

Fundamental Utilization of Floating Mass (*Salvinia cucullata* Roxb.) in Agricultural Aspect

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บทคัดย่อ

วัตถุประสงค์ของการวิจัยครั้งนี้เพื่อศึกษาการนำจอกหูหนู (*Salvinia cucullata* Roxb.) มาใช้ประโยชน์เบื้องต้นในทางเกษตรกรรมทั้งในรูปวัสดุที่ช่วยในการอุ้มน้ำและการนำมาเป็นวัสดุในการผลิตปุ๋ยหมัก โดยทำการทดลองเก็บจอกหูหนูบริเวณอ่างเก็บน้ำที่ 7 ของศูนย์ศึกษาการพัฒนาห้วยฮ่องไคร้ อันเนื่องมาจากพระราชดำริ ในช่วงเดือนธันวาคม พ.ศ. 2547 ถึงเดือนกุมภาพันธ์ พ.ศ. 2548 เพื่อศึกษาถึงการเจริญเติบโต น้ำหนักและปริมาตรต่อพื้นที่การเก็บในสภาพสดและแห้ง ต้นทุนการเก็บ และธาตุอาหารหลักของจอกหูหนูและปุ๋ยหมัก

จากการศึกษา พบว่า จอกหูหนูมีคุณลักษณะในการเจริญเติบโตบริเวณพื้นที่อ่างเก็บน้ำได้อย่างรวดเร็วจาก 0.0900 เป็น 1.00 ลูกบาศก์เมตร ภายในระยะเวลา 2 สัปดาห์ เมื่อทำการเก็บโดยใช้แรงงานได้จอกหูหนูในสภาพสด 3,600

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กิโลกรัมต่อแรงงาน 1 คน คิดเป็นต้นทุน 0.330 บาทต่อกิโลกรัม ภายหลังการตาก แดดให้แห้งเป็นเวลา 96 ชั่วโมง พบจอกหูหนูน้ำหนักสด : น้ำหนักแห้งเท่ากับ 25,600 : 3,200 กิโลกรัมต่อไร่ คิดเป็นอัตราส่วน 8 : 1 และปริมาตรสด : ปริมาตรแห้งเท่ากับ 64.5 : 32.3 ลูกบาศก์เมตรต่อไร่ คิดเป็นอัตราส่วน 2 : 1 ตามลำดับ เมื่อวิเคราะห์คุณค่าทางโภชนาในจอกหูหนู พบว่า มีคุณค่าที่สูงโดยเฉพาะอย่างยิ่ง โปรตีนสูง คือ มีโปรตีนสูง ร้อยละ 4.10 ในโตรเจน ร้อยละ 1.20 และ ฟอสฟอรัส ร้อยละ 0.100 และภายหลังการหมักเป็นปุ๋ยหมักที่ 50 วัน พบธาตุอาหารหลักที่สำคัญ คือ โปรตีนสูง ร้อยละ 5.50 ในโตรเจน ร้อยละ 1.34 และ ฟอสฟอรัส 0.100 ตามลำดับ

สรุปได้ว่า จอกหูหนูสามารถนำมาเป็นวัสดุที่ช่วยในการอุ้มน้ำและเป็นวัตถุดิบสำหรับการผลิตปุ๋ยหมักคุณภาพสูงสำหรับใช้ในทางเกษตรกรรมได้ ซึ่งจะส่งผลให้ลดการใช้ปุ๋ยเคมีและก่อให้เกิดประโยชน์และการสร้างงานให้กับท้องถิ่น รวมทั้งช่วยทำให้อ่างเก็บน้ำมีภูมิทัศน์ที่สวยงามมากขึ้น

ABSTRACT

This research studies the use of floating mass *Salvinia cucullata* Roxb. as peatmoss and raw material in composting. This is a preliminary study of the *Salvinia cucullata* Roxb. in the 7th reservoir of Huaihongkhrai Royal Development Study Center, Doisaked District, Chiang Mai Province and was carried out from December, 2004 to February, 2005. Fresh and dry weight, volume/area, nutritional value, cost of harvesting, and macro elements of compost were recorded.

The results show that *S. cucullata* grew rapidly from 0.0900 m³ to 1.00 m³ within 2 weeks. It was harvested by hand. Fresh yield was 3,600 kg./person and its cost was 0.330 bath/kg. The fresh weight and dry weight of *S. cucullata* were 25,600 and 3,200 kg./rai and the volumes were 64.5 and 32.3 m³ (dried for 96 hours), respectively. The ratio of fresh weight : dry weight was 8 : 1 and fresh volume : dry volume was 2 : 1. It had high element content, especially of potassium (1.20% nitrogen, 0.100% phosphorus and 4.10% potassium). The quality of compost at 50 days after fermentation contained nitrogen, phosphorus, and potassium contents of 1.34, 0.100, and 5.50 percent, respectively.

It can be concluded that *S. cucullata* can be used as a peatmoss and a raw material in producing high quality compost for agricultural use. These reduce the use of chemical fertilizer, increase local employment, and make the reservoir more attractive to tourists.

Key words: Agriculture, Nutritional value, Composting, Peatmoss, Fertilizer

INTRODUCTION

The scientific name of floating mass is *Salvinia cucullata* Roxb., in genus Salviniaceae (Suraneerarat, 2005). It is an annual aquatic ferns and an aquatic small plant. It has several season ages and rapid propagation. It consists of stem, a circle bar that is parallel on the water. Its leaf is on the node consisting of 3 leaves/node and its shape looks like a mouse ear. There is hair on the leaf and is smooth leaf edge (Fresh Water Fishery Division, Department of Fishery, 2005). An increase of *S. cucullata* in the large public reservoir causes the death of them and also plankton, producing toxic gas and resulting in

insufficient of oxygen for living things in the water (Fern Siam, 2005). Finally, it can produce the wastewater. Moreover, they devastate sightseeing around the reservoir and have led to a visual pollution. There are many methods using to control *S. cucullata* including the use of chemical substances that gives effects on environment. Chemical substances used involves for instance 2, 4 – D NaCl (2,607 tons/year) and propanyl (800 tons/year) (Suppadit, 2005). Suppadit (2003) reported that, 10.0 percent of chemical substances can distribute or accumulate to environment or food chain including affect to community health. Thus, the utilization of *S. cucullata* as an agricultural material can solve the problem. Due to its potential characteristics, it can be used to replace peatmoss, a planting material used to increase the ability of soil to retain water. Farmers can apply them as a mulch material for horticulture crops, field crops, and vegetable crops, since they can decrease water evaporation of plant. This method can save the water, especially in the dry season. Apart from this, when *S. cucullata* is decomposed, it releases several minerals to plant. Moreover that, it can be used as a main raw material for bioextract fertilizer or high quality composting for general agricultural utilization or organic agriculture (Suppadit and Sangla, 2004). The utilization of *S. cucullata* from the public reservoir has led to a decrease of an import of fertilizer from aboard, decrease cost of plant production and the means to save country or world food (Sangla and Suppadit, 2005) including has more beautiful sightseeing reservoir.

MATERIALS AND METHODS

The study was conducted at the 7th reservoir of Huaihongkhrai Royal Development Study Center, Doisaked District, Chiang Mai Province from December, 2004 to February, 2005. It was a preliminary experiment. There are two methods used for harvesting *S. cucullata*. 1) An aquatic weed management boat was used and then they were carried to an ashore by a belt used for transmitting power. 2) They were kept near the banks of a reservoir by labor and then used 4 car wheels or gallons of tanks to keep up labor. Next, *S. cucullata* was pulled in the half circle by rope or bamboo. Then, used hand or steel sieve (like spade) to carry them to an ashore, and continued harvesting until they were controlled, after that, used a float as a controller to limit a growth of *S. cucullata*.

DATA COLLECTION

S. cucullata was carried to the nearest of the banks to save the cost of transportation. Data recorded were fresh weight, dry weight, volume/area, cost of harvesting, macro element (nitrogen (N), phosphorus (P) and potassium (K)). It was used as a raw material for high quality composting by using fresh *S. cucullata*: old mushroom production material: cattle excrement, and their ratio were 6 : 1 : 3, respectively. Fifty days after fermentation, macro elements were recorded. Data were measured according to Association of Analytical Chemists Manual (AOAC, 1992).

RESULTS AND DISCUSSION

S. cucullata Weight/Volume

S. cucullata was kept from the 7th reservoir, the area of reservoir was 200 rai and contained water about 2,000,000 m³. The area of *S. cucullata* on the surface of water was 50.0 rai. *S. cucullata* had grown rapidly from 0.0900 m³ to 1.00 m³ within 2 weeks. It was harvested by labor. Fresh yield was 3,600 kg./labor and its cost was 0.330 bath/kg. Fresh weight/square meter of *S. cucullata* on water surface was 16.0 kg./m² as for dry weight/square meter was 9.00 kg./m², 4.00 kg./m², 3.00 kg./m², and 2.00 kg./m² after sun dried 24, 48, 72 and 96 hours, respectively, (Table 1). The fresh weight and volume of *S. cucullata* were 25,600 kg./rai and 64.5 m³/rai, respectively. After, sun dried for 96 hours, its dry weight and volume were 3,200 kg./rai and 32.3 m³/rai, respectively. The ratio of fresh weight : dry weight was 8 : 1 and fresh volume : dry volume was 2 : 1.

The quantity of *S. cucullata* for agricultural utilization had 160 ton or 1,613 m³. It could be used as a raw material of fertilizer production for horticulture crops, vegetable crops and field crops. It can be applied for soybean production about 320 rai (500 kg./rai for application) that had led to decrease quantity or the import of fertilizer about 8.00 ton (25.0 kg./rai for application) (Chiang Mai Field Crops research Center, 2000)

Nutritional Value

Table 2, showed nitrogen, phosphorus, and potassium contents of *S. cucullata* compared with animals excrement, water hyacinth, filter cake, and bagasse. They were ranged from 0.360 – 3.77, 0.0300 – 14.8, 0.150 – 4.10

percent of nitrogen, phosphorus, and potassium, respectively. *S. cucullata* had the highest of potassium (4.10 percent). Its phosphorus content (1.10 percent) is higher than filter cake, bagasse, water hyacinth, horse excrement, sheep excrement, and cattle excrement. Moreover, it does not result in a weed contamination problem when it is used as high quality composting. Compost made from *S. cucullata* had high micro elements and quality. Table 3 showed the quality of compost from plants and animals. They were ranged from 0.620 – 2.71, 0.100 – 14.3, and 0.460 – 5.50 percent in nitrogen, phosphorus, and potassium contents, respectively. Compost from *S. cucullata* had the highest potassium (5.50 percent). Its nitrogen content (1.34 percent) is higher than compost from cattle excrement, swine excrement, duck excrement, filter cake and cassava plant. In contrast, it had the lowest phosphorus contents. Similar results were obtained by Hongprayoon (2005), who reported that compost should contained at least of total nitrogen, available phosphorus, and soluble potassium contents of 0.400 – 2.50, 0.200 – 2.50, and 0.500 – 1.80 percent, respectively.

Table 1. Fresh and dry weight/square meter of *S. cucullata* on water surface

Types of <i>S. cucullata</i>	Weight/Square meter (kg./m ²)
Fresh <i>S. cucullata</i>	16.0
Dry <i>S. cucullata</i> (sun dried 24 hours)	9.00
Dry <i>S. cucullata</i> (sun dried 48 hours)	4.00
Dry <i>S. cucullata</i> (sun dried 72 hours)	3.00
Dry <i>S. cucullata</i> (sun dried 96 hours)	2.00

Table 2. Macro element contents (%) in raw material for high quality composting

Materials	Macro elements (%)		
	N	P	K
<i>S. cucullata</i>	1.20	0.100	4.10
Cattle excrement ¹	1.91	0.560	1.40
Buffalo excrement ¹	1.23	0.550	0.690
Chicken excrement ¹	3.77	1.89	1.76
Duck excrement ¹	2.15	1.13	1.15
Swine excrement ¹	2.80	1.36	1.18
Bat excrement ¹	1.05	14.8	1.84
Sheep excrement ¹	1.87	0.790	0.920
Horse excrement ¹	2.33	0.830	1.31
Water hyacinth ²	1.50	0.700	2.80
Filter cake ³	1.80	0.960	0.390
Bagasse ³	0.360	0.0300	0.150

Resource: ¹ Pintasean and Sangla (2004)

² Suraneerarat (2005)

³ Meunchang *et al.* (2005)

Table 3. Macro element contents (%) in each compost type

Types of compost	Macro elements (%)		
	N	P	K
<i>S. cucullata</i> compost	1.34	0.100	5.50
Cattle compost ¹	1.10	0.400	1.60
Buffalo compost ¹	0.970	0.600	1.66
Chicken compost ¹	2.42	6.29	2.11
Duck compost ¹	1.02	1.84	0.520
Swine compost ¹	1.30	2.40	1.00
Bat compost ¹	1.54	14.3	0.600
Rice straw compost ¹	1.34	0.530	0.970
Filter cake compost ¹	0.620	0.990	0.460
Azolla compost ¹	3.30	0.570	1.23
Corn straw compost ¹	1.78	0.250	1.53
Soybean compost ¹	2.71	0.560	2.47
African sesbania compost ¹	1.68	0.150	2.40
Striped crotalaria compost ¹	1.98	0.300	2.41
Pigeonpea compost ¹	1.42	0.260	0.900
Cassava plant compost ¹	1.23	0.240	1.23

Resource: ¹ Division of Soil Science, Department of Agriculture (1998)

CONCLUSIONS

S. cucullata is known as an aquatic weed. Though it devastates sightseeing of reservoir or environmental conditions, and is a habitat of carriers of filariasis disease, it can develop or apply for agricultural utilization. It can be used as a peatmoss for crops and raw materials of high quality composting in order to reduce chemical fertilizer application, decrease the import of fertilizer from abroad and increase the benefit and local employment. Furthermore it leads to more beautiful and clean sightseeing reservoir.

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