PRELIMINARY STUDY ON URINE-COMPOST EXTRACT AS BIO-LIQUID FERTILISER FOR HYDROPONICS

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Outlines

- Concept Background
- Objectives
- Methodology
- Results
- Conclusion

Human Urine Concept

Human urine is:

- a sterile by-product of human excreta (which is mostly combined with water and feces in the flush toilet system, and treated in the sewerage system).
- the urine separation with dry toilet system can be recycled the plant nutrient in urine recycled to agriculture and farmland which is the food for animal and human, thus, it will be the close loop of plant nutrient

(Sene *et al*., 2012; Johansson and Nykvist, 2001)

Stored human urine had:

- pH values of 8.9
- composed of eight main ionic species (> 0.1 meq L^{-1}),
  + the cations Na^+, K^+, NH_4^+, Ca^{2+}
  + the anions, Cl^-, SO_4^{2-}, PO_4^{3-} and HCO_3^-
- heavy metal concentrations in urine samples were low compared with other organic fertilizers, but copper, mercury, nickel and zinc were 10–500 times higher in urine than in precipitation and surface waters.

Kirchmann and Pettersson (1994)

Composting Concept

- Composting is a biological process which degrades the organic matter with microorganism.
- The key factors of this process are moisture content, carbon and nitrogen source as nutrient.
- Composting can kill pathogens by self-heating
- Composting can reduce the toxic of chemical substances (by changing to less toxic form)

Urine Composting Concept

Urine can be:

- the nitrogen source for composting
- the water source for adjusting moisture content for composting, therefore it can also conserve the water for using in composting.
- the other composition in urine as minor- and micro-nutrient

Compost Concept

The product of Composting is "Compost"

- plenty of key plant nutrient (nitrogen, phosphorous and potassium in utilized form for plant

- the electrical conductivity (dissolved salt as minor- and micro- nutrients) which can be adjusted for plants.

- the compost texture can adjust the physical properties of soil.

The compost is in solid form, it can be used for growing plants with soil as media and supporter.

Hydroponic Concept

Hydroponic is:

- a technique for growing the plant without soil.

- the inert matrix material is used to support the stem of plant and aerate their root system

- the plant adsorbs the solution as liquid fertilizer for nutrients

(Berry and Knight (1997) and Marr (1994)

The parameters for hydroponics are the adequate aeration and the environment in the root zone, a known rate and concentration of nutrients

(Berry and Knight, 1997)

The Advantage of Hydroponics used in some situations, for example:

- No land or soil
- Flooding place
- High rise building
- Refugee Camp

- If compost will be used for growing plants without soil,
- It needs to be changed the form into liquid.

Objectives

Comparing the Vegetable Characteristics which grown in Commercial liquid fertiliser (chemical fertiliser) to Compost extract (liquid organic fertiliser)

Methodology

Mixed between corncob and urine as composting material

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Compost was extracted

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Compost extract as bio-liquid fertiliser

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Suitable pH and electrical conductivity were adjusted for Hydroponics

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Red oak and Butterhead was chosen for vegetable Characteristics studied

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Vegetable Characteristics were studied

Results

The key parameters of urine-corncob composting

Parameters	Urine-corncob composting
Temperature , max (◦C)	52.60
Moisture contents (%)	74.14-63.69
Volatile solid contents (%)	68.78-42.85
Carbon contents (%)	48.47-34.38
Carbon to nitrogen ratio	40:1-10:1
pH	4.08-7.79
Electrical conductivity (μS/cm)	925.66-1566.66

The plant nutrients in compost and compost extract

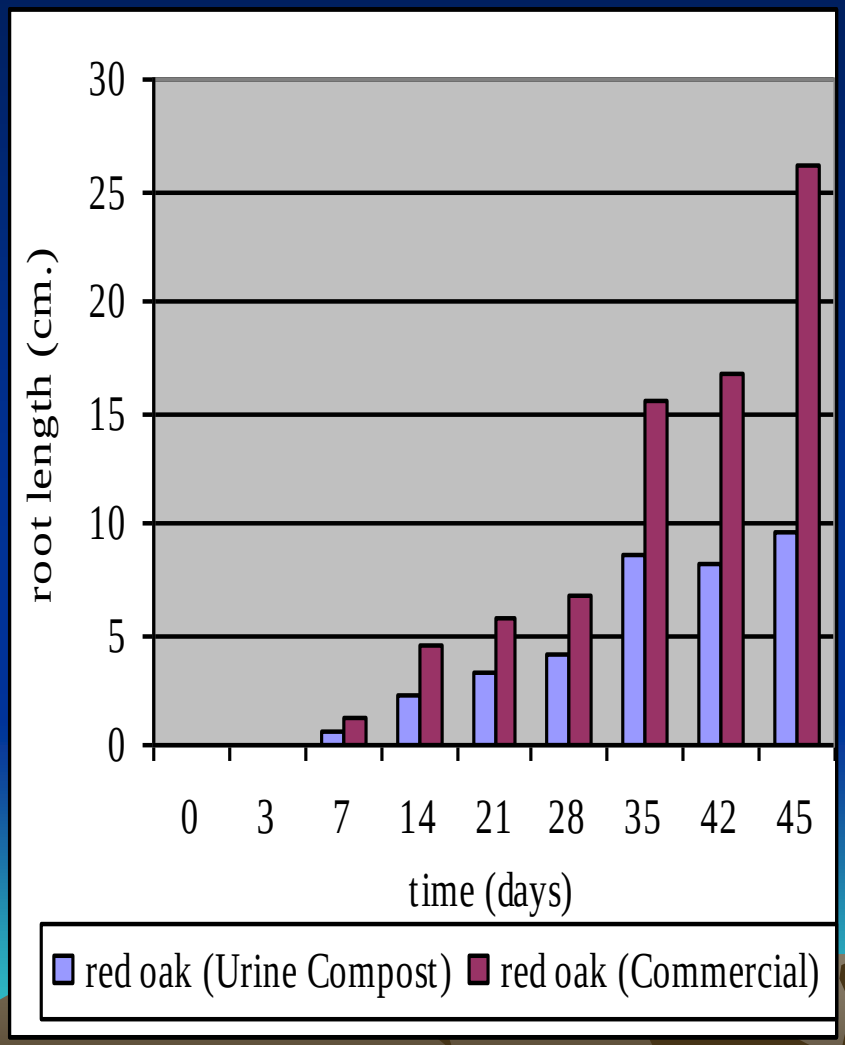
Plant nutrients	Compost	Compost extract
Nitrogen contents (%)	3.74	2.76
Phosphorous contents (%)	0.058	0.045
Potassium contents (%)	1.105	0.034

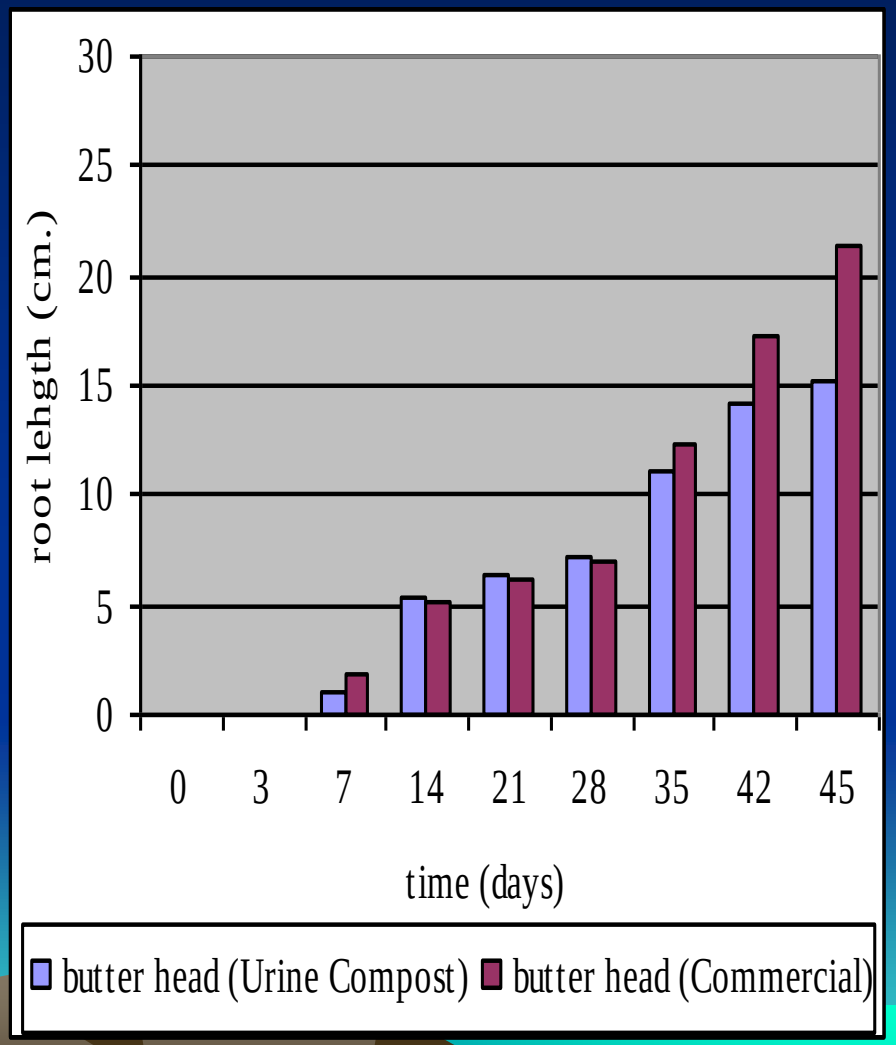
The plant nutrients in diluted compost extract and commercial liquid fertiliser

Plant nutrients	diluted compost extract	commercial liquid fertiliser
Nitrogen contents (%)	0.028	0.034
Phosphorous contents (%)	0.021	0.004
Potassium contents (%)	0.012	0.011

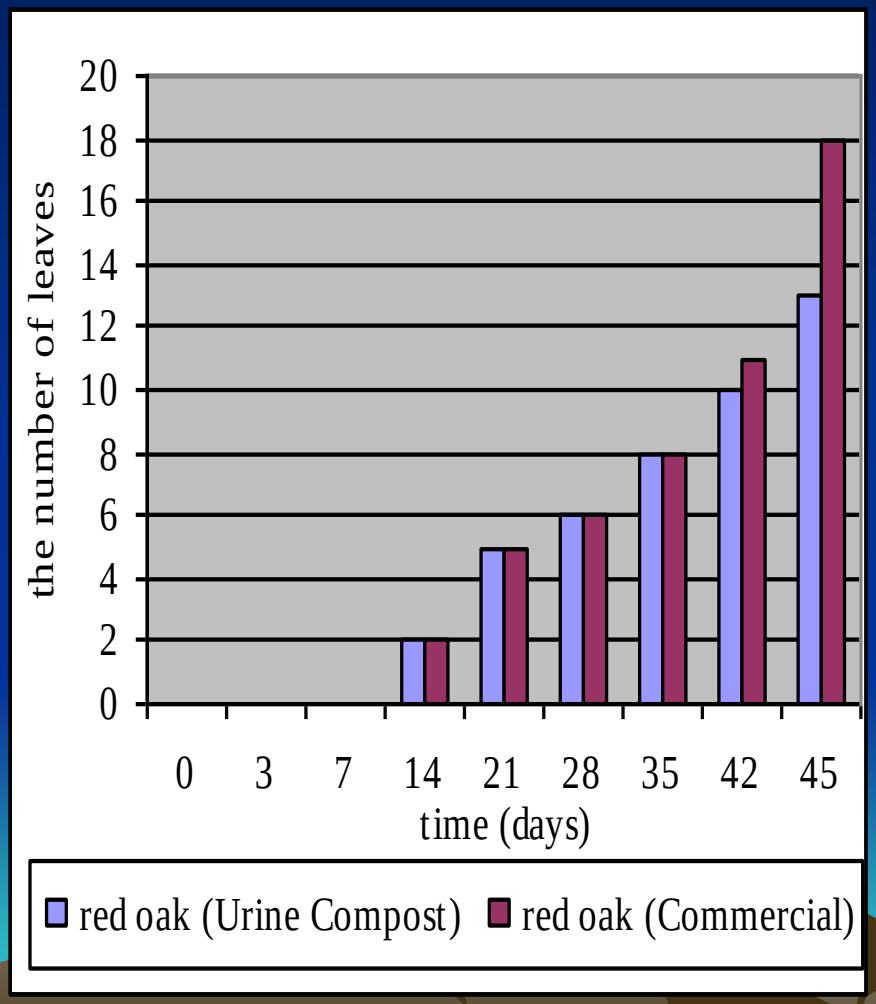
The characteristic plant results

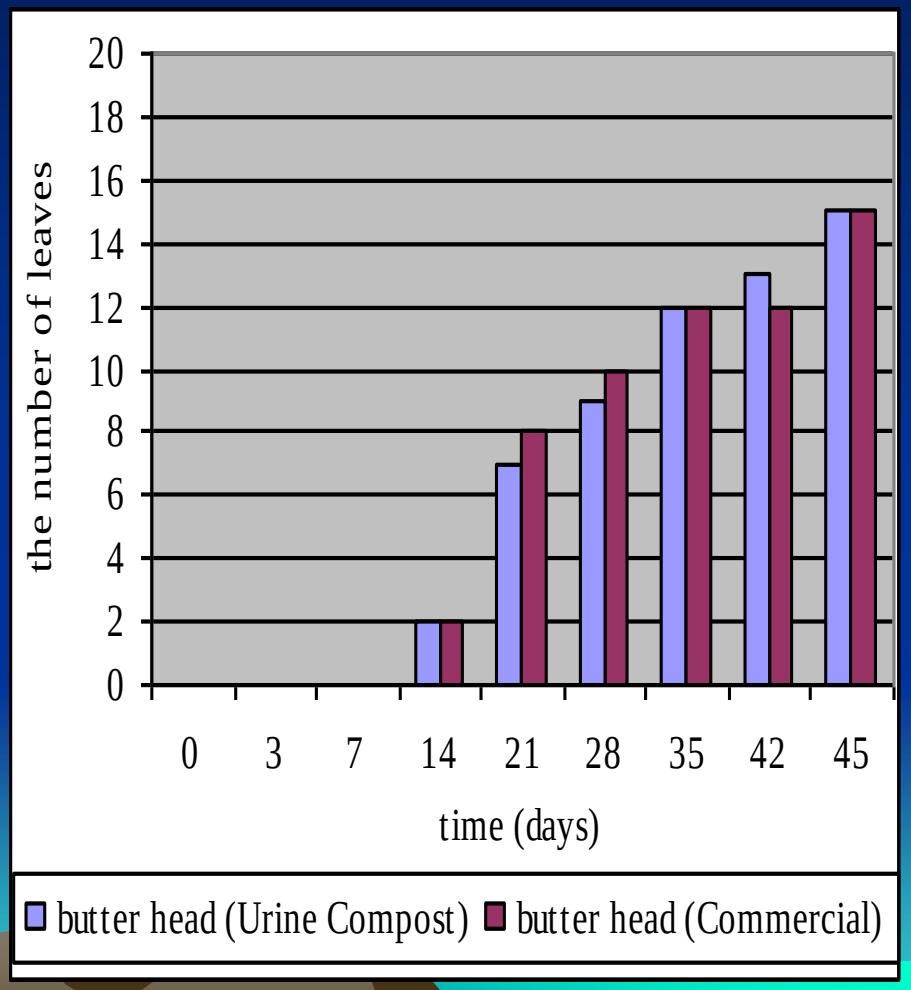
The length of roots





The number of leaves





The dry and wet weight of Red oak and Butter head

Parameters	Red oak	Red oak	Butter head	Butter head
	Commercial liquid fertiliser	Compost extract	Commercial liquid fertiliser	Compost extract
Wet weight	37.12	25.02	45.64	36.22
Dry weight	1.89	1.29	2.02	1.79

The heavy metal in diluted compost extract and commercial liquid fertiliser

Parameters	Compost extract	Commercial liquid fertiliser
Lead contents (mgl-1)	NF	NF
Chromium contents (mgl-1)	NF	4.67
Cadmium contents (mgl-1)	0.027	NF

Conclusion

It can be concluded that

- the bio-liquid fertiliser had similar the key nutrient plants to the chemical liquid fertiliser
- the heavy metals in the bio-liquid fertiliser was less
- While the most vegetable characteristic from bio-liquid fertilizer were less than ones from chemical liquid fertiliser, except the number of leaves of Butter head was equal.
- Thus, the bio-liquid fertiliser can use as the liquid fertiliser for hydroponics
- but the compost extract quality will be improved.

Hydroponic can be one alternative of the Urine and compost application

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Thank you very much