การศึกษาปริมาณธาตุอาหารพืชในปุ๋ยอินทรีย์น้ำที่ได้จากการหมักโดยใช้หัวปลา ผลไม้ เศษอาหาร วัชพืช และสัตว์ทะเล

A Study on Amounts Plant Nutrients in Soluble Organic Fertilizer from Fermentation of Fish heads, Fruits, Food Leftovers, Weeds and Marine Animals

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บทคัดย่อ

การศึกษาปริมาณธาตุอาหารพืชในปุ๋ยอินทรีย์น้ำที่ได้จากการหมักหัวปลา ผลไม้ เศษอาหาร วัชพืชและสัตว์ทะเล ดำเนินการระหว่างเดือนมีนาคม 2550 ถึง สิงหาคม 2550 ณ สำนักส่งเสริมและการศึกษาต่อเนื่อง มหาวิทยาลัยสงขลานครินทร์ โดยมีวัตถุประสงค์เพื่อศึกษาว่าวัตถุดิบชนิดใด เมื่อนำมาทำปุ๋ยอินทรีย์น้ำแล้วให้ปริมาณธาตุอาหารมากที่สุด จากการศึกษาพบว่าปุ๋ยอินทรีย์น้ำจากสัตว์ทะเลให้ไนโตรเจน โพแตสเซียม แคลเซียม แมกนีเซียม กำมะถัน เหล็ก สังกะสี และทองแดงสูงสุด (1.46 %, 1.15 %, 0.91 %, 0.83 %, 0.18 %, 215 ppm, 5.34 ppm และ 4.77 ppm ตามลำดับ) ปุ๋ยอินทรีย์น้ำจากหัวปลาให้ฟอสฟอรัสสูงสุด (0.47 %) และปุ๋ยอินทรีย์น้ำจากผลไม้ให้แมงกานีสสูงสุด (11.25 ppm) ปุ๋ยอินทรีย์น้ำจากการหมักเศษอาหารมีต้นทุนต่ำที่สุด (10.06 บาทต่อลิตร)

Abstract

A research on the amount of plant nutrients in soluble organic fertilizer from fermentation of fish heads, fruits, food leftovers, weeds and marine animals was conducted from March 2007 to August 2007 at Office of Extension and Continuing Education, Prince of Songkla University to find kind of material that was best for producing soluble organic fertilizer. It was found that : the highest amounts of nitrogen (1.46%), potassium (1.15%), calcium (0.91%), magnesium (0.83%), sulfur (0.18%), iron (215 ppm), zinc (5.34 ppm) and copper (4.77 ppm) were from marine animal fermentation ; highest amount of phosphorus (0.47%) from fish head fermentation ; and highest amount of magnesium (11.25 ppm) from fruit fermentation. Soluble organic fertilizer from food leftovers was lowest in production cost (10.06 baht per litre).

Key words : plant nutrients, soluble organic fertilizer, fermentation

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Introduction

Thailand imported 3,592,069 tons of chemical fertilizer costing 35,946 millions baht in 2005 (Office of Agricultural Economics, 2006). To reduce the import expenditure and the use of chemical fertilizer, both governmental and private sectors put the in interest on organic fertilizer from natural materials such as animal excrements, weeds, plant pests and leftovers from agricultures and industries as the replacement of chemical fertilizer (Suksawat, 2002). Physically classified, organic fertilizer was divided into soluble and dry types (Technology Transfer Section, 2001). Apart from giving plant nutrients, both types of fertilizer also improve soils by releasing plant nutrients, improving pH value and increasing microbe (Fuangchan, 1995; Tisdale, et al. 1985). In practice, the use of organic fertilizer causes many major problems to farmers. For example, the price of fertilizer is rather expensive. Farmers do not know type and amount of nutrients in each organic fertilizer. In making fertilizer by themselves, they lack the knowledge of raw materials, types of plant nutrients in home-made fertilizer and appropriate application of the fertilizer. This research therefore aimed to examine the amounts of plant nutrients in soluble organic fertilizer from fermentation of different materials in order that the utmost use of plentiful natural materials that have no economic value may be made.

Materials and Methods

The research on the amounts of plant nutrients in soluble organic fertilizer from fermentation used fruits (pumpkins or *Cucurbita moschata* Duchesne, papaya or *Carica papaya* Linn. and Banana or Musa (ABB Group) Kluai Nam Wa at 1:1:1 ratio) or food leftovers or marine animals or fish heads or weeds (Indian marsh fleabane or *Pluchea indica* Less, Lesser reedmace or *Typha angustifolia* Linn, Java weed or *Eichhornia crassipes* (mart.) Solms at 1:1:1 ratio). The fermentation process employed 3 kilos of five experimented materials, 3 gram of microbial inoculum a Land Development Station, 0.5 kilo of molasses, 1.5 litre of water. After forty days of fermentation in a plastic bucket, the solution was measured and analized the nutrients in accordance with the methods of Leawwarin (1995). Duncan's Multiple Range Test was used in comparing different mean of pH value, EC and manufacturing cost per litre.

Results

Soluble organic fertilizers from the fermentation of fish heads, fruits, leftovers, weeds and marine animals contained statistically different amounts of plant nutrients. The highest amount of nitrogen was obtained from marine animal fermentation. The highest amount of potassium was obtained from marine animal fermentation. Fish heads gave the highest percentage of phosphorus, followed by food leftovers, weeds, fruits and marine animals respectively (Table 1). Highest percentage calcium, magnesium, sulfur, iron, zinc and copper were obtained from the fermentation of marine animals (Table 2). The greatest amount of magnesium was found in soluble organic fertilizer from fruit fermentation (Table 3).

Table 1 Amounts of nitrogen, phosphorus and potassium in soluble organic fertilizers from fermentation of different materials*

Materials used	Nitrogen (%)	Phosphorus (%)	Potassium (%)
Fish Heads	1.43^{a}	0.47^{a}	0.79^{a}
Fruits	0.23^{b}	0.14^{a}	0.94^{a}
Food leftovers	0.41^{b}	0.27^{a}	0.71^{a}
Weeds	0.18^{b}	0.26^{a}	0.77^{a}
Marine Animals	1.46^{a}	0.05^{a}	1.15^{a}

* Within a column, means with different letters differ significantly at $P \leq 0.05$

Table 2 Amounts of calcium, magnesium and sulfur in soluble organic fertilizer from fermentation of different materials*

Materials used	Calcium (%)	Magnesium (%)	Sulfur (%)
Fish Heads	0.47^{b}	0.30^{b}	0.17^{a}
Fruits	0.12^{c}	0.20^{b}	0.16^{a}
Food leftovers	0.25^{bc}	0.21^{b}	0.16^{a}
Weeds	0.12^{c}	0.23^{b}	0.15^{a}
Marine Animals	0.91^{a}	0.83^{a}	0.18^{a}

* Within a column, means with a common letter are not different at $P \leq 0.05$.

Table 3 Amounts of iron, manganese, zinc and copper in soluble organic fertilizers from fermentation of different materials*

Materials used	Iron (ppm)	Manganese (ppm)	Zinc (ppm)	Copper (ppm)
Fish Heads	9.21[a]	2.42[b]	1.17[b]	0.55[a]
Fruits	127.30[a]	11.25[a]	1.79[ab]	0.95[a]
Food leftovers	170.00[a]	9.25[ab]	4.39[ab]	0.94[a]
Weeds	165.30[a]	9.16[ab]	1.35[b]	0.75[a]
Marine Animals	215.80[a]	6.28[ab]	5.34[a]	4.77[a]

* Within a column, means with a common letter are not different at $P \leq 0.05$.

Table 4 pH value, EC and production cost of soluble organic fertilizers from fermentation of different materials*

Materials used	pH Value	EC (dS/m)	Production Cost (baht/litre)
Fish Heads	5.8[ab]	9.63[b]	11.93[c]
Fruits	4.2[b]	13.87[c]	22.12[a]
Food leftovers	4.0[b]	6.85[a]	10.06[d]
Weeds	5.7[ab]	16.25[d]	10.61[d]
Marine Animals	7.1[a]	34.61[e]	13.29[b]

* Within a column, means with a common letter are not different at $P \leq 0.05$.

pH values of soluble organic fertilizers from the fermentation of food leftovers, fruits, weeds and fish heads ranged from strongly acid to neutral. The most favorable pH value was found in fertilizer from marine animals. Salinity of soluble organic fertilizers from all materials were high especially that from marine animal fermentation. The fermentation of food leftovers was lowest in production cost, followed by those of weeds, fish heads, marine animals and fruits respectively (Table 4).

Discussion

Soluble organic fertilizers from marine animal fermentation gave the greatest amount of nitrogen (1.46%). To some extent, the obtained amount was higher when compared with soluble organic fertilizer derived from the fermentation of other raw materials which produced lower amount of nitrogen such as 0.57% from left shells, 1.23% from golden apple snails' eggs, 0.84% from golden apple snails and 0.33% from water hyacinth (Technology Transfer Section, 2001; Chaiwong and Subgaree, 2004). However, not only type of materials but also material preparation such as chopping and crushing were important factors affecting plant nutrients in the soluble organic fertilizer. Kaewtubtim (in press) produced soluble organic fertilizer from fruits, leftovers, marine animals, fish heads and weeds employing microbes from Q-Se Foundation without chopping and crushing materials and found that soluble organic fertilizer from leftovers tended to give highest concentration of plant nutrients, while in the present research, marine animals were the best in plant nutrient production. This resulted from easier dissolution of leftovers than that of marine animals. Without material chopping or crushing, nutrients were able to dissolve easily. On the other hand, with chopping and crushing, marine animals, could release more plant nutrients. As a result, it became the best material in making soluble organic fertilizer. Compared with chemical fertilizer, the amount of plant nutrients in soluble organic fertilizer was rather low. Therefore, to give sufficient nutrients for plants, the amount of organic fertilizer should be high. However, practically, this was difficult to manage because of the salinity of soluble organic fertilizer, especially from marine animals which were 34.61 dS/m. With this level of salinity, great amount of water is needed for the fertilizer mixture (Wunsow and buntowwong, 2000). Because of the two limitations of soluble organic fertilizers, low plant nutrients and high saltiness, the research on means of development such as mixing the fertilizer with other organic materials, making dry organic fertilizer by dehydration or producing low salinity organic fertilizer should be done.

Conclusion

Soluble organic fertilizers from marine animal fermentation gave the highest amount of plant nutrients.

Acknowledgements

This work was supported by Pattani Campus Research Funds, Prince of Songkla University.

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