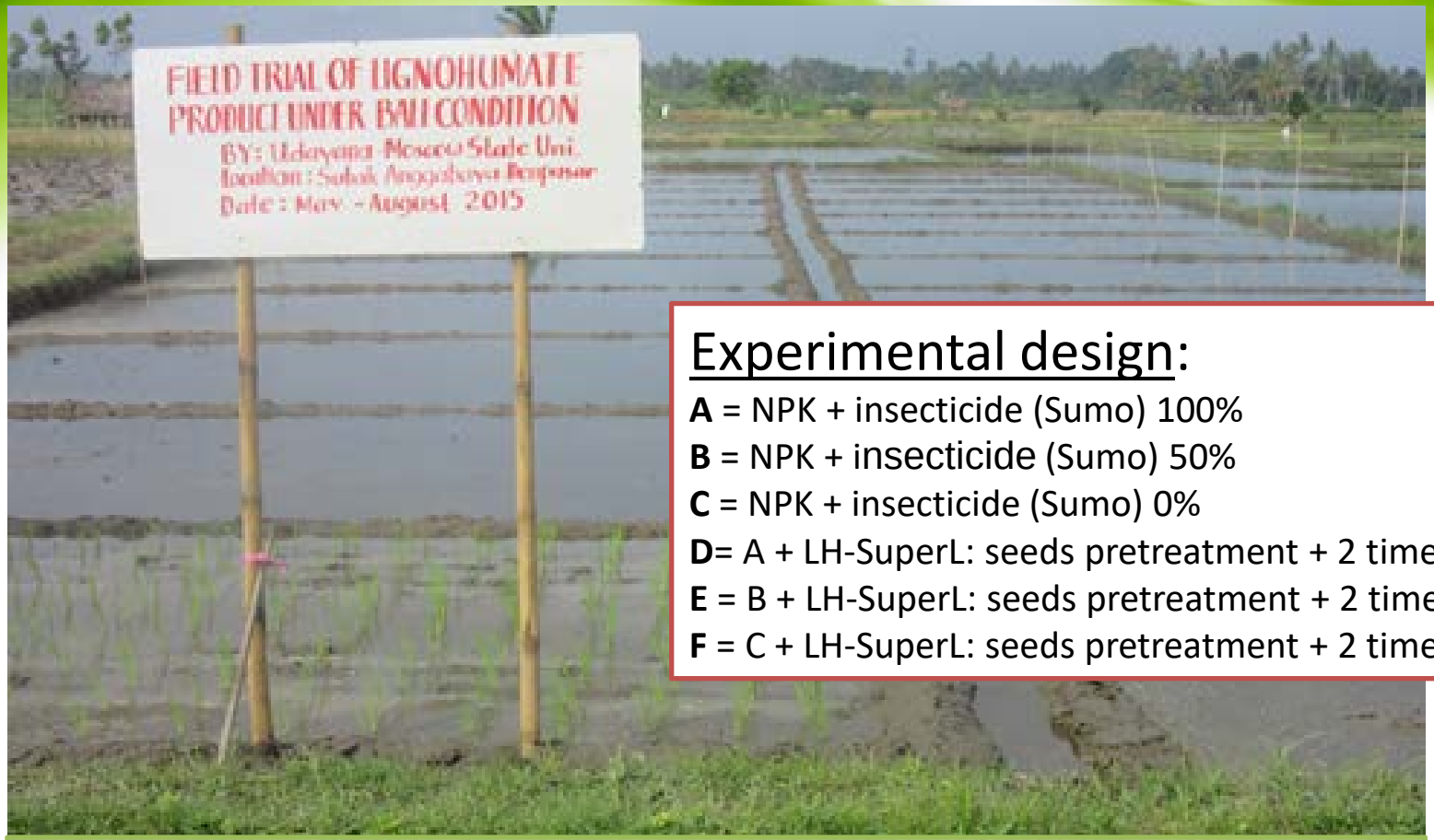
Dry weight (g) on Lignohumate applicati
10 days after sowing

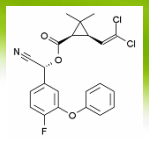
Crops/ concentration	0.0%	0.05%	0.1%
Yellow Salad (*Lactuca sativa*)	0.09 (c)	0.24 (b)	0.31 (a)
Rukola/Arugula (*Eruca sativa*)	0.05 (b)	0.26 (a)	0.28 (a)
Coriander (*Coriandrum sativum*)	0.16 (b)	0.23 (a)	0.27 a)
Red cabbage (*Brassica oleracea* var. capitata)	0.02 (a)	0.05 (a)	0.07 (a)



Credits to: Dr Ketut Suada et al

FIELD TRIAL





beta-cyfluthrin

Experimental design:

A = NPK + insecticide (Sumo) 100%
B = NPK + insecticide (Sumo) 50%
C = NPK + insecticide (Sumo) 0%
D= A + LH-SuperL: seeds pretreatment + 2 times foliar spray
E = B + LH-SuperL: seeds pretreatment + 2 times foliar spray
F = C + LH-SuperL: seeds pretreatment + 2 times foliar spray

Complete randomized design with 4 replications of 4 m x 5 m blocks and planting spacing of 30 cm x30 cm. All the plots were treated with basic NPK fertilization: Urea (46% N) and Ponska (15% N, 15% P_2O_5 and 15% K_2O) with doses of Urea 2 kg/100 m^2 + Ponska 2 kg/100 m^2
Rice (Oryza sativa L., HYV Cigeulis) was cultivated under fully irrigated conditions.

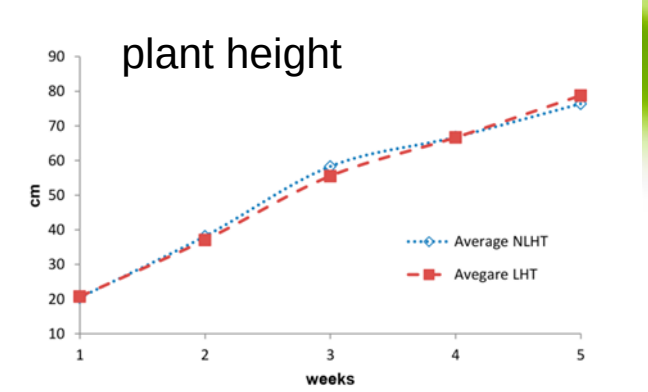
PLANT GROWTH

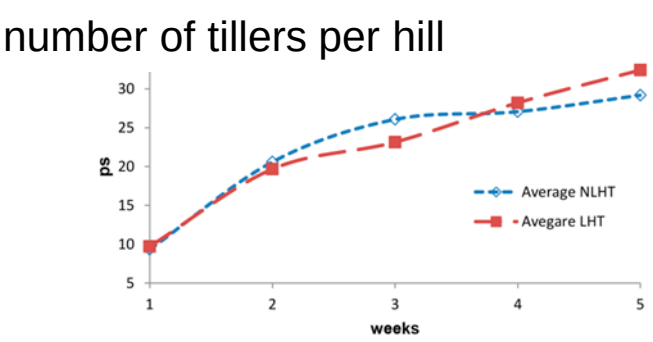
Seedling of 10 days after sowing on non-Lignohumate treatments NLHT (left) and Lignohumate treatments LHT (right).

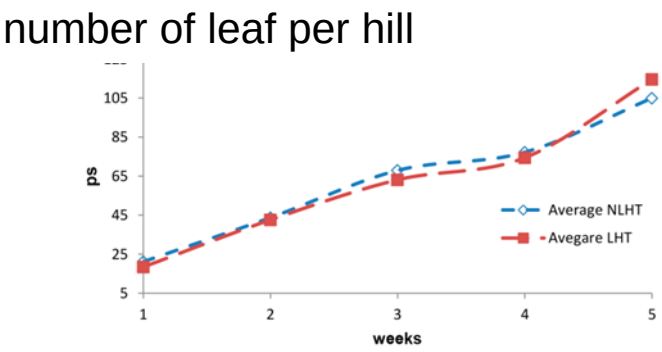
Seedling height and root length at 2 weeks after sowing, cm

Parameter	NLHT[1]		LHT[2]	
	Root	Shoot	Root	Shoot
Length	12.3±0.4	20.1±0.7	13.1±0.3	19.4±0.2
Signification. Student t-test 5% (n=45)	A t (calculated) = 8.95 t (table) = 1.98	a t (calculated) = 13.12 t (table) = 2.18	B	b

PLANT GROWTH







Rice plants growth characteristics during 1st five weeks of vegetation on non-lignohumate (NLHT) and lignohumate (LHT) treatments:

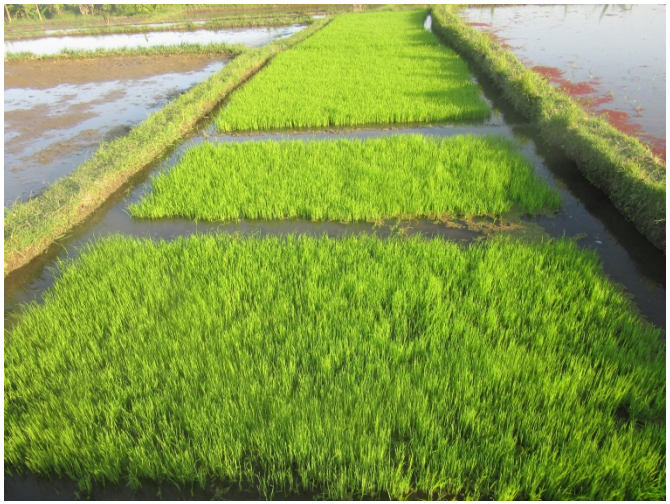
Plant height, tiller number, and productive tiller number 3 weeks after transplanting

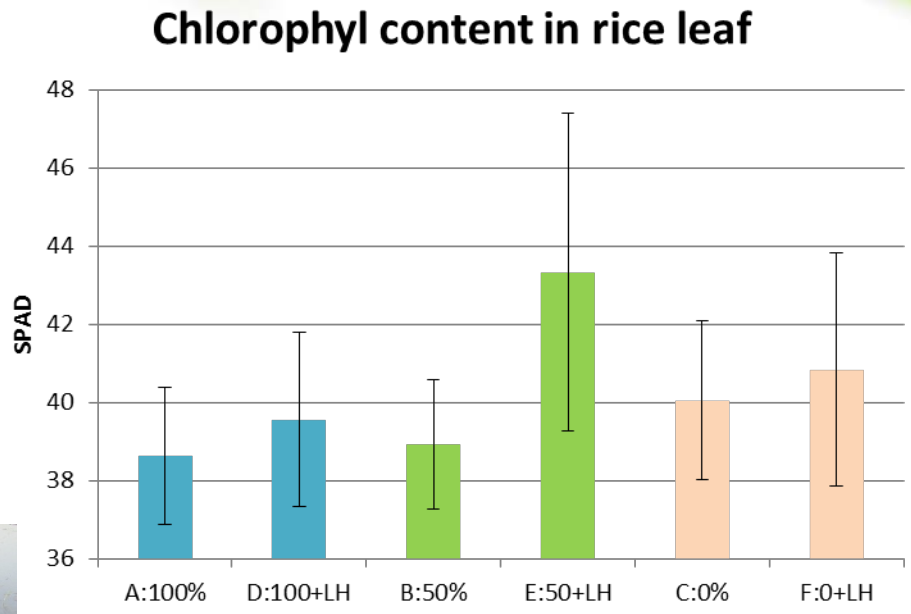
Treatments*	Plant height (cm)	Total tiller hill^{-1} (No.)	Productive tillers hill^{-1} (No.)
A	60.8±0.2 a	27.4±0.4 a	16.6±2.3 a
B	59.3±1.1 a	25.0±0.9 a	17.4±2.2 a
C	54.9±0.8 ab	25.8±0.1 a	19.1±2.4 a
D	57.3±0.5 ab	21.6±2.0 a	18.7±3.3 a
E	57.2±0.2 ab	23.8±1.2 a	19.3±4.2 a
F	52.2±1.1 b	24.1±1.2 a	17.4±0.5 a
NLHT[1]	60.8±0.2 a	27.4±0.9 a	16.6±0.6 a
LHT[2]	59.3±3.0 a	25.0±0.6 a	17.4±0.3 a

LEAF NUMBER, LEAF AREA AND CHLOROPHYLL CONTENT IN RICE LEAVES 5 WEEKS AFTER TRANSPLANTING

Leaf number, and leaf area 5 weeks after transplanting

Treatments*	Leaf number (No.)	Leaf area (cm^2 $hill^{-1}$)
A	71±3.0 a	8635±16 a
B	69±6.0 a	9947±23 a
C	63±7.0 a	8555±12 a
D	60±0.0 a	8902±13 a
E	69±0.1 a	8937±11 a
F	60±0.9 a	8640±12 a
NLHT[1]	67.7±3.5 a	9045±22 a
LHT[2]	63.0±2.3 a	8826±23 a





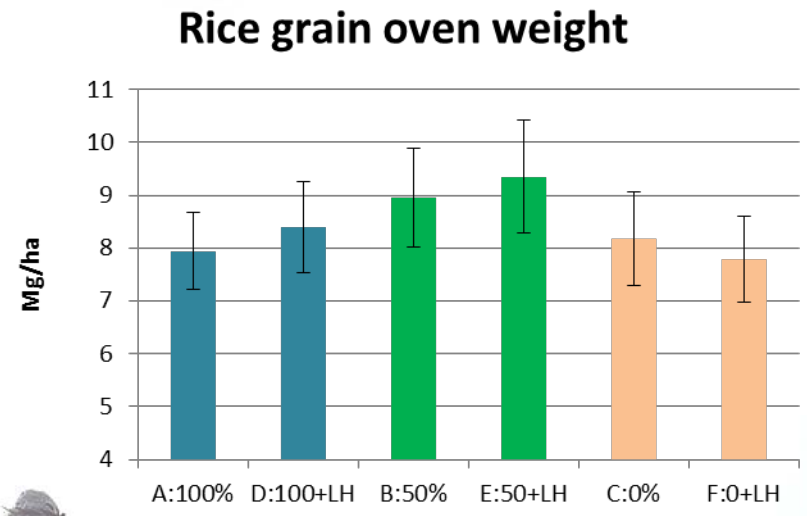
THE NUTRITIONAL CONTENT OF RICE

Treatments*	Content (mg/100g)					
	Water content	Ash	Protein	Lipid	Carbohydrate	Amylose
A	11,65±2,0 b	1,29±0,4 e	12,87±0,3 a	3,70±0,2 b	70,51±4,0 e	10,76±1,3 f
B	10,72±1,4 f	1,55±0,1 c	12,88±0,7 a	3,93±0,5 a	70,94±3,1 c	11,96±2,2 c
C	11,31±0,5 d	2,16±0,2 b	12,86±0,4 a	3,52±0,7 c	70,15±5,3 f	11,13±3,0 e
D	10,88±0,4 e	2,21±0,7 a	12,85±0,8 a	2,37±0,2 e	71,68±2,4 a	12,66±2,1 a
E	11,47±1,4 c	1,16±0,4 f	12,87±0,5 a	3,92±0,1 a	70,58±7,2 d	12,49±1,7 b
F	11,75±0,7 a	1,33±0,2 d	12,88±0,5 a	2,52±0,2 d	71,54±3,2 b	11,42±1,6 d
NLHT[1]	11,23±0,3 a	1,67±0,2 a	12,87±0,5 a	3,72±0,5 a	70,53±4,1 a	11,28±2,1a
LHT[2]	11,37±0,8 a	1,57±0,4 a	12,87±0,6a	2,94±0,2 b	71,27±4,2 b	12,19±1,8 b

RICE YIELD AND GRAIN QUALITY

Effect of Lignohumate and pesticide on rice yield and yield components

Treatments*	1000-grain dry weight (g)	Grain hill^{-1} (No.)	Panicle hill^{-1} (No.)
A	25.5±3.0 b	1412±12 a	27.4±1.6 a
B	24.7±3.3 b	1571±19 a	25.0±2.3 a
C	25.4±4.0 b	1805±13 a	25.8±1.3 a
D	24.6±3.0 b	1709±23 a	21.6±2.5 a
E	36.5±3.3 a	1762±16 a	23.8±3.3 a
F	24.1±3.0 b	1410±11 a	24.1±4.5 a
NLHT[1]	25.2±3.4 a	1596±15 a	26.1±3.4 a
LHT[2]	28.4±5.3 b	1627±17 b	23.1±3.4 b



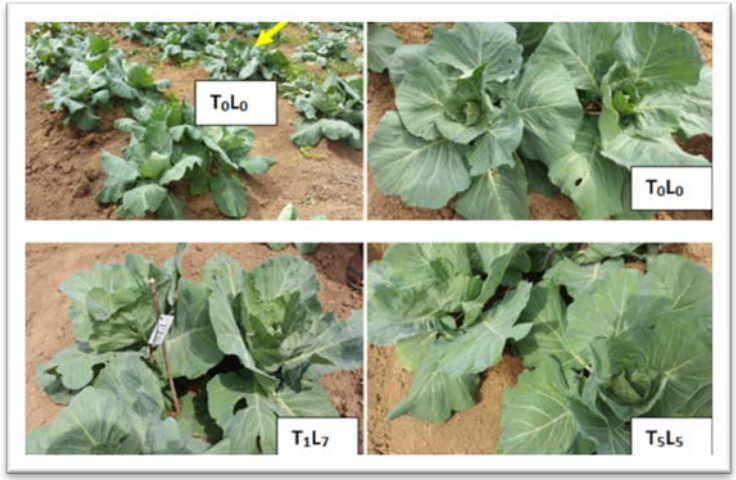
Additional yield is not a function of extra nutrients, but of biological activity of humic product

COMBINATION WITH BIOLOGICAL PRODUCT

TO KNOW

How effective is the combine application of *Trichoderma* spp. and *Lignohumate* to control clubroot and promote the growth of cabbage?

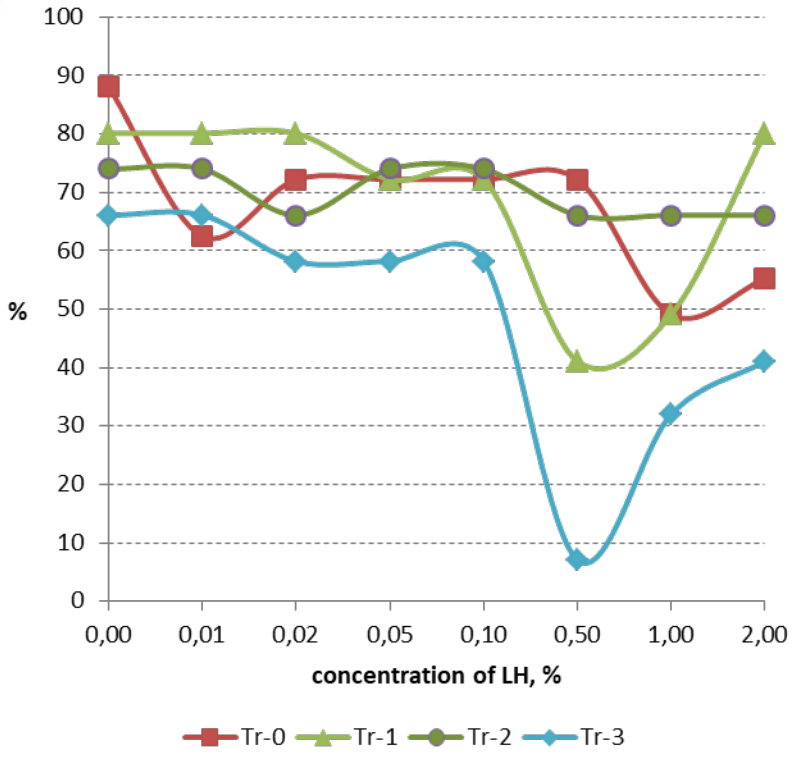
	0 (0 g)	$1x10^6$ (5 g)	$2x10^6$ (10 g)	$3x10^6$ (15 g)
LH, %	Tr-0	Tr-1	Tr-2	Tr-3
0.00	+	+	+	+
0.01	+	+	+	+
0.02	+	+	+	+
0.05	+	+	+	+
0.10	+	+	+	+
0.50	+	+	+	+
1.00	+	+	+	+
2.00	+	+	+	+



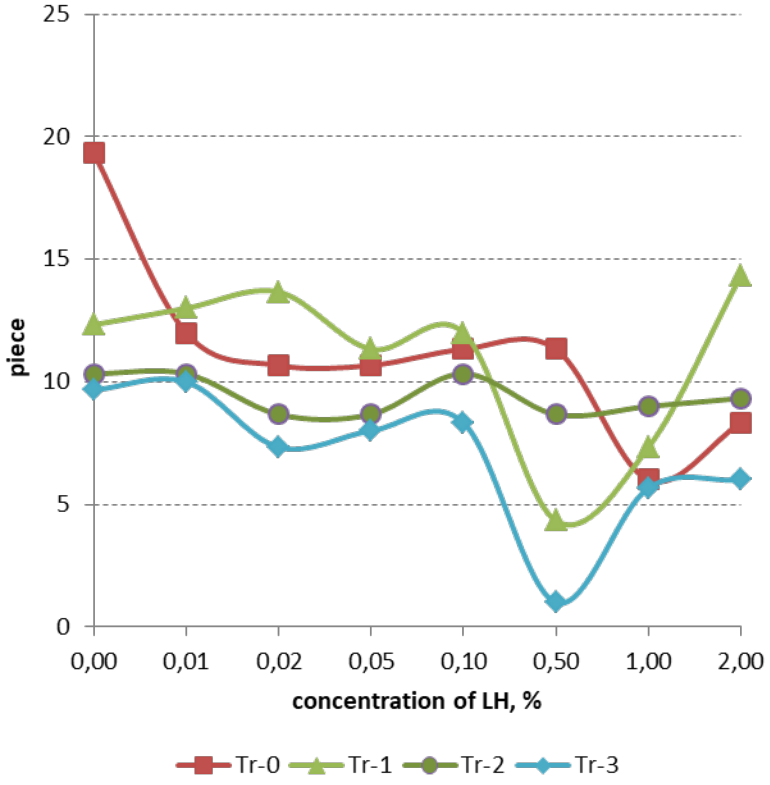
Credits to: Dr Ketut Suada et al

EFFECT ON CLUBROOT MANIFESTATION

Disease incidence of clubroot on cabbage under treatment of LH and Trichoderma



Amount of clubroots on cabbage under treatment of LH and Trichoderma



Humic product enhances the effect of biological agent. Synergy!

FINAL REMARKS

- Humic amendment was for the first time tested for crop cultivation in tropics and showed the promising prospects.
- Positive effects were observed both for HA along and for combinations with insecticide and biological agent. It was likely able to maintain plant resistance to a toxic influence of pesticide and to mitigate fungal disease. These effects can be of a special benefit for farmers.
- However further experiments need to be focused on optimization of its application under local climate conditions and agricultural practices. Experiments need also to be done on a variety of plants including vegetables and horticultural crops in order to get the optimum dosage of each plant.

Acknowledgements

Natalia Shchegolkova

Rodion Poloskin

Oleg Gladkov

LIGNO HUMATE
CONCENTRATED HUMIC PRODUCT

Sergey Kokhan

ANNEX 1

ASEAN-RUSSIA *JOINT PROJECT*

Ketut Suada

Ngurah Santosa

Nyoman Sunarta

Waian Budiasa

Thank you for your attention

Happy