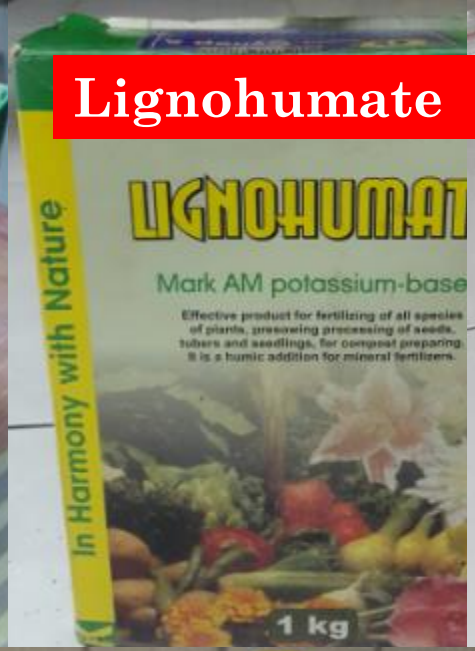
LIGNOHUMATE PROSPECT: RESEARCH AND BUSSINESS

LAUNCHING INTO PRODUCTION OF A NEW HUMIC PREPARATION WITH THE ADDITION OF A FUNGAL COMPONENT

Lignohumate



LIGNOHUMATE

WHAT IS?

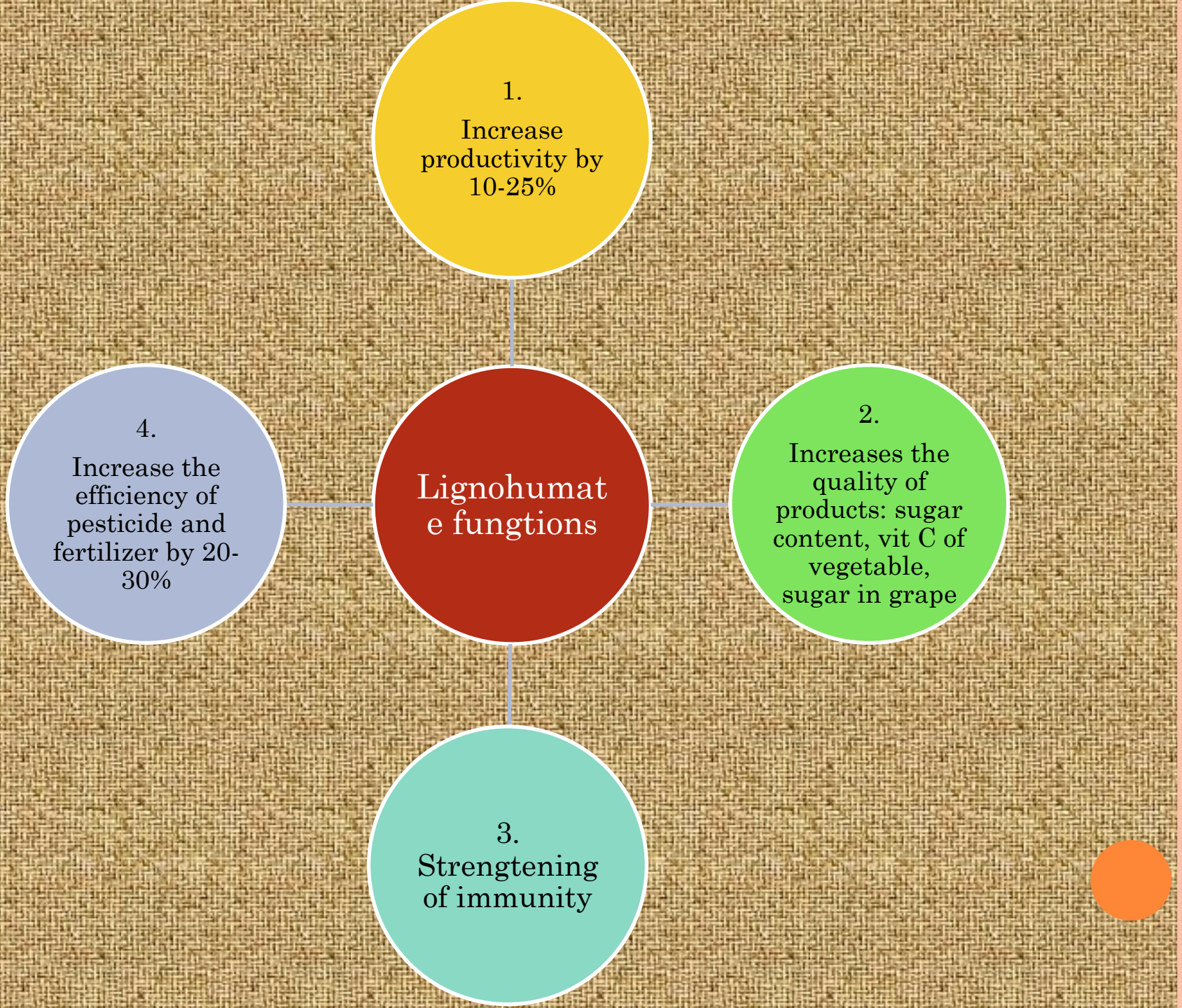
- Highly effective and technological humic fertilizer with microelement in chelate form with the properties of a growth factor and anti-stressor

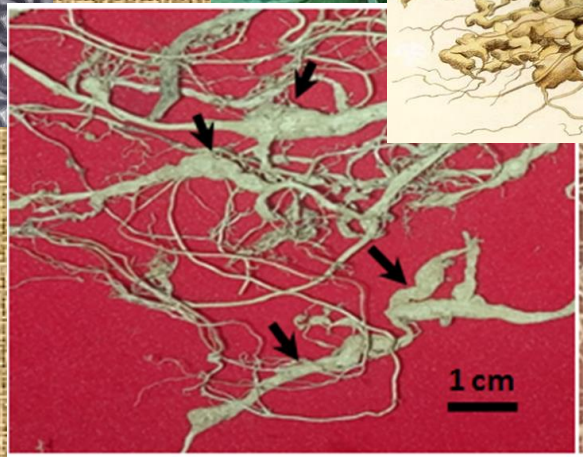
With humic properties:

- macromolecular complexes that contain phenolic, carboxylic, and aliphatic moieties, acting as colloidal component, having high surface area and ion absorption capacity

WHAT IS THE ADVANTAGES

- 1. Promote the growth of plant
- 2. Increase the resistance to biotic and abiotic stress
- 3. Immunomodulator


1.
Increase productivity by 10-25%
2.
Increases the quality of products: sugar content, vit C of vegetable, sugar in grape
3.
Strengtening of immunity
4.
Increase the efficiency of pesticide and fertilizer by 20-30%
Lignohumate fungtions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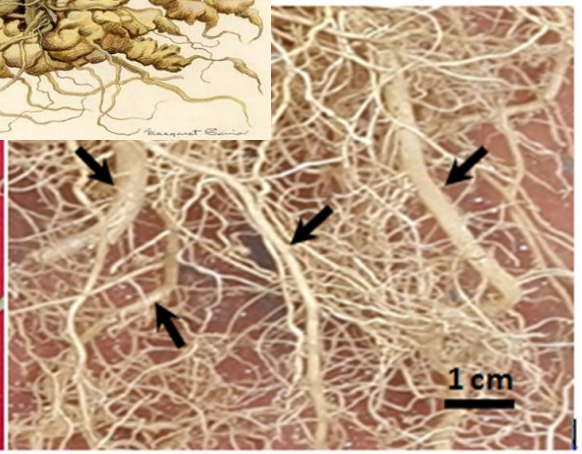
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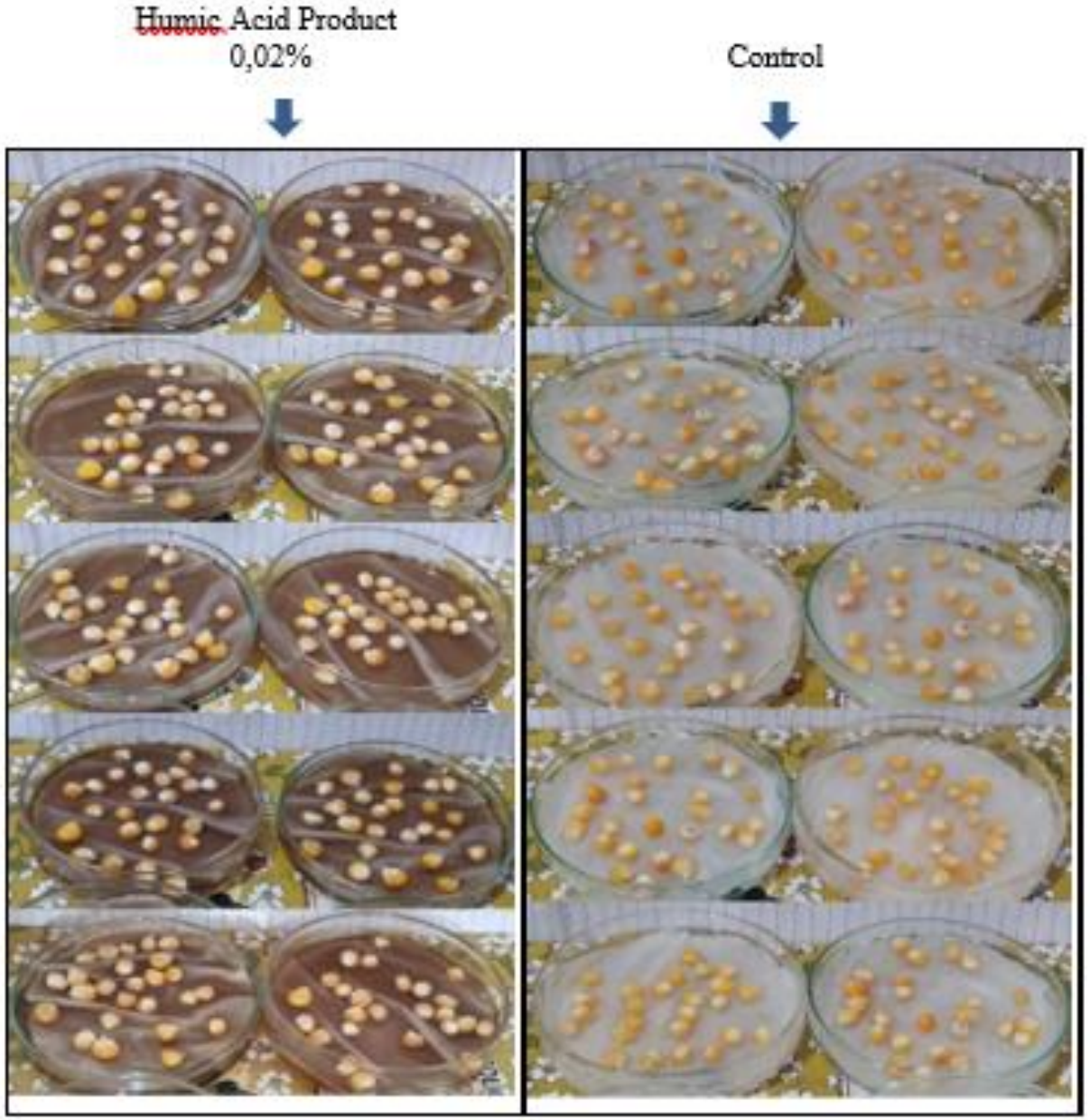


Figure 1. Use of humic on corn seed day 1.
Humic acid 0.02% (left), Control (right)

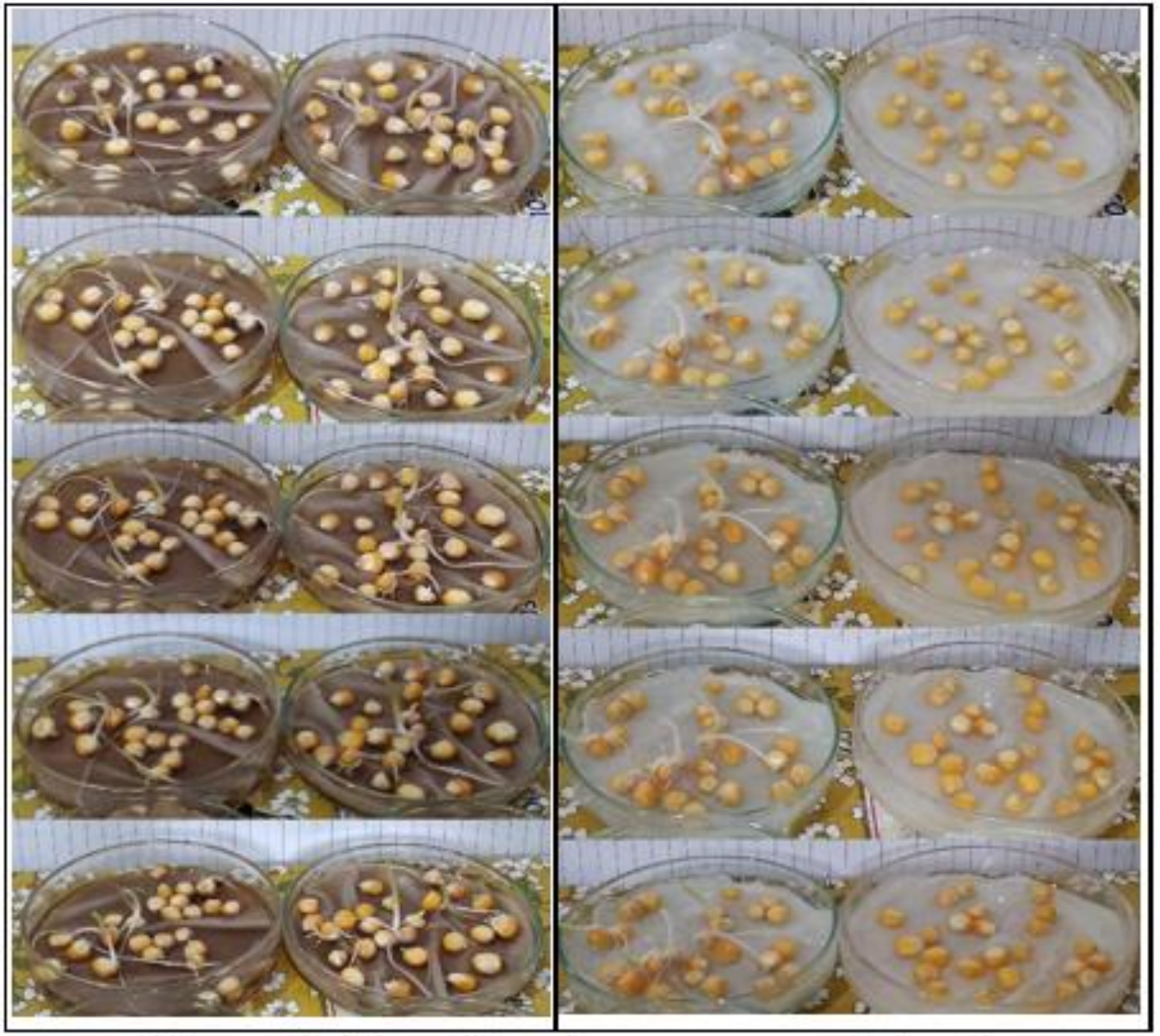


Figure 3. Use of humic on corn seed day 3.
Humic Acid (left), Control (right)

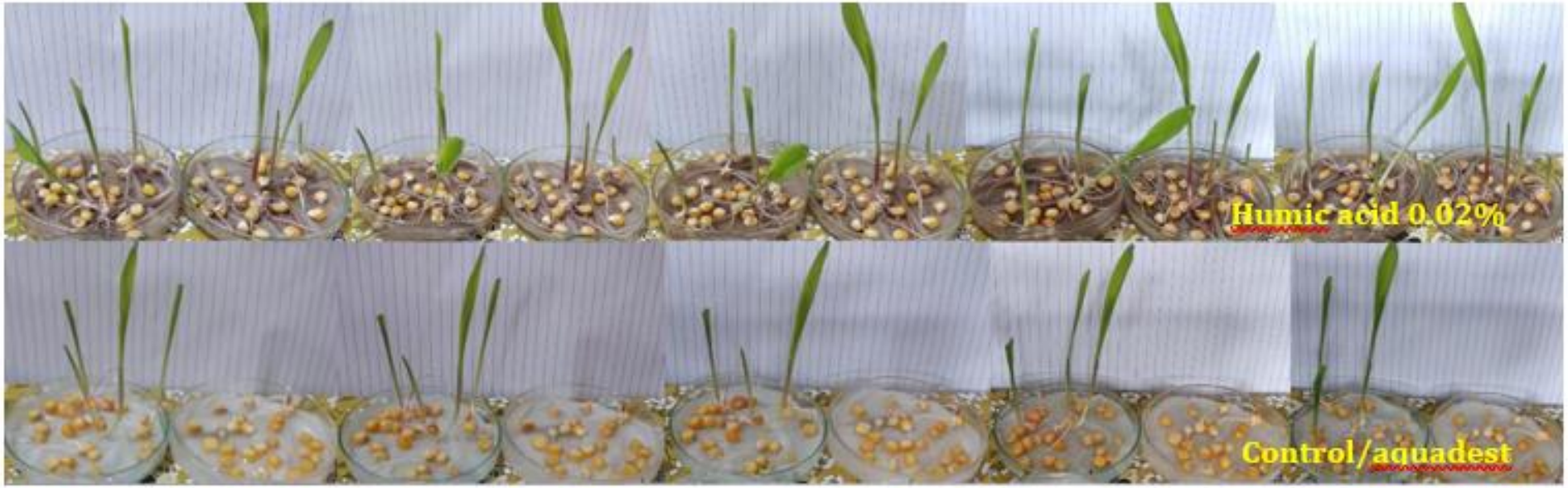


Figure 5. Use of humic on corn seed day 5; Humic acid (top), Control (bottom)

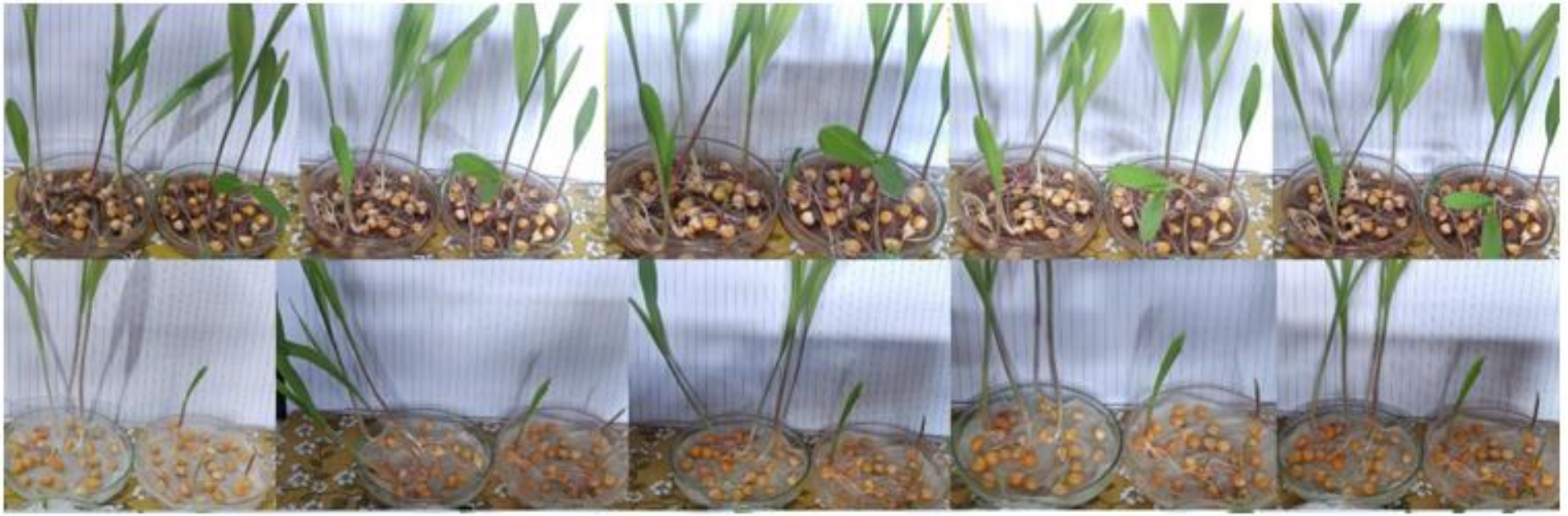


Figure 7. Use of humic on corn seed day 7; Humic Acid (top), Control (bottom)

Figure 9. Use of humic on corn seed day 9; Humic Acid (top), Control (bottom)

Table 1. Influence of 0.02% humic to corn seeds

Treatment	Seed germinated (pieces)	Average height (cm)	Average fresh mass (g)
Humic acid	24	43.83	0.96
Control	16	45.42	1.00

*Average of 25 grains

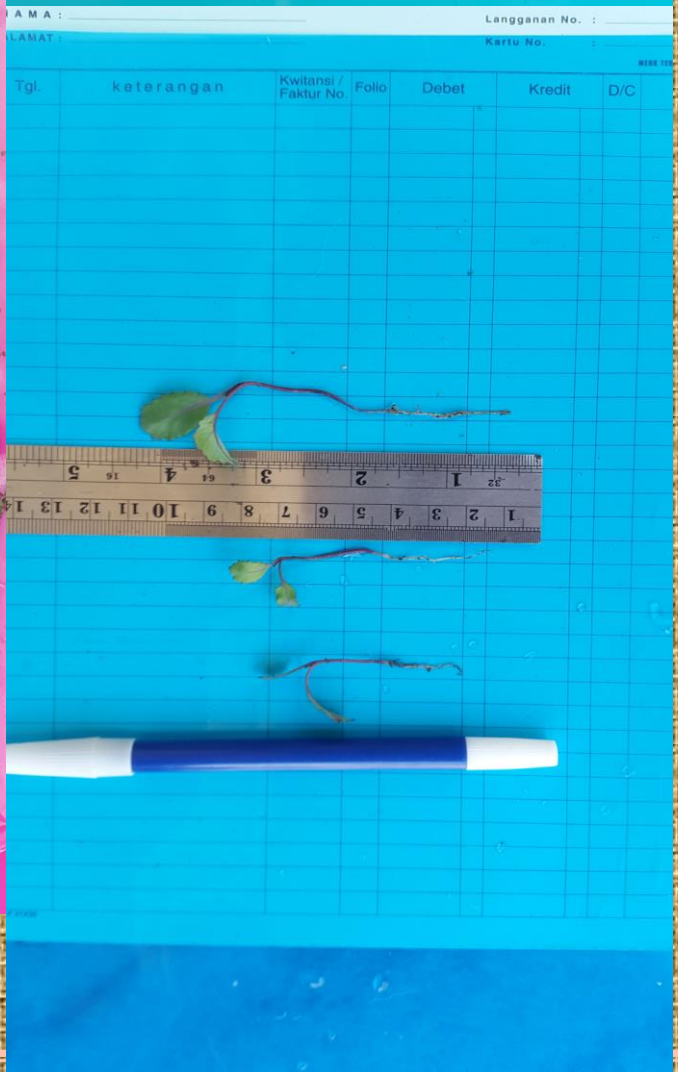

0.5%
control

Lignohumate on Racola

Lignohumate 0, 0.05, 0,1% on Coriander

Lignohumate on *Lactuca sativa*


0.00%
0.05%
0. 1%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Plant height (cm) on Lignohumate application at 10 days after sowing

Crops/con-centration	***0.0%***	***0.05%***	***0.1%***
Yellow Selada (Lactuca sativa)	4.75 (A)	5.50 (A)	7.75 (B)
Rukola/Arugula (*Eruca sativa)*	4.25 (A)	5.75 (A)	7.50 (B)
Coriander (*Coriandrum sativum*)	4.25 (A)	5.75 (A)	8.00 (B)
Red cabbage (*Brassica oleracea* var. *capitata*)	4.50 (A)	4.1 (A)	6.55 (B)

Fresh Weight (g) on Lignohumate application at 10 days after sowing

Crops/con-centration	0.0%	0.05%	0.1%
Yellow Selada (Lactuca sativa)	0.51 (b)	1.29 (a) (3X)	1.98 (a) (4X)
Rukola/Arugula (Eruca sativa)	0.31 (c)	0.97 (b) (3X)	1.37 (a) (4X)
Coriander (Coriandrum sativum)	0.16 (a)	0.23 (a) (1X)	0.27 (a) (2X)
Red cabbage (Brassica oleracea var. capitata)	0.22 (a)	0.24 (a) (1X)	0.27 (a) (1X)

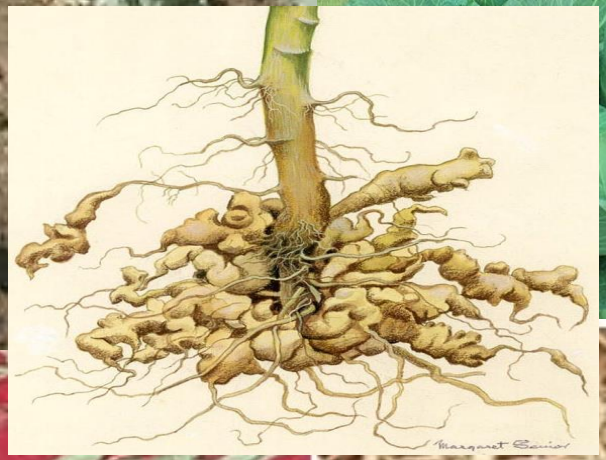
Dry weight (g) on Lignohumate application at 10 days after sowing

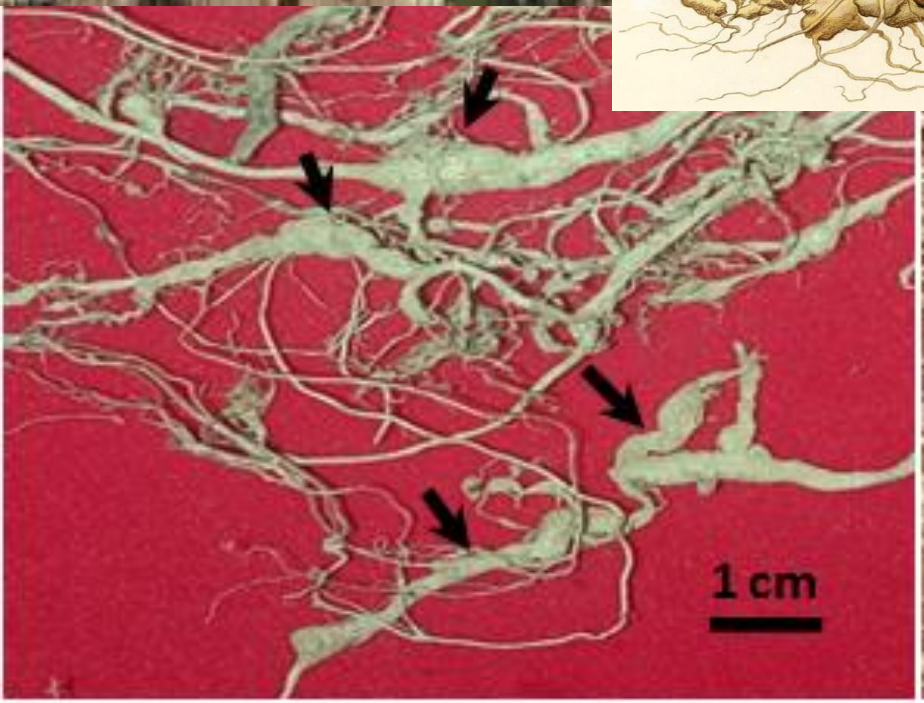
Crops/con-centration	0.0%	0.05%	0.1%
Yellow Selada (Lactuca sativa)	0.09 (c)	0.24 (b) (3X)	0.31 (a) (3X)
Rukola/Arugula (Eruca sativa)	0.05 (b)	0.26 (a) (5X)	0.28 (a) (6X)
Coriander (Coriandrum sativum)	0.16 (b)	0.23 (a) (1X)	0.27 (a) (2X)
Red cabbage (Brassica oleracea var. capitata)	0.02 (a)	0.05 (a) (3X)	0.07 (a) (4X)

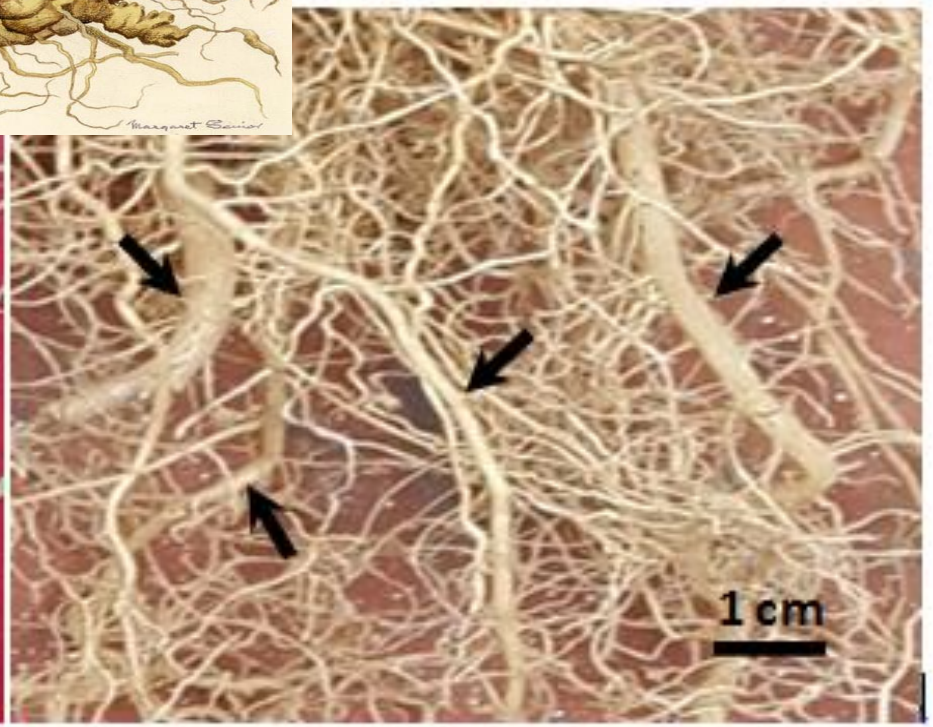
CONCLUTIONS

- The lignohumate was able to promote the growth of many vegetable seedlings.
- On concentration of 0.05% and 0.1% lignohumte has significance effect in average of 2x and 3x compared to control

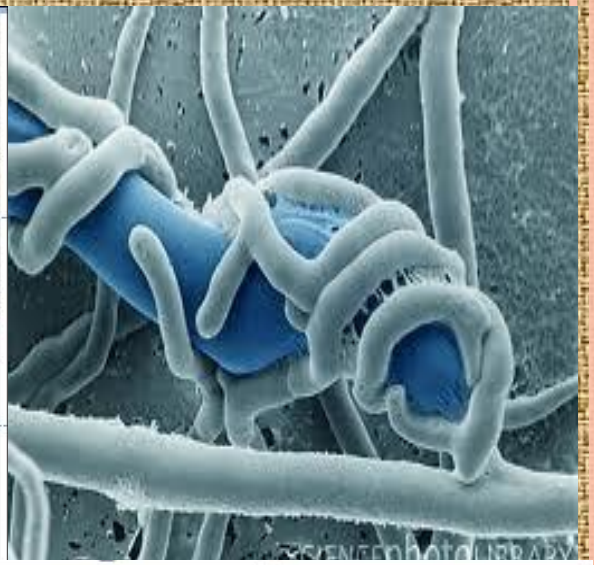
CLUB ROOT DISEASE

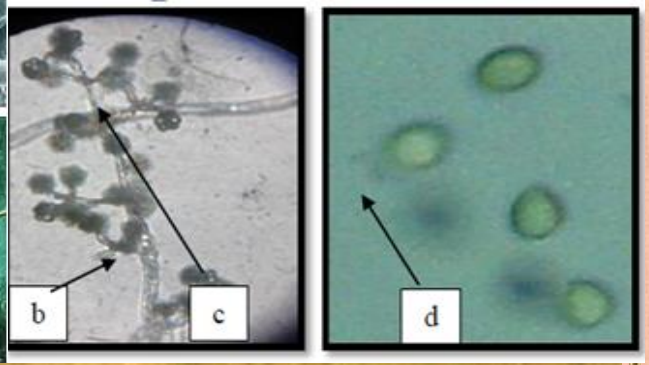






Trichoderma spp.





TO KNOW

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

Table 1. Disease incidence of clubroot on cabbage under treatment of lignohumate and *Trichoderma*

Ligno-humate dose (%)	*Trichoderma* sp.			
	0 (0 g)	$1x10^6$ (5 g)	$2x10^6$ (10 g)	$3x10^6$ (15 g)
	..... %			
0.00	88.1 a	80.1 a	74.0 a	66.1 A
0.01	62.5 a	80.1 a	74.0 a	66.1 A
0.02	72.2 a	80.1 a	66.1 a	58.2 B
0.05	72.2 a	72.2 a	74.0 a	58.2 B
0.10	72.2 a	72.2 a	74.0 a	58.2 B
0.50	72.2 a	41.1 b	66.1 a	7.1 C
1.00	49.1 b	49.1 b	66.1 a	32.0 B
2.00	55.2 b	80.1 a	66.1 a	41.1 B

Description: Figures followed by the same letters are not significantly different according to the 5% level of Duncan test.

Table 2. Total clubroot exhibited on the cabbage root on lignohumate and *Trichoderma* treatments

Ligno-humate dose (%)	*Trichoderma* sp.			
	0 (0 g)	$1x10^6$ (5 g)	$2x10^6$ (10 g)	$3x10^6$ (15 g)
	..... buah			
0.00	19.33 a	12.33 b	10.33 b	9.67 c
0.01	12.00 b	13.00 b	10.33 b	10.00 b
0.02	10.67 b	13.67 b	8.67 c	7.33 c
0.05	10.67 b	11.33 b	8.67 c	8.00 c
0.10	11.33 b	12.00 b	10.33 b	8.33 c
0.50	11.33 b	4.33 de	8.67 c	1.00 f
1.00	6.00 cd	7.33 cd	9.00 c	5.67 de
2.00	8.33 cd	14.33 b	9.33 c	6.00 cd

Description: Figures followed by the same letters are not significantly different according to the 5% level of Duncan test.

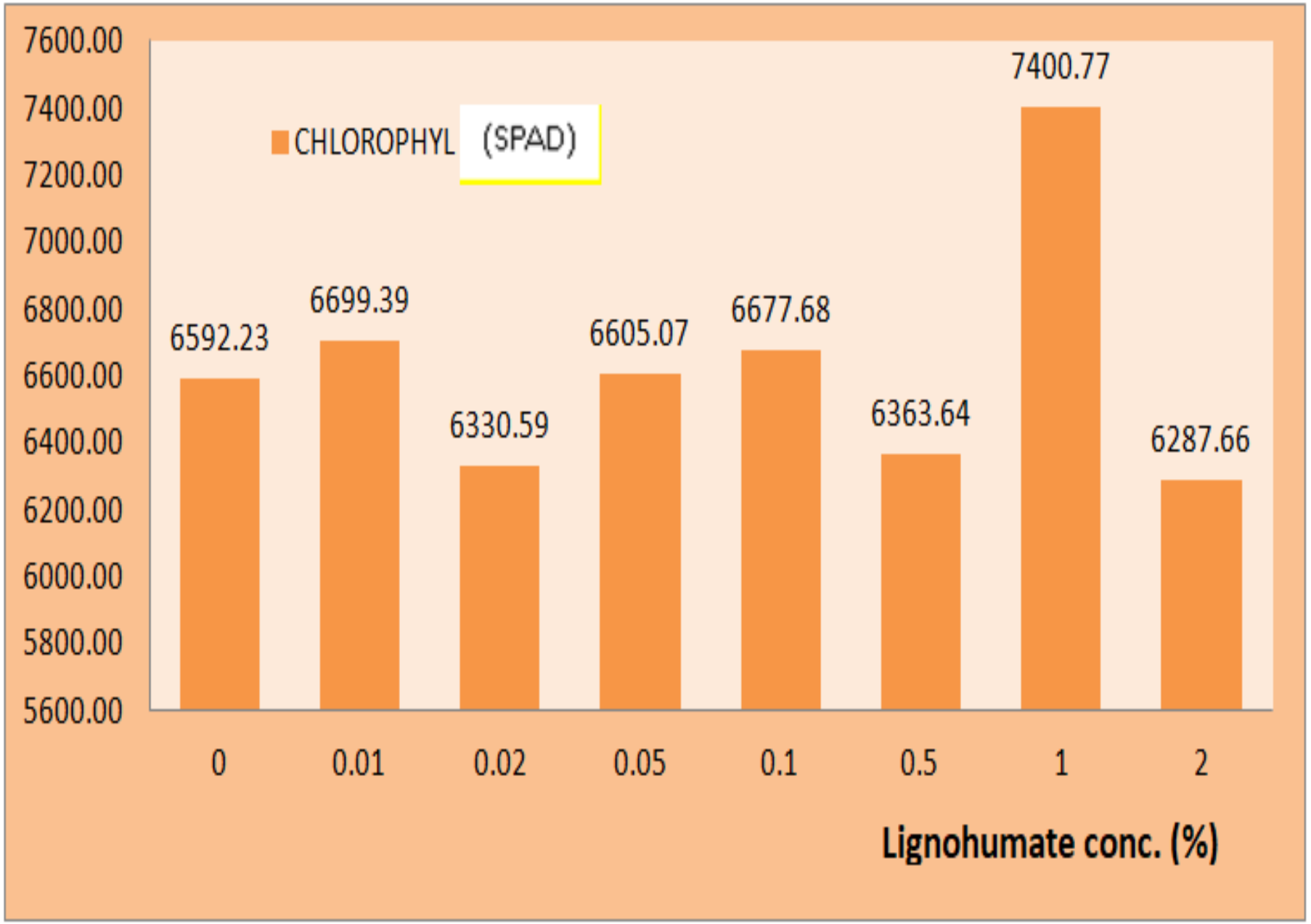


Figure 2. Total leaf chlorophyll on the various lignohumate concentration

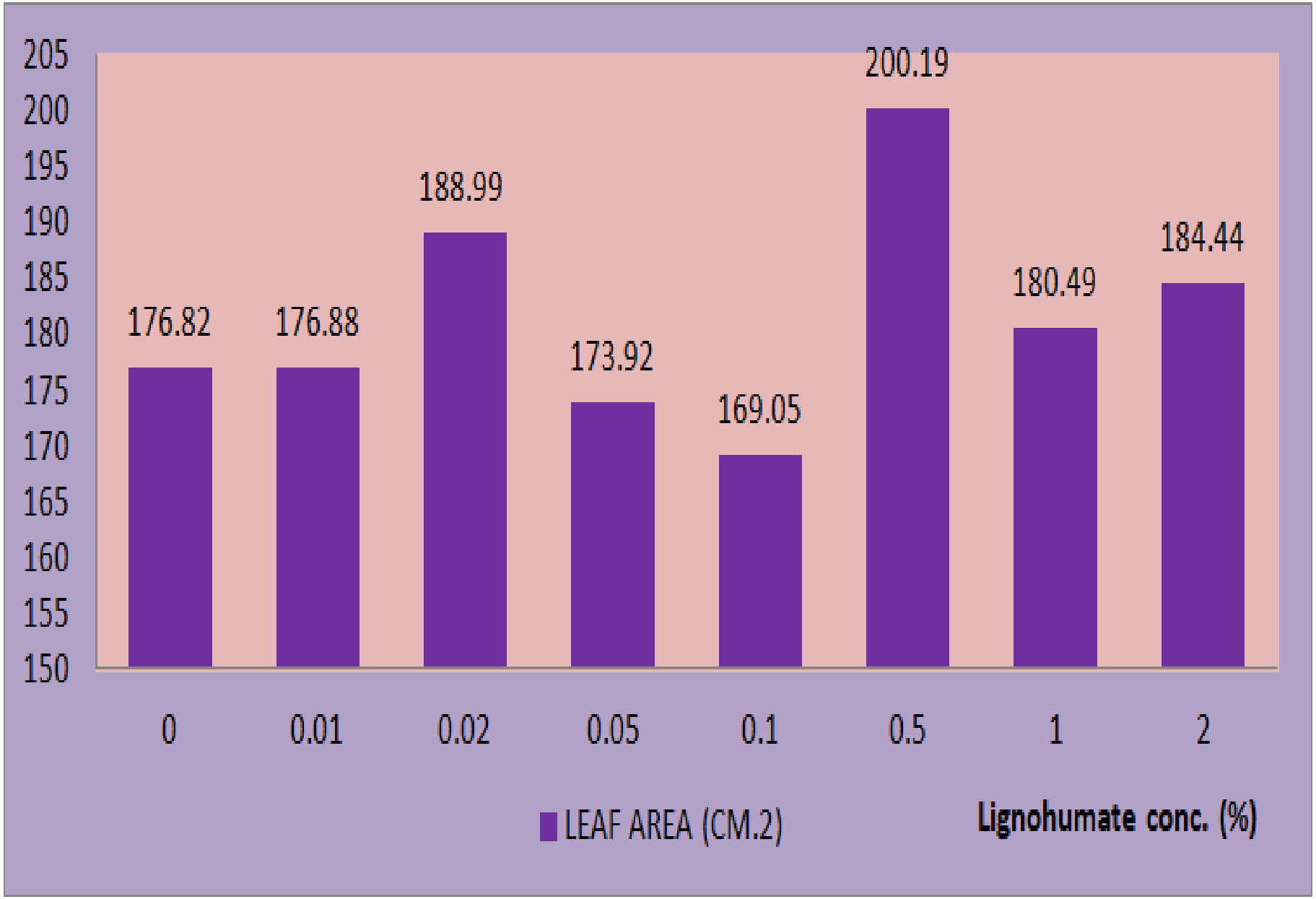


Figure 1. Leaf area of cabbage on the various lignohumate concentration

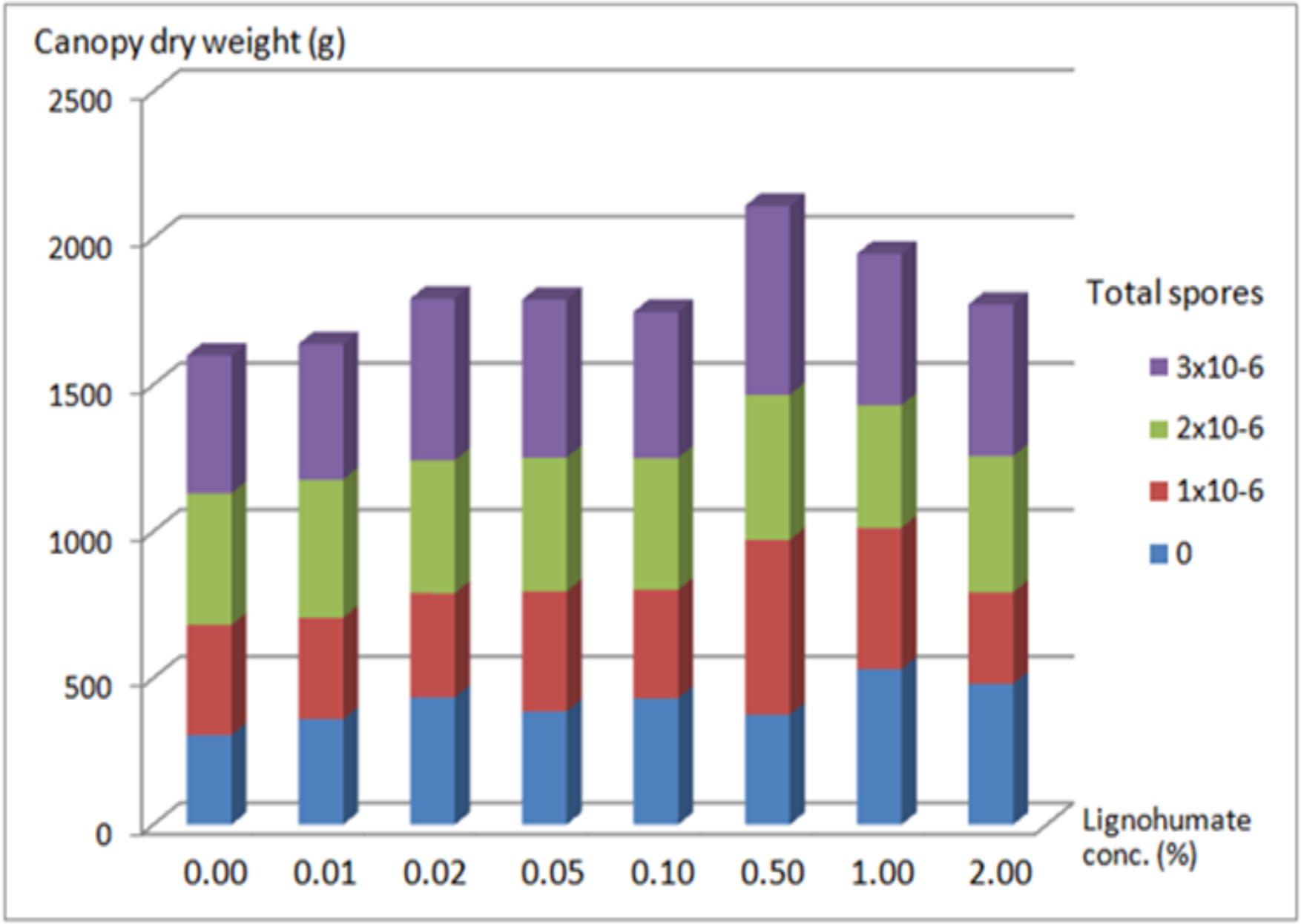


Figure 3. Canopy dry weight under lignohumate concentration and total *Trichoderma* spores.

Table 2

Seedling height and root length at 2 weeks after sowing

	NLHT[1]		LHT[2]	
	Root	Shoot	Root	Shoot
Length (cm)	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

[1]Non-lignohumate-treatments, [2]Lignohumate-treatments.

Table 6

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	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	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

Description: Numbers followed by the same letters are not significantly different based on 5% Duncan test level (above data block). Numbers followed by the same letters are not differentiated based on 5% Student t-test (below data block).

CONCLUTIONS

- 1. Lignohumate (humic acid) promote the growth of many kind of plant i.e. corn, lettuce, rice, cabbage with varous concentration from 0.02%-0.5%
- 2. The lignohumate was able to promote the growth of many vegetable seedlings (cabbage plants) as much as 2x and 3x compared to non lignohumate.
- 3. Lignohumate promote the content of rice nutrition especially carbohydrate and amylose.
- 4. Lignohumate in combination to *Trichoderma* gave significant interaction effect to support growth of cabbage and decrease disease incidence on concentration of 0.5% and *Trichoderma* of 15 gram (~$3x10^6$ spores) per plant


ЛИГНОГУМАТ
LIGNOHUMATE
CONCENTRATED HUMIC PRODUCT
LIGNOGUMAT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Thank You!