Influence of rice husk ash on the production of vermicompost from swine manure, cassava peel and Korat soil series.

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Outline

- Introduction
- Objective
- Material and Method
- Result and Discussion
- Conclusion

Introduction

Vermitecnology

Technique of converting decomposable organic waste into is process

- **Vermicomposting**
- **Vermistabilization**
- **Vermiremediation**
- **Vermibioindicator**

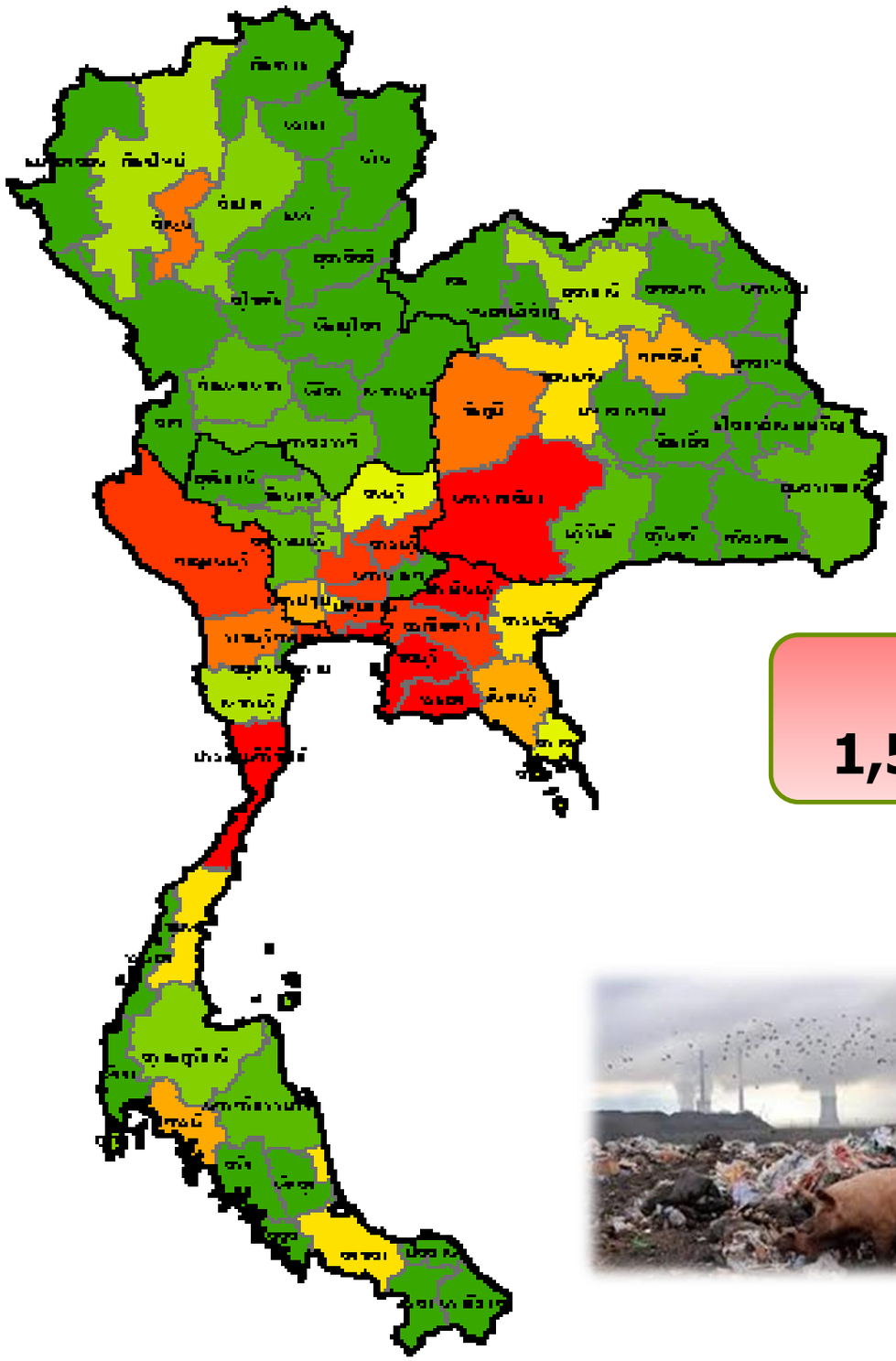
Introduction

Vermitcomposting

Vermicomposting is an ecological technique that utilizing the joint action of earthworms and microorganism under aerobic condition.

Most of the organic components can be degraded and the residuals are transformed into stabilized vermicompost.

Introduction



Nowadays, The amount of total waste in Thailand was estimated to reach 10 million tons in 2016.

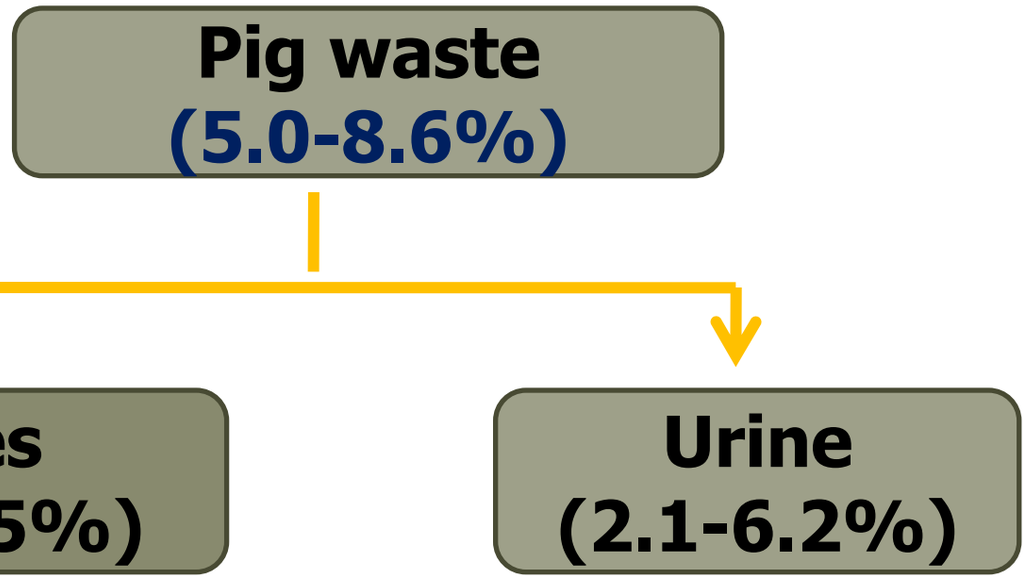
Hazardous waste
1,558,743.23 ton/year

Non-Hazardous waste
8,684,653.21 ton/year

Introduction

Livestock : Swine farm

- **In 2015: 9,886,897 pigs**
- **pig weight around 87 kg had feces 1.73 kg/day**



Introduction

Table 1 Nutrient content in dry manure of various animals.

Animal	Nutrient content									
	N	P	K	Ca	Mg	S	Na	Fe	Cu	Zn
Pigs	2.6	3.2	1.1	3.9	1.2	0.2	0.3	0.4	611	976
Laying hens	2.6	2.0	2.3	8.1	0.7	0.5	0.3	0.3	76	396
Calves	1.4	0.5	1.7	1.8	0.5	0.3	0.7	0.5	41	134
Lactating cows	1.3	0.5	1.4	1.0	0.4	0.3	0.2	0.3	30	121
Sheep	1.0	0.5	1.1	1.2	0.3	0.2	0.2	0.1	21	103

Source: Pollution control department(2015)

Introduction

Table 2 Concentration of copper in commercial feedstuffs in Australia

Animal	Cu (mg/kg)[a]		
	Single feeds	Supplementary feeds	Mineral component
Piglets	119	535	2,970
Pigs	37	110	868
Sows		166	759
Calves		87	243
Lactating cows		50	560
Sheep	10.3	60	

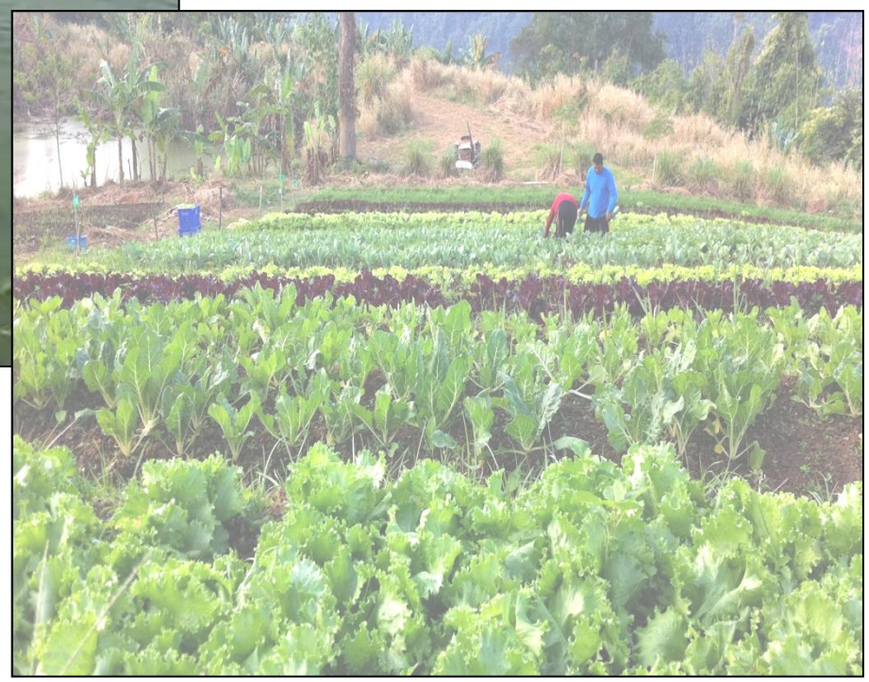
Source: Sager(2007)

Introduction

Utilization of waste

Biogas

Feed



Land application

Introduction

Toxicity of Copper : Soil, plant

High Cu in soil may build up after long term of pig manure application

Excessive levels of Cu can induce deficiencies of Fe and other nutrients and are toxic to plants.

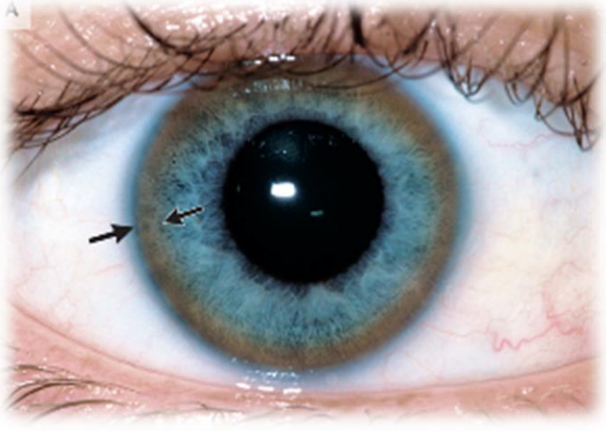
Introduction

Toxicity of Copper : Human

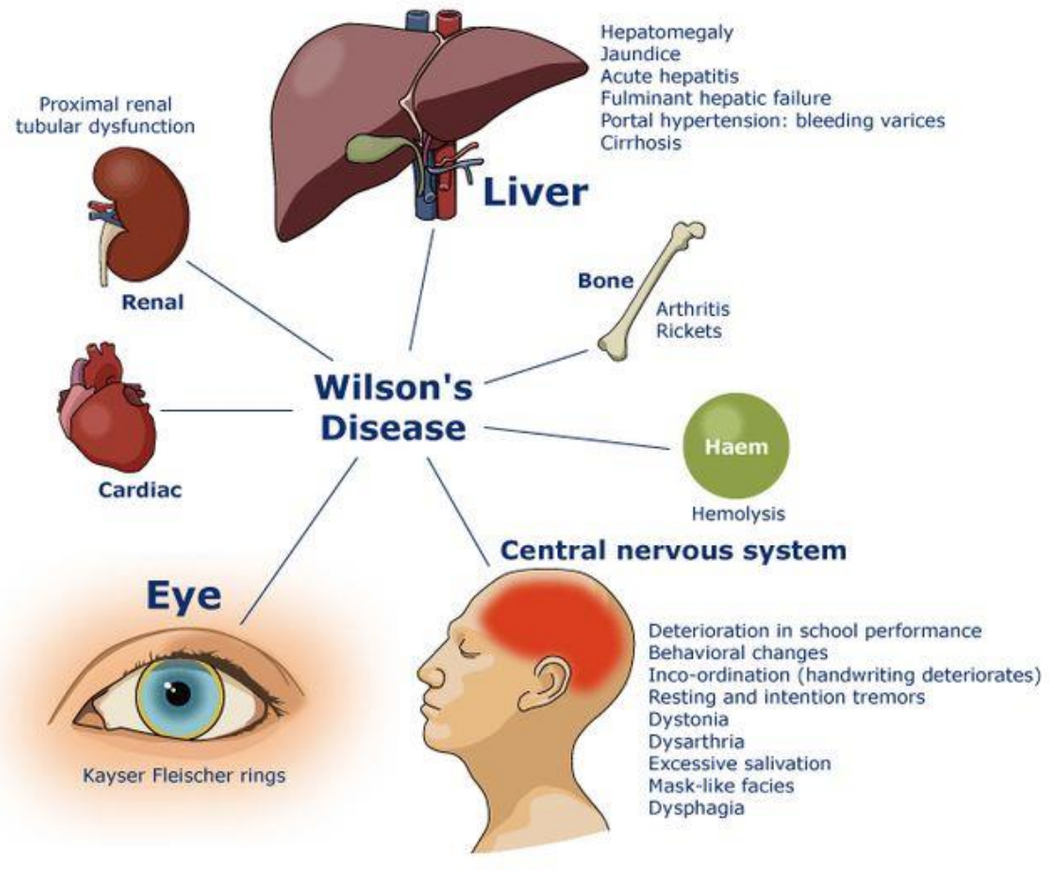
Copper has a number of important roles in the human body.
Some of these are:

- **Energy production.**
- **The nervous system.**
- **Bones and connective tissue.**

Toxic accumulation: Wilson’s disease



Kayser-Fleischer ring



Introduction

Cassava Industry

- **Area : 9,319.718 rai**
- **Product : 30,557,857 tons**
- **Waste : 3.05 Mtons**

Introduction

Waste of cassava Industry

Cassava pulp: **6% of total waste**

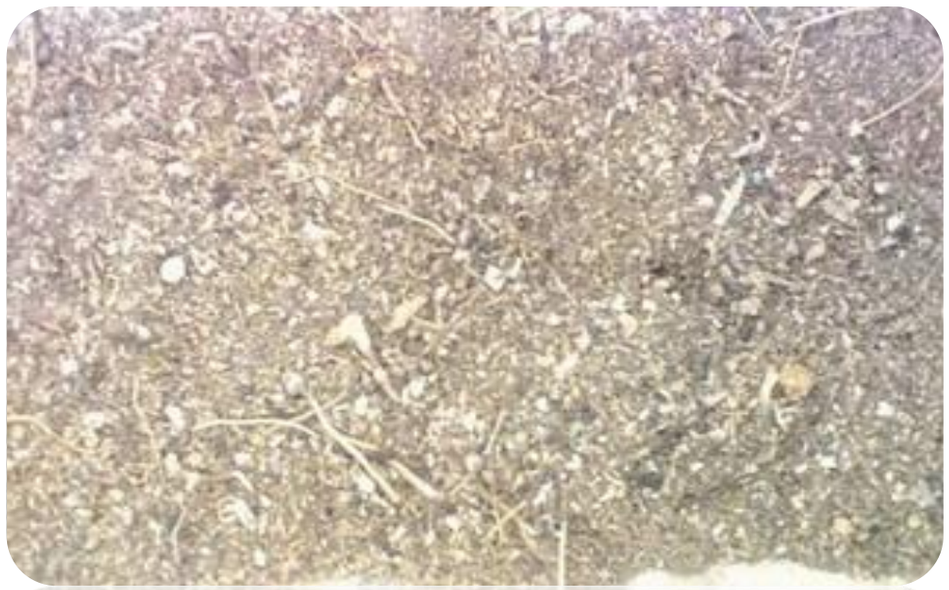
Include : starch 66-90%
protein 1-3%
fiber 0.2-0.8%
ash 1-10%

Used : animal feed

Cassava peel: **3% of total waste**

Include : soil, root and Cassava chips

Quality : low



Introduction

Organic waste

Swine manure: High Copper

Cassava peel: Cyanogenic glucoside

- **Fresh peel 364.2 - 814.7 mg/kg**
- **Sundried peel 264.3 - 321.5 mg/kg**

Introduction

Problems : occurred during vermicompost process

Zhu et al.(2014) : reported that the 14-days LC_{50} for Cu in *E.fetida* was 683 mg/kg

Ratchanee (2015): reported the 28-days for Cu 1,000 mg/kg *E.eugeniae* was mortarity 93.33%

Rachid et al. (2011): Cyanide complex 131mgCN^-/kg had effect on survival of the *E.fetida*

Introduction

Problems : **occurred during vermicompost process**

Ratchanee (2015): reported the cassava peel, soil and chicken manure rate 7:2:1mixed with Cu 500, 1,000 and 2,000 mg/kg were effect to decrease weight and not found cocoon of earthworm .

Nattakit (2015): reported the cassava peel, soil and chicken manure rate 7: 3 had effect to decraese weight and cocoon of earthworm

Introduction

Find methodology to management and reduce toxicity ?

Krystyna et al. (2016): reported the addition of biochar to composting facilitated the growth and reproduction of *E.fetida*

- **mixture with biochar 4% increase by 13% of cocoon**
- **mixture with biochar 8% increase by 66% of cocoon**

Introduction

Rice mill industry

Paddy field : in-season 58,434,500 rai
off-season 6,060,746 rai

Paddy : in-season 25,406,786 ton
off-season 3,776,690 ton

Husks : 22.5-25.2% (220 kg/ton paddy)
Ash : 17.4% (38.28 kg/ton paddy)

Introduction

Rice husk ash

Objective

Study about influence of rice husk ash on the production of vermicompost from swine manure, cassava peel and Korat soil series.

Material and Method

Experiment: compared with

T1 : Vermicompost without rice husk ash (swine manure : cassava peel : soil : RHA ; 2:6:1:0)

T2 : Vermicompost with rice husk ash (swine manure : cassava peel : soil : RHA ; 2:6:1:1)

Swine manure

Cassava peel

Rice husk ash

Korat soil series

Material and Method

Table 1 Chemical properties of raw materials used for experiment

Parameter	Swine manure	Cassava peel	Rice husk ash
1.pH (1:10)	7.4	6.7	8.5
2.EC (1:10;dSm^{-1})	2.2	0.5	0.2
3.TN (%)	2.3	0.3	0.2
4.TP (%)	9.4	0.04	1.4
5.TK (%)	1.3	0.36	0.56
6.Organic carbon(%)	30.6	17.8	3.5
7. Organic matter (%)	52.7	29.8	5.9
8.C/N	13/1	59/1	23/1
9.Cu (mg/kg)	731.73	4.99	24.45

Material and Method

Earthworm species: *Eudrilus eugeniae*

Some aspects	
Color	**Reddish brown**
Size of adults	**5-7 mm x 80 -190 mm**
Mean weight of adults	**2.7 – 3.5 g**
Time to maturity (days)	**40 -49**
Number of cocoon day^{-1}	**0.42 -0.51**
Incubation time (days)	**12 -16**
Number of worm cocoon^{-1}	**2.0 – 2.7**
Life cycle(days)	**50 -57**
Limits and optimal temperature	**16 – 30 °C**
Limits and optimal moisture	**70 -85%**

Material and Method

Prepare of vermicompost

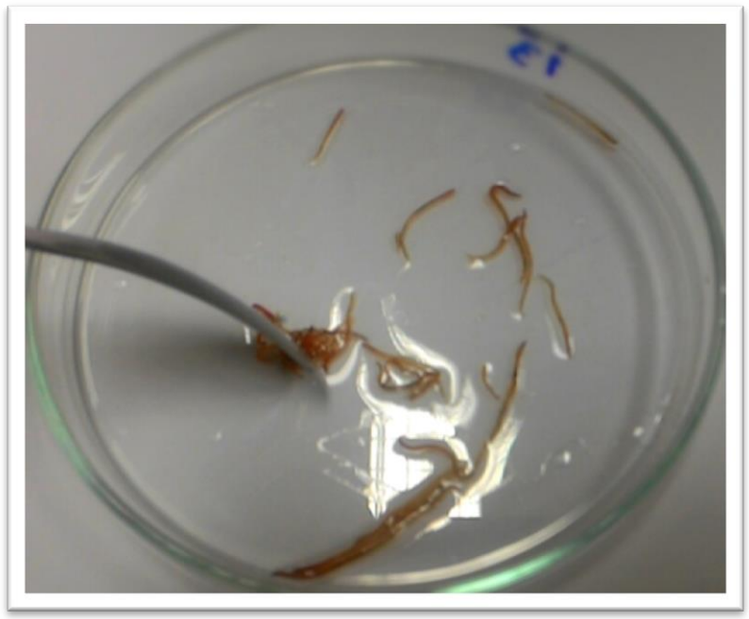
- Used mixture of feeding 200 g/pot
- Precompost 15 days, before put earthworm
- Used earthworm weight, 13 g/pot

pH, EC, Moisture, Temperature

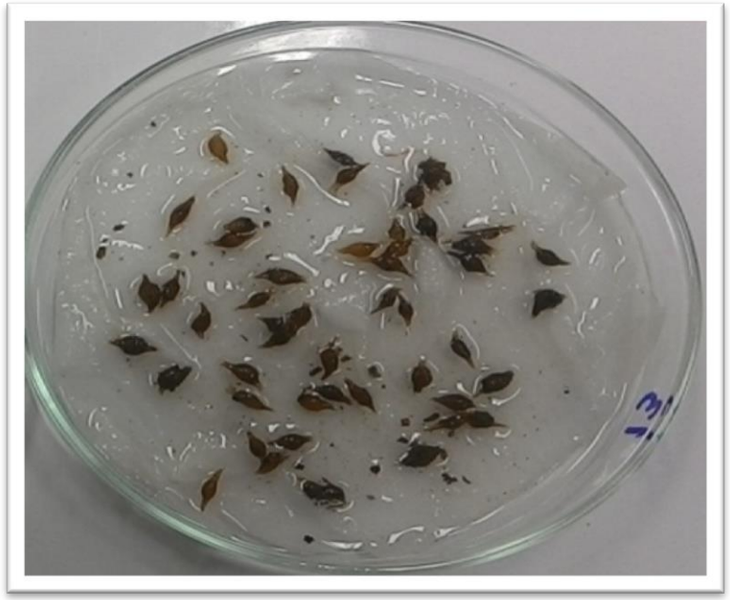
Material and Method

Collected : weight, cocoon and juvenile at 15, 30 and 45 days

Weighing of earthworm



Counting number of juvenile



Counting number of cocoon

Material and Method

Quality of Vermicompost

- pH
- EC
- Total Nitrogen
- Total phosphorus
- Total potassium
- Copper

Results and discussion

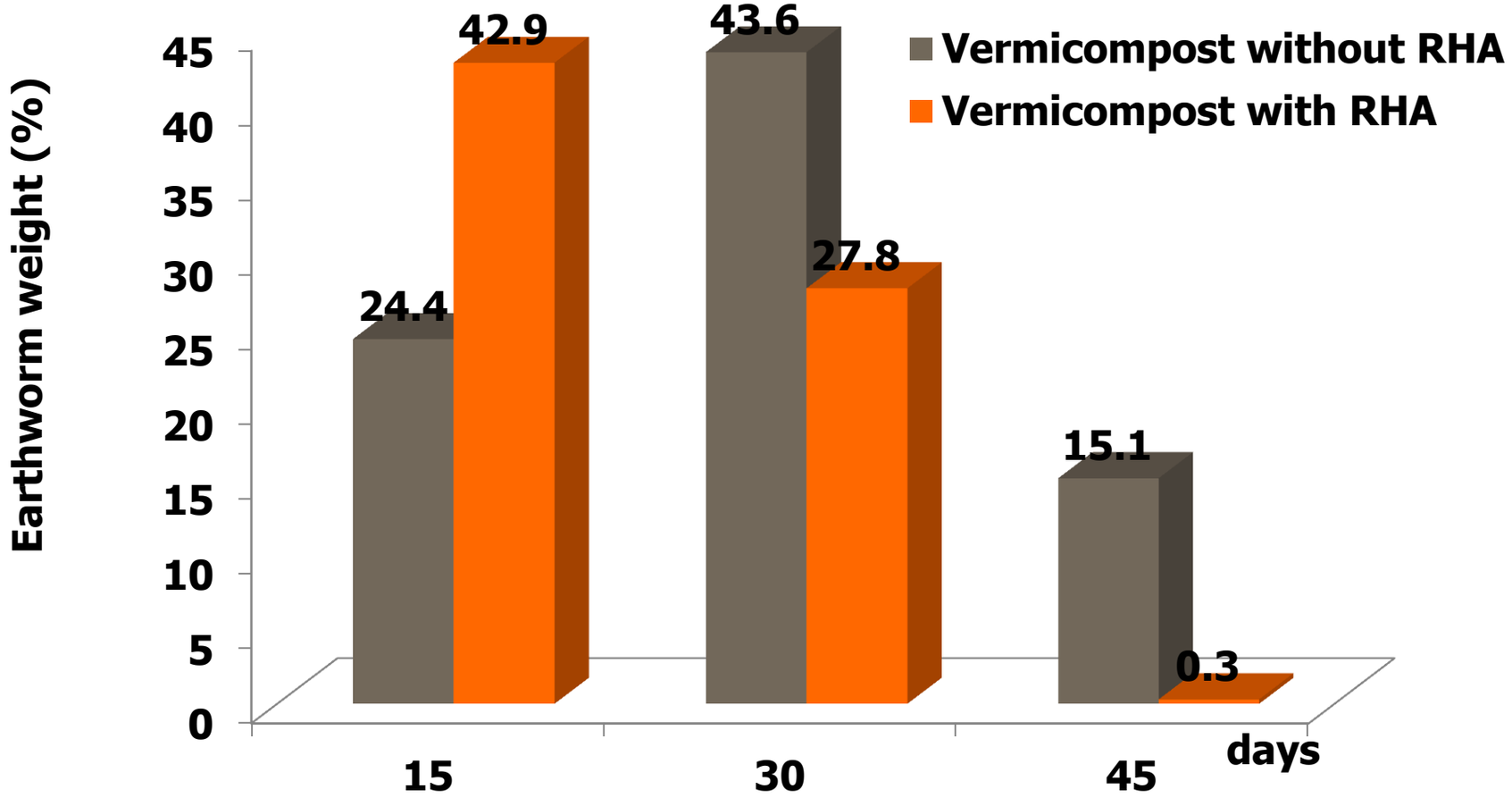


Fig. 1 The changes of earthworm weight during vermicompost

Results and discussion

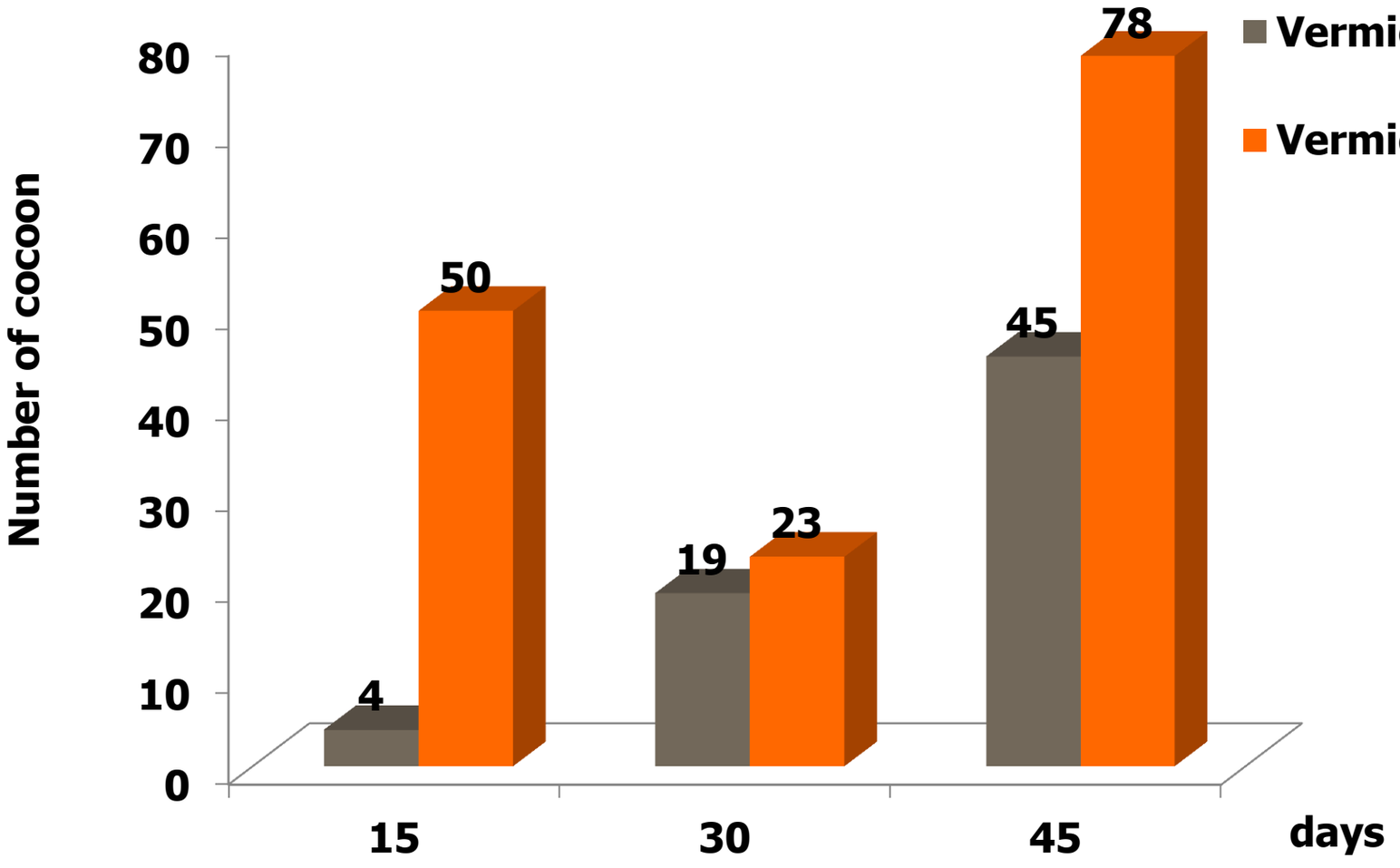


Fig. 2 Number of cocoon during vermicompost

Results and discussion

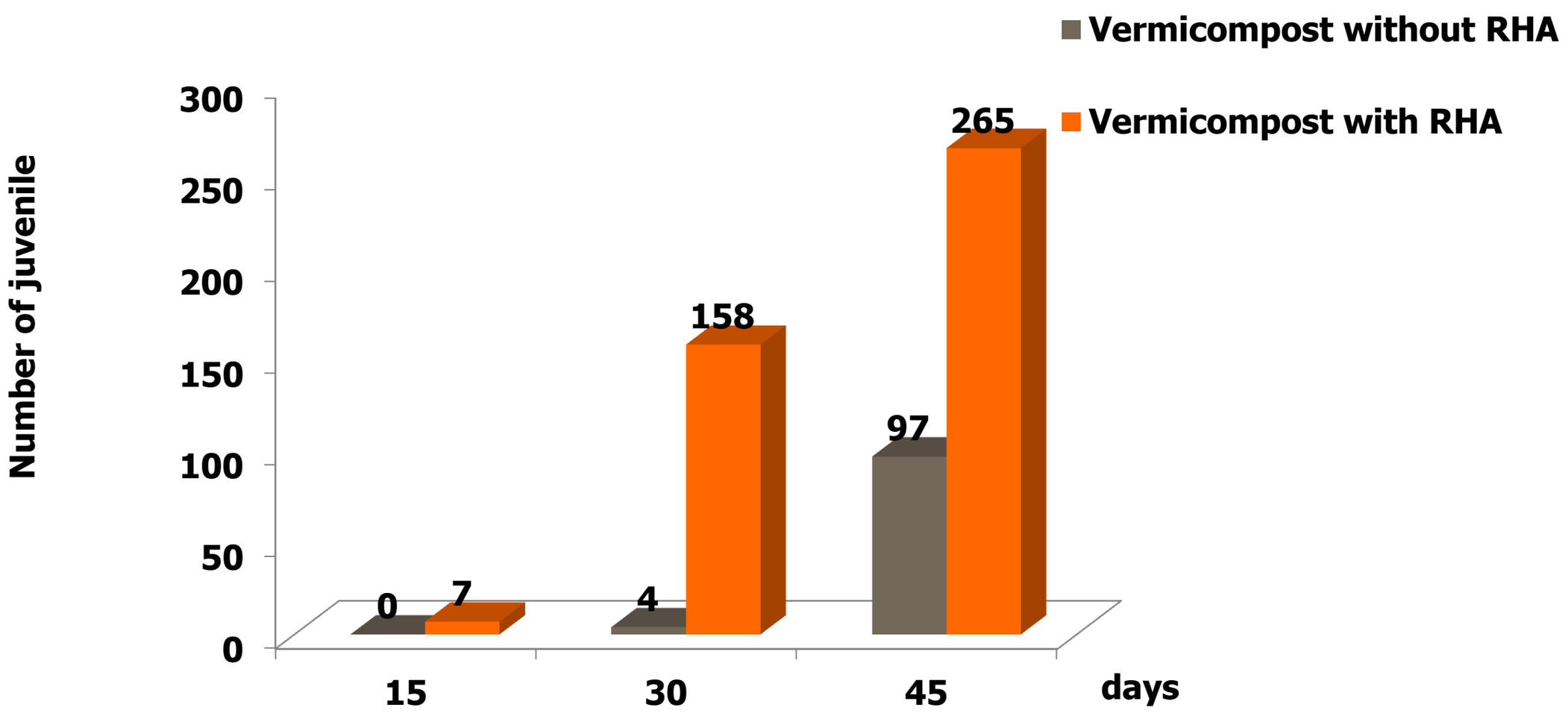


Fig. 3 Number of juveniles during vermicompost

Results and discussion

Table 2 The changes of chemical properties (pH,EC) in vermicompost

Treatment	pH (1:10)			EC (1:10; dS/m)		
	0 day	45 days	%Changed	0 day	45 days	%Changed
Vermicompost without RHA	7.56	7.87	+4.10	1.06	1.07	+0.94
Vermicompost with RHA	7.61	7.85	+3.15	1.13	1.23	+8.85

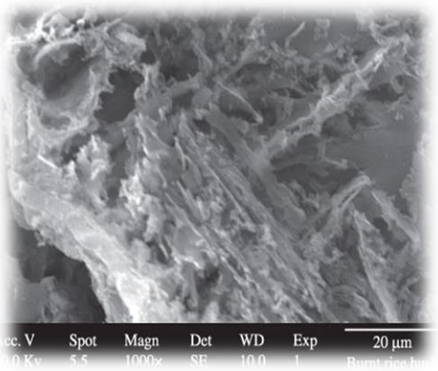
Results and discussion

Table 4 The percent changes of nutrient (TN, TP, TK) in vermicompost

Treatment	TN (%)			TP (%)			TK (%)		
	0 day	45 days	% Changed	0 day	45 days	% Changed	0 day	45 days	% Changed
Vermicompost without RHA	0.59	0.57	-3.39	0.92	1.26	+35.87	0.64	1.10	+71.88
Vermicompost with RHA	0.60	0.54	-10.00	0.89	1.35	+51.69	0.56	1.04	+85.71

Conclusions

Vermicomposting



- porosity
- Water holding capacity
- Nutrient retention
- Reduce the toxicity of heavy metal to earthworm

Rice husk ash

Earthworm

- Growth weight
- Reproduction

Vermicompost

- swine manure
- cassava peel
- korat soil series

Toxic

- Cu
- Cyanide
- Gas
- etc.

Nutrient

- TN (NH_3, NH_4^+, No_x^-)
- TP ($H_2PO_4^-$, HPO_4^{2-})
- TK (K^+)

Conclusions

Swine manure, cassava peel and Korat soil series mixed with rice husk ash enhanced the growth and reproduction of earthworm, compared the treatment without rice husk ash by increasing weight, cocoon and juvenile of earthworm.

Vermicompost showed that phosphorus and potassium are higher in the mixture with rice husk ash.

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Thank you!