# ວິໄລລາຍງານການທົດສອບຝຸ່ນເອັນເອສເອ-ປັບປຸງຄືນ 03.03.2020

# Lao People's Democratic Republic Peace Independence Democracy Unity Prosperity

Ministry of Agriculture & Forestry Department of Agriculture Plant Protection Centre Pesticide and plant food unit

#### Report

# On Effectiveness Study of NSA Organic Fertilizers That Affect Plant Growth

## 1. Excerpt

This effectiveness study of the Soils North NSA fertilizer on crop growth was initiated between 01/09/2019 to 30/01/2020. The purpose of comparing crop growth in banana and maize by the introduction of Soils North NSA fertilizer at different rates (Completely Randomized Design, CRD).

There are 4 treatment options: Method 1 is No NSA Fertilizer (Control); Method 2 is at the rate of 1 tonne of NSA /ha; Method 3 is 2 tonnes of NSA /ha and Method 4 is at 3 tonnes of NSA/ha.

There were 4 duplications totaling 16 test units. From the experiments, the number of leaves, the height of the trees, the length of the leaves, the width of the leaves, the circumference of the tree, the length of the fruit, the circumference of the fruit and the weight of the fruit were statistically different.

Bananas and corn that have been fertilized with Soils North NSA at a rate of 3 tonnes / ha are best and able to promote plant growth: for a banana leaf of 10.00 leaves, a mean height of 105.25 cm, an average leaf length of 69.25 cm, a width of 32.63 cm and the tree circumference is 15.88cm.

For the corn, the number of leaves is 11.25 leaves, the height of the plants is 134.25 cm, the length of the leaflets is 79.25 cm, the width of the leaflets is 8.25 cm, the circumference of the plant is 6.83 cm, the length of the fruit is 24.13 cm, fruit circumference is average 13.50cm and average weight is 114.92grams.

# 2. Principles and reasons

Banana is the plant that can grow and yield the crops quickly, compared to other types of fruits, however, it needs a lot of nutrients to yield more products. It absorbs a lot of nutrients and needs a lot of water but is not fond of waterlogged land. It can be planted and grow well in the soil in every part of Lao PDR. Currently, bananas are exported abroad increasingly every year. The major markets are China, Vietnam and Thailand, but the highest number is exported to China.

Another issue of cultivating bananas is that even though bananas can grow in the common soil, applying the synthetic fertiliser is necessary because it needs a lot of nutrients. Therefore, farmers often apply excessive fertiliser. The vital nutrients for growing are Nitrogen, Phosphorus and Potassium. Applying the Nitrogen fertiliser will promote the healthy banana leaves and therefore produce more crops, especially the bigger fruits, branch; flower and can be ripen quicker when Nitrogen fertiliser is applied at 170 grams/plant. As well applying Phosphorus at 60 grams/plant, it can boost up the number of hands per branch, the size of fruits and the flowering. Additionally, Potassium is crucial for fruiting, it could be seen that applying Potassium 300 grams/plant for approximately 4-5 months after planting can result in an increase of the weight of the branch, the number of fruits, the weight of fruits per tree. The fruiting efficiency had risen for more than 10% and the period before harvesting had been reduced for approximately 3 months.

# 3. Purpose

To compare the effectiveness of Soils North NSA fertilizer with the effect of promoting plant growth at different rates.

# 4. Experimental equipment and methods

### 4.1 Equipment

- Soils North NSA Organic Fertilizer (Soil Conditioner)
- Cavendish banana tissue culture seedlings (Brazilian cultivar)
- Corn seedlings
- Planting bowl
- Other

# 4.2 Experimental method

### 4.2.1 Experimental location

Green House, at Plant Protection Centre, Ban Nahai, Hat Saifong District, Vientiane Capital, Laos PDR.

#### 4.2.2 Experimental duration

01 September 2019 to 30 January 2020

#### 4.2.3 Trial planning

The study of the effectiveness of the NSA fertilizer on the growth of plants is planned in a four-step, Completely Randomized Design (CRD) trial. There are 4 repetitions, 1 plant per pot, 1 pot for each repetition with 4 treatments as follows:

- T<sub>1</sub>, no fertiliser (Control)
- T<sub>2</sub>, apply NSA 1 Tonne/Hectare (0.9 Kg/pot)
- T<sub>3</sub>, apply NSA 2 Tonnes/Hectare (1.8 Kg/pot)
- T<sub>4</sub>, apply NSA 3 Tonnes/Hectare (2.7 Kg/pot)

### 4.2.4 Data Collection

Experimental data were collected after 30, 60, and 90 days of planting:

- The number of leaves of banana and corn plants
- The height of them
- The length of their leaves
- The width of their leaves
- The circumference of their stem (trunk)
- The length of the corn
- The circumference of the corn
- The weight of the corn

### 4.2.5 Data analysis

Statistical analysis was performed using the Analysis of variance Analysis (ANOVA) to compare the differences between the mean of the experimental factors by Duncan's Multiple Range Test at 95% confidence level (P <0.05) using the statistical SAS (Statistic Analysis System) Window 9.1.

# 5. Experimental results

Efficiency studies of Soils North NSA fertilizer affecting the growth of plants after 30, 60 and 90 days can be collected in the following experimental results:

### 5.1 Number of leaves

It can be seen that after planting for 30, 60 and 90 days that the number of banana leaves contains statistical differences according to the data as follows:

Test Method	Number of leaves (ໃပ)		
	30days	60days	90days
T1 = No fertilizer	6.50 b	5.00 b	5.50 b
T2 = 1 tonne / ha	6.75 b	5.75 b	5.50 b
T3 = 2 tonnes / ha	7.25 b	8.75 a	10.00 a
T4 = 3 tonnes / ha	8.75 a	9.50 a	10.00 a
CV (%)	9.97	11.61	7.45

**Table 1**: Effectiveness of Soils North NSA fertilizer for leaf growth of banana trees

The number of corn leaves was found to be statistically different at 30 and 60 days after planting, as shown below:

Test Method	Number of leaves (ໃပ)		
	30days	60days	
T1 = No fertilizer	4.00 c	4.00 c	
T2 = 1 T/HA	4.50 c	7.00 b	
T3 = 2 T/HA	6.50 b	10.75 a	
T4 = 3 T/HA	10.25 a	11.25 a	
CV (%)	10.63	23.08	

**Table 2:** Effectiveness of Soils North NSA fertilizer for leaf growth of corn

#### 5.2 The height of plants

It can be seen that the height of the banana plants after planting for 30, 60 and 90 days contain statistical differences according to the data as follows:

Test Method	Height of banana plant(cm)		
	30days	60days	90days
T1 = No fertilizer	53.00 b	46.75 b	45.00 b
T2 = 1 T/HA	61.25 b	54.50 b	52.00 b
T3 = 2 T/HA	70.05 a	71.50 a	103.25 a
T4 = 3 T/HA	76.50 a	76.75 a	105.25 a
CV (%)	9.09	11.41	12.87

Table 3: Effectiveness of Soils North NSA fertilizer on height growth of banana trees

Height of corn was found to vary statistically by age at 30 and 60 days, as shown in the following table:

Table 4: Effectiveness of Soils North NSA fertilizer to promote height growth of corn

Test method	Height of corn plants(cm)		
	30day	60days	
T1 = No fertilizer	19.50 c	20.50 c	
T2 = 1 T/HA	41.00 b	40.25 b	
T3 = 2 T/HA	57.00 a	129.88 a	
T4 = 3 T/HA	62.63 a	134.25 a	
CV (%)	12.23	7.23	

#### 5.3 Length of leaves

It can be seen that the length of the banana leaves after planting for 30, 60 and 90 days contain statistical differences according to the data as follows:

#### Table 5:

Effectiveness of Soils North NSA fertilizer growth on the banana leaves length

Test Method	Banana leave length(cm)		
	30 days	60days	90days
T1 = No fertilizer	33.75 c	31.25 c	29.50 c
T2 = 1 T/HA	37.00 c	36.50 bc	34.25 c
T3 = 2 T/HA	41.63 b	42.00 b	63.25 b
T4 = 3 T/HA	45.88 a	53.25 a	69.25 a
CV (%)	6.39	10.76	6.74

The length of corn leaves was found to vary statistically by age at 30 and 60 days, as shown in the table below:

**Table 6:** Effectiveness of Soils North NSA fertilizer for the corn leaves length

Test Method	Corn leave length(cm)		
	30days	60days	
T1 = No fertilizer	16.75 c	17.50 d	
T2 = 1 T/HA	38.75 b	39.53 c	
T3 = 2 T/HA	62.63 a	63.63 b	
T4 = 3 T/HA	68.75 a	79.25 a	
CV (%)	11.53	9.88	

#### 5.4 Width of leaves

It can be seen that the width of the banana plants after planting for 30, 60 and 90 days contain statistical differences according to the data as follows:

**Table 7:** Effectiveness of Soils North NSA fertilizer for promoting broad-based growth of banana leaves

Test Method	Width of banana leaves(cm)		
	30days	60days	90days
T1 = No fertilizer	16.55 b	16.93	13.13 b
T2 = 1 T/HA	16.75 b	17.05	15.38 c
T3 = 2 T/HA	18.88 ab	18.63	30.88 b
T4 = 3 T/HA	20.38 a	19.63	32.63 a
CV (%)	8.05	10.73	8.44

The width of the corn leaves was statistically different at 30 and 60 days after planting, as shown in the table below:

**Table 8:** Effectiveness of Soils North NSA fertilizers as a function of promoting on corn leaves

Test Method	Corn leaves width(cm)		
	30days	60days	
T1 = No fertilizer	1.43 d	1.70 d	
T2 = 1 T/HA	2.85 c	3.20 c	
T3 = 2 T/HA	5.48 b	5.83 b	
T4 = 3 T/HA	6.80 a	8.25 a	
CV (%)	8.39	9.69	

#### 5.5 The circumference of the plant

It can be seen that the circumference of the banana plants after planting for 30, 60 and 90 days contain statistical differences according to the data as follows:

**Table 9:** Effectiveness of Soils North NSA fertilizer to promote the circumference ofbanana plants

Test Method	Circumference of banana plant(cm)		
	30days	60days	90days
T1 = No fertilizer	7.55 c	7.75 c	7.50b
T2 = 1 T/HA	8.00 c	8.00 c	8.38 b
T3 = 2 T/HA	9.68 b	10.10 b	15.25 a
T4 = 3 T/HA	10.83 a	11.90 a	15.88 a
CV (%)	5.93	6.26	6.78

The circumference of the corn plants was found to vary between the ages of 30 and 60 days, as shown in the table below:

**Table 10:** Effectiveness of Soils North NSA fertilizer for the promotion of corn plant circumference

Tost Mothod	Circumference of corn plants(cm)		
rest wethou	30days	60days	
T1 = No fertilizer	1.13 d	1.00d	
T2 = 1 T/HA	3.33 c	2.68 c	
T3 = 2 T/HA	5.03 b	4.60 b	
T4 = 3 T/HA	6.25 a	6.83 a	
CV (%)	9.09	8.43	

#### 5.6 Fruit length

Corn fruit length was found to vary statistically by age after 90 days, as shown in the table below:

Test Method	Corn fruit length (cm)	
	90 days	
T1 = No fertilizer	0.00c	
T2 = 1 T/HA	0.00 c	
T3 = 2 T/HA	22.50 b	
T4 = 3 T/HA	24.50 a	
CV (%)	8.82	

**Table 11:** Effectiveness of Soils North NSA fertilizer for corn fruit length

## 5.7 Fruit circumference

The diameter of the fruit corn was found to vary statistically by age after 90 days, as shown below:

Table 12: Effectiveness of Soils North NSA fertilizers for fruit corn diameter

Test Method	Diameter of fruit corn (cm)	
rest Method	90days	
T1 = No fertilizer	0.00c	
T2 = 1 T/HA	0.00 c	
T3 = 2 T/HA	12.50 b	
T4 = 3 T/HA	13.50 a	
CV (%)	4.44	

#### 5.8 Fruit Weight

Corn weight was found to vary statistically by age after 90 days.

**Table 13:** Effectiveness of Soils North NSA fertilizers for corn fruit weight

Test Method	Corn fruit weigth (gr)
	90days
T1 = No fertilizer	0.00c
T2 = 1 T/HA	0.00 c
T3 = 2 T/HA	88.73 b
T4 = 3 T/HA	114.92 a
CV (%)	16.78

# 6. Summary of experimental results

From the study of the effectiveness of Soils North NSA fertilizers affecting leaf growth, height, length, leaf length, root length, fruit length, and fruit weight, it is found that the 4th method of growing with NSA at the rate of 3 tons / ha can be the best growth of plants.

Vientiane Capital, Date: January 30, 2020

Reporter

Vilosa Thaliboot

# **APPENDIX PHOTOS**



Photos 1: Corn Plants after 30 days





#### PHOTO 2: BANANA PLANTS AFTER 30 DAYS



**T1** 

PHOTO 3: CORN PLANTS AFTER 60 DAYS



PHOTO 4: BANANA PLANT AFTER 60 DAYS



T1

Т4

PHOTO 5: CORN PLANTS AFTER 90 DAYS



T1

PHOTO 6: BANANA PLANTS AFTER 90 DAYS



PHOTO 7: GREEN HOUSE, PLANT PROTECTION CENTRE, DEPARMENT OF AGRICULTURE MINISTRY OF AGRICULTURE & FORESTRY