



ผลของปุ๋ยอินทรีย์ชนิดเหลวต่อการเจริญเติบโตและ  
องค์ประกอบผลผลิตของข้าวโพดเลี้ยงสัตว์

Effect of liquid organic fertilizer (LOF) on growth  
and yield components of maize

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# Introduction

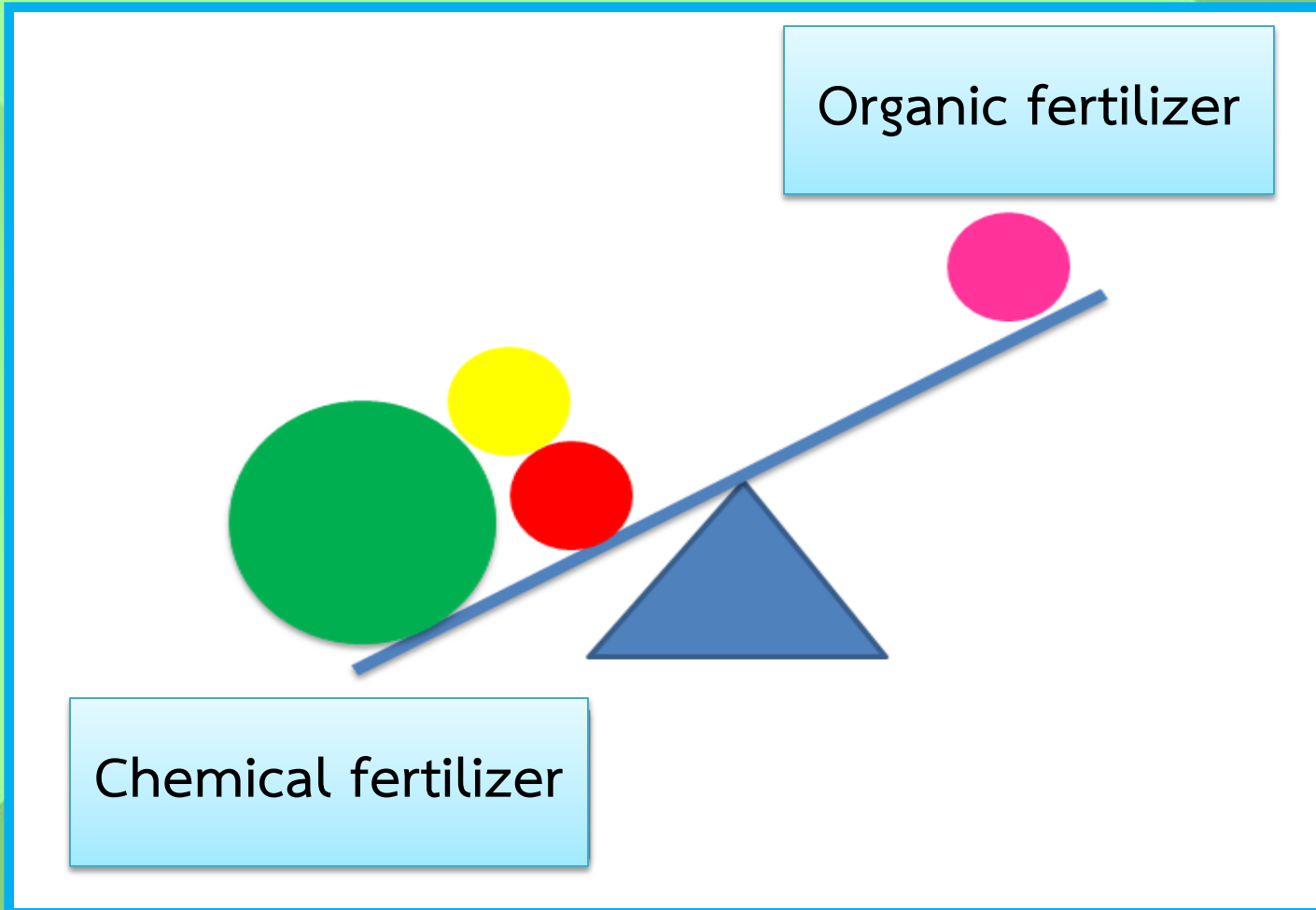


\* Office of Agricultural Economics (2015)

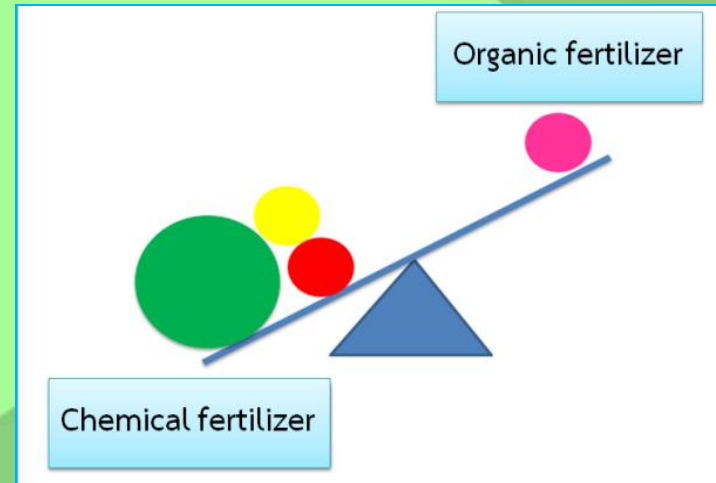
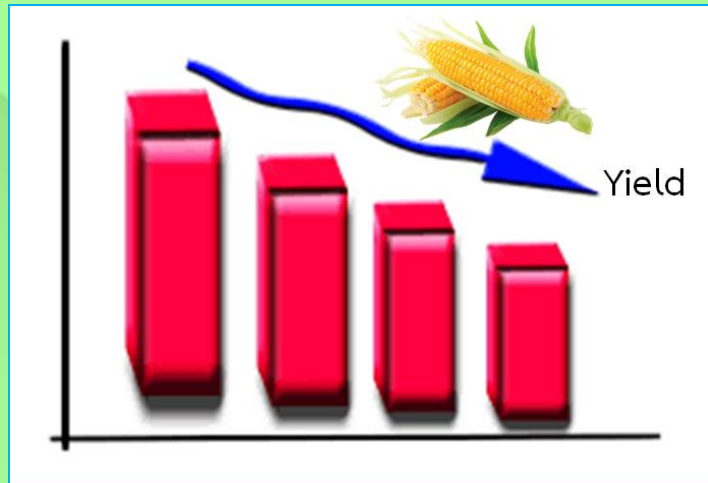
# Introduction



# Introduction



# Introduction



## Literature review

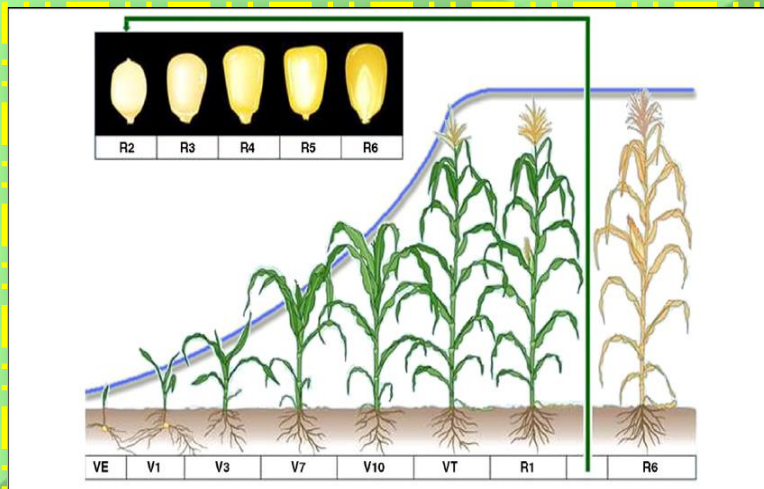
Chanon *et al.* (2003) reported that the use of liquid organic fertilizer in combination with filter cake and chicken manure can be increased the yield of corn when compared with the use of chemical fertilizer only.

## Literature review

Christos *et al.* (2008) reported that the liquid cattle manure can affect maize growth, development and N use efficiency.

# Objective

To study the effect of liquid organic fertilizer application on growth and yield components of maize.



# Materials



**Table 1** Some properties of soil before planting at 0-30 cm.

Soil properties	Values	Interpretation *
Soil pH (1:1)	7.22	neutral
Electrical conductivity of soil ( $EC_e$ ; dS/m)	0.81	non-saline
Soil organic matter (%)	1.29	rather low
Available P in soil (mg/kg)	42.36	high
Exchangeable K in soil (mg/kg)	110.78	high
Sand (%)	80.3	-
Silt (%)	10.4	-
Clay (%)	9.3	-
Soil texture	loamy sand	-

\* Land Development Department (1980)

**Table 2** Chemical properties and nutrient contents of liquid organic fertilizer (LOF).

Parameters	Values	Limitation *
pH	6.62	-
Electrical conductivity (EC <sub>e</sub> ; dS/m)	9.43	≤ 10
Sodium (%)	0.55	≤ 1
organic matter (%)	12.67	≥ 10
C:N ratio	4.48	≤ 20:1
Total N (%)	1.64	≥ 0.5
Total P <sub>2</sub> O <sub>5</sub> (%)	0.63	≥ 0.5
Total K <sub>2</sub> O (%)	1.12	≥ 0.5
Total primary nutrients (%)	3.39	≥ 1.5

\* Department of Agriculture (2009)

# Materials



# Methods

The experiment was a completely randomized design (CRD) with 3 replications and 8 treatments

Treatment 1: No fertilizer (control) Treatment 2: IF<sub>DOA</sub>

Treatment 3: LOF<sub>500</sub> Treatment 4: IF<sub>LOF-500</sub>

Treatment 5: LOF<sub>250</sub> + IF<sub>LOF-250</sub> Treatment 6: LOF<sub>1000</sub>

Treatment 7: IF<sub>LOF-1000</sub> Treatment 8: LOF<sub>500</sub> + IF<sub>LOF-500</sub>

Note: IF = Inorganic Fertilizer, LOF = Liquid Organic Fertilizer,  
DOA = Department of Agriculture (15, 5, and 5 kg N, P<sub>2</sub>O<sub>5</sub>  
and K<sub>2</sub>O / rai)

# Methods



Data analysis

Data collection

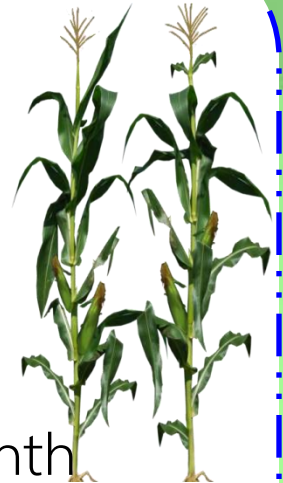
Fertilizer application



# Data collection

## Growth of maize

- Plant height (cm.) at 1,2 and 3 month
- Leaf collar height (cm.) at 1,2 and 3 month
- Leaf greenness (SPAD reading) at 1,2 and 3 month



# Data collection

## Yield components of maize

- a. Number of ear per plant
- b. Ear weight (g)
- c. Ear without husk weight (g)
- d. Grain weight per ear (g)
- e. 100 grain weight (g)
- f. Protein content in grain (%) = Total N x 6.25



# Data analysis

The data collected were subjected to statistical analysis of variance and treatment means were compared using Duncan's New Multiple Range Test (DMRT).



# Results



**Table 3** Plant height of maize at 1,2 and 3 month after planting.

Treatments	Plant height (cm.)		
	1 month	2 month	3 month
T <sub>1</sub> = control	86.23 <sup>c</sup>	144.17 <sup>e</sup>	150.30 <sup>e</sup>
T <sub>2</sub> = IF <sub>DOA</sub>	97.07 <sup>b</sup>	186.53 <sup>c</sup>	206.27 <sup>c</sup>
T <sub>3</sub> = LOF <sub>500</sub>	96.27 <sup>b</sup>	170.33 <sup>d</sup>	178.35 <sup>d</sup>
T <sub>4</sub> = IF <sub>LOF-500</sub>	96.87 <sup>b</sup>	172.27 <sup>d</sup>	185.41 <sup>d</sup>
T <sub>5</sub> = LOF <sub>250</sub> + IF <sub>LOF-250</sub>	96.97 <sup>b</sup>	173.20 <sup>d</sup>	189.49 <sup>d</sup>
T <sub>6</sub> = LOF <sub>1000</sub>	103.93 <sup>ab</sup>	193.23 <sup>bc</sup>	218.41 <sup>bc</sup>
T <sub>7</sub> = IF <sub>LOF-1000</sub>	106.93 <sup>a</sup>	199.90 <sup>b</sup>	225.43 <sup>b</sup>
T <sub>8</sub> = LOF <sub>500</sub> + IF <sub>LOF-500</sub>	109.27 <sup>a</sup>	213.80 <sup>a</sup>	245.35 <sup>a</sup>
F-test	**	**	**
CV (%)	14.62	13.33	14.89

Note: Means followed by the same letter(s) in a column are not significantly different at the 0.01 level according to DMRT. \*\* = significantly different at the 0.01 level

**Table 4** Leaf collar height of maize at 1,2 and 3 month after planting.

Treatments	Leaf collar height (cm.)		
	1 month	2 month	3 month
T <sub>1</sub> = control	22.93 <sup>e</sup>	100.73 <sup>f</sup>	112.49 <sup>f</sup>
T <sub>2</sub> = IF <sub>DOA</sub>	30.47 <sup>bc</sup>	139.73 <sup>cd</sup>	145.60 <sup>c</sup>
T <sub>3</sub> = LOF <sub>500</sub>	27.53 <sup>d</sup>	125.77 <sup>e</sup>	131.66 <sup>e</sup>
T <sub>4</sub> = IF <sub>LOF-500</sub>	28.93 <sup>cd</sup>	131.10 <sup>de</sup>	136.43 <sup>de</sup>
T <sub>5</sub> = LOF <sub>250</sub> + IF <sub>LOF-250</sub>	30.37 <sup>bc</sup>	132.57 <sup>de</sup>	144.33 <sup>cd</sup>
T <sub>6</sub> = LOF <sub>1000</sub>	30.63 <sup>bc</sup>	146.20 <sup>bc</sup>	158.57 <sup>b</sup>
T <sub>7</sub> = IF <sub>LOF-1000</sub>	32.10 <sup>ab</sup>	151.17 <sup>b</sup>	168.49 <sup>a</sup>
T <sub>8</sub> = LOF <sub>500</sub> + IF <sub>LOF-500</sub>	33.13 <sup>a</sup>	161.13 <sup>a</sup>	172.38 <sup>a</sup>
F-test	**	**	**
CV (%)	13.38	13.48	12.32

Note: Means followed by the same letter(s) in a column are not significantly different at the 0.01 level according to DMRT. \*\* = significantly different at the 0.01 level

**Table 5** SPAD reading of maize at 1,2 and 3 month after planting.

Treatments	SPAD reading		
	1 month	2 month	3 month
T <sub>1</sub> = control	36.67 <sup>e</sup>	32.37 <sup>f</sup>	30.50 <sup>d</sup>
T <sub>2</sub> = IF <sub>DOA</sub>	45.43 <sup>bc</sup>	54.13 <sup>cd</sup>	47.38 <sup>bc</sup>
T <sub>3</sub> = LOF <sub>500</sub>	42.00 <sup>d</sup>	51.50 <sup>e</sup>	44.52 <sup>c</sup>
T <sub>4</sub> = IF <sub>LOF-500</sub>	43.27 <sup>cd</sup>	51.83 <sup>e</sup>	45.33 <sup>c</sup>
T <sub>5</sub> = LOF <sub>250</sub> + IF <sub>LOF-250</sub>	44.17 <sup>cd</sup>	52.60 <sup>de</sup>	46.33 <sup>c</sup>
T <sub>6</sub> = LOF <sub>1000</sub>	46.93 <sup>ab</sup>	54.63 <sup>bc</sup>	48.50 <sup>abc</sup>
T <sub>7</sub> = IF <sub>LOF-1000</sub>	47.60 <sup>ab</sup>	56.23 <sup>ab</sup>	51.21 <sup>ab</sup>
T <sub>8</sub> = LOF <sub>500</sub> + IF <sub>LOF-500</sub>	48.10 <sup>a</sup>	57.43 <sup>a</sup>	52.34 <sup>a</sup>
F-test	**	**	**
CV (%)	12.88	12.91	13.25

Note: Means followed by the same letter(s) in a column are not significantly different at the 0.01 level according to DMRT. \*\* = significantly different at the 0.01 level

**Table 6** Number of ear per plant, ear weight and ear without husk weight of maize at harvesting time.

Treatments	Number of ear per plant	Ear weight (g)	Ear without husk weight (g)
T <sub>1</sub> = control	0.70 <sup>e</sup>	168.38 <sup>d</sup>	132.36 <sup>d</sup>
T <sub>2</sub> = IF <sub>DOA</sub>	1.33 <sup>c</sup>	230.54 <sup>b</sup>	184.45 <sup>ab</sup>
T <sub>3</sub> = LOF <sub>500</sub>	1.00 <sup>d</sup>	212.41 <sup>c</sup>	167.53 <sup>c</sup>
T <sub>4</sub> = IF <sub>LOF-500</sub>	1.33 <sup>c</sup>	225.31 <sup>b</sup>	172.24 <sup>c</sup>
T <sub>5</sub> = LOF <sub>250</sub> + IF <sub>LOF-250</sub>	1.33 <sup>c</sup>	228.46 <sup>b</sup>	176.37 <sup>bc</sup>
T <sub>6</sub> = LOF <sub>1000</sub>	1.50 <sup>b</sup>	236.49 <sup>ab</sup>	186.29 <sup>ab</sup>
T <sub>7</sub> = IF <sub>LOF-1000</sub>	1.67 <sup>a</sup>	243.50 <sup>a</sup>	190.38 <sup>a</sup>
T <sub>8</sub> = LOF <sub>500</sub> + IF <sub>LOF-500</sub>	1.67 <sup>a</sup>	248.23 <sup>a</sup>	195.36 <sup>a</sup>
F-test	**	**	**
CV (%)	14.21	13.05	13.44

Note: Means followed by the same letter(s) in a column are not significantly different at the 0.01 level according to DMRT. \*\* = significantly different at the 0.01 level

**Table 7** Grain weight per ear, 100 grain weight and protein content in grain of maize at harvesting time.

Treatments	Grain weight per ear (g)	100 grain weight (g)	Protein content in grain (%)
T <sub>1</sub> = control	102.32 <sup>f</sup>	28.64 <sup>f</sup>	5.56 <sup>d</sup>
T <sub>2</sub> = IF <sub>DOA</sub>	141.39 <sup>bc</sup>	30.69 <sup>bc</sup>	10.50 <sup>bc</sup>
T <sub>3</sub> = LOF <sub>500</sub>	128.56 <sup>e</sup>	30.37 <sup>e</sup>	9.75 <sup>c</sup>
T <sub>4</sub> = IF <sub>LOF-500</sub>	135.34 <sup>d</sup>	30.43 <sup>de</sup>	10.13 <sup>bc</sup>
T <sub>5</sub> = LOF <sub>250</sub> + IF <sub>LOF-250</sub>	136.53 <sup>cd</sup>	30.59 <sup>cd</sup>	10.31 <sup>bc</sup>
T <sub>6</sub> = LOF <sub>1000</sub>	145.25 <sup>ab</sup>	30.72 <sup>bc</sup>	10.94 <sup>abc</sup>
T <sub>7</sub> = IF <sub>LOF-1000</sub>	146.38 <sup>ab</sup>	30.82 <sup>b</sup>	11.31 <sup>ab</sup>
T <sub>8</sub> = LOF <sub>500</sub> + IF <sub>LOF-500</sub>	148.30 <sup>a</sup>	31.23 <sup>a</sup>	11.75 <sup>a</sup>
F-test	**	**	**
CV (%)	12.46	11.46	10.35

Note: Means followed by the same letter(s) in a column are not significantly different at the 0.01 level according to DMRT. \*\* = significantly different at the 0.01 level

## Discussion

In liquid organic fertilizers have a high CEC that can enhance nutrients uptake from chemical fertilizer. According to Susilawati *et al.* (2011), high CEC is a major reason for the increase nutrients uptake of corn.

## Discussion

In addition, liquid organic fertilizer containing humic acid that has promote growth of maize. According to Tan and Nopamornbodi (1979), moderate amount of humic acid can promote root and shoot growth and development of maize.

## Conclusion

The study revealed that the application of liquid organic fertilizer of 500 L/rai in combination with chemical fertilizers containing all major elements equivalent to 500 L/rai of the liquid organic fertilizer ( $LOF_{500} + IF_{LOF-500}$ ) affected the highest growth and yield components of maize in all parameters, while the control treatment produced the lowest growth and yield components of maize in all parameters.

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thank you for your attention

