

## 2-3 Survey on Food Waste Utilization by Hog Farmers in Guam

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### Introduction

Guam is a tropical island in the western Pacific region with the geographic coordinates of 13° 28' N, 144° 47' E and the area of 549 sq km. It is a U.S. territory with the current population of about 170,000. It is expected to have an increase in population in near future with planned US military buildup. Major employment opportunities in Guam can be found with military and tourism, and their related jobs. Agriculture takes place with a limited scale due mainly to unstable and costly supply of agricultural resources, lack of stable marketing infrastructure and heavy dependence of imported goods from US mainland. In fact, more than 90% of food items are imported. One of reasons of less agricultural activity especially animal production is due to high cost of imported feeds. It is observed that some hog farmers in Guam obtain food waste from local restaurants and hotels to supplement feeds to reduce the cost. An aim of this project is to convert food waste into animal feeds or composting materials for agricultural use in small-scale farms in Guam. The objective of this study was to conduct a survey to find out the status of food waste utilization by hog farmers in Guam and how food waste providers such as hotels and restaurants dispose their wet garbage.

### Materials and methods

Two survey forms were developed: Survey form A to find out how potential food waste providers dispose their wet garbage; and Survey form B to find out whether hog farmers are utilizing food waste generated by providers. The description of two surveys is as follows.

Survey A: for Potential Food Waste Providers

Targeted respondents: a) hotels, b) restaurants, c) schools, d) supermarkets, e) bakeries, and f) wholesalers

Survey method: by phone or by site visit

Survey period: November 2010-January 2011

Questions: 1) How much food waste do you dispose per day?

2) Are there seasonal differences in the amount of food waste?

3) Do you separate food waste from other trash?

4) Do you store your food waste in designated container until disposal?

5) Where do you dispose of the food waste?

6) How often do farmers pick up your food waste?

7) Are you interested in recycling food waste to use for agriculture in Guam?

Survey B: for Potential Food Waste Users

Targeted respondents: hog farmers

Survey method: by phone or by site visit

Survey period: November 2010-January 2011

Questions: 1) How many pigs do you have now?

2) Do you collect food waste from places such as hotels and/or restaurants to use for your farm?

If your answer is YES to Question 2,

3) How many 'food waste suppliers' do you have?

4) Where do you go to pick up food waste?

5) How often do you go to 'suppliers' to pick up food waste?

6) How many gallons of food waste do you collect on daily basis?

7) Are there seasonal differences in the amount of food waste collected?

8) How do you use food waste collected from 'suppliers'?

9) How often do you need to remove any objects such as plastic utensils from food waste?

10) If you use food waste to feed farm animals, do you cook food waste before feeding to animals?

There were three additional questions to find out how much pig farmers were interested in purchasing pelletized feeds produced by food waste recycle. These questions are:

11) Are you interesting in recycling food waste in agricultural uses?

12) Support the idea of production of pelletized animal feeds to distribute to growers?

13) Do you agree to pay for pelletized animal feeds originating from food waste materials?

## Results and Discussion

From the survey of food waste provider (Survey A), we obtained 115 responses consisting 19 hotels, 46 restaurants, 17 schools, 17 supermarkets and stores, 10 bakeries, and 6 wholesalers. The summary of the survey is presented in Table 1. The majority of respondents generate less than 20 gallons (76 L) per day, being the majority with less than 5 gallons (17 L). There is no difference in the amount of food waste production between dry and wet seasons. About 80% respondents separate and store food waste in designated containers. Except wholesalers and small stores, the majority of food waste is picked up by farmers daily. There is a great interest in recycling food waste to use for agriculture.

From the survey of hog farmers (Survey B) it was found that when the number of pigs at a farm was greater, farmers would collect food waste to supplement to commercial feeds. Among the total of 29 farmers, 13 farmers used food waste and they had the average of 11 pigs/farm,

Table 1. Summary of survey A: Potential Food Waste Providers for agricultural application in Guam. (Survey period: November 2010 - January 2011)

	Restaurants	Hotels	Markets & Stores	Bakeries	Wholesales	Schools	Total
1) Amount of food waste disposal per day?	No. (%) (N=46)	No. (%) (N=19)	No. (%) (N=17)	No. (%) (N=10)	No. (%) (N=6)	No. (%) (N=17)	No. (%) (N=115)
a. Less than 5 gallons	19 (41)	8 (42)	2 (12)	7 (70)	5 (83)	10 (59)	51 (44.3)
b. 6-10 gallons	8 (17)	4 (21)	5 (29)	2 (20)	0 (0)	1 (6)	20 (17.4)
c. 11-20 gallons	7 (15)	0 (0)	8 (47)	1 (10)	0 (0)	3 (18)	19 (16.5)
d. 21-30 gallons	5 (11)	0 (0)	1 (6)	0 (0)	0 (0)	0 (0)	6 (5.2)
e. 31 - 50 gallons:	7 (15)	7 (37)	0 (0)	0 (0)	1 (17)	2 (12)	17 (14.8)
f. More than 50 gallons	0 (0)	0 (0)	1 (6)	0 (0)	0 (0)	1 (6)	2 (1.7)
2) Seasonal differences in the amount of food waste?	No. (%) (N=46)	No. (%) (N=19)	No. (%) (N=17)	No. (%) (N=10)	No. (%) (N=6)	No. (%) (N=17)	No. (%) (N=115)
a. More in the dry season	2 (4)	2 (10.5)	0 (0)	0 (0)	0 (0)	0 (0)	4 (3.5)
b. More in the rainy season	1 (2)	2 (10.5)	0 (0)	0 (0)	0 (0)	0 (0)	3 (2.6)
c. No changes	43 (93)	15 (79)	17 (100)	10 (100)	6 (100)	17 (100)	108 (93.9)
3) Do you separate food waste from other trash?	No. (%) (N=46)	No. (%) (N=19)	No. (%) (N=17)	No. (%) (N=10)	No. (%) (N=6)	No. (%) (N=17)	No. (%) (N=115)
a. Always	27 (59)	19 (100)	12 (71)	7 (70)	4 (67)	11 (65)	80 (69.6)
b. Sometimes	13 (28)	0 (0)	3 (18)	1 (10)	0 (0)	1 (6)	18 (15.6)
c. Never	6 (13)	0 (0)	2 (12)	2 (20)	2 (33)	5 (29)	17 (14.8)
4) Do you store in designated container(s) until disposal?	No. (%) (N=44)	No. (%) (N=19)	No. (%) (N=15)	No. (%) (N=8)	No. (%) (N=4)	No. (%) (N=15)	No. (%) (N=105)
a. Yes	34 (77)	17 (89)	13 (76)	7 (87.5)	2 (50)	11 (73)	84 (80.0)
b. No	10 (23)	2 (11)	2 (12)	1 (13.5)	2 (50)	4 (27)	21 (20.0)
5) Where do you dispose? (Choose all that apply)	No. (%) (N=46)	No. (%) (N=19)	No. (%) (N=17)	No. (%) (N=10)	No. (%) (N=6)	No. (%) (N=17)	No. (%) (N=115)
a. Farmer will take food waste	25 (54)	15 (79)	7 (41)	6 (60)	1 (17)	9 (53)	63 (54.8)
b. Ask professional company	7 (15)	6 (32)	5 (29)	1 (10)	1 (17)	0 (0)	20 (17.4)
c. Take to a designated place	5 (11)	0 (0)	1 (6)	0 (0)	2 (33)	0 (0)	8 (7.0)
d. No answer/ others	9 (20)	0 (0)	4 (24)	3 (30)	2 (33)	8 (47)	26 (22.6)
6) If your answer for 5) is a), how often do farmer(s) pick up your food waste?	No. (%) (N=33)	No. (%) (N=19)	No. (%) (N=7)	No. (%) (N=6)	No. (%) (N=1)	No. (%) (N=9)	No. (%) (N=75)
a. Daily (every day)	21 (64)	15 (79)	4 (57)	3 (30)	1(100)	9 (100)	53 (70.6)
b. Every other days	3 (9)	2 (11)	1 (14)	0 (0)	0 (0)	0 (0)	6 (8.0)
c. 2-3 times per week	3 (9)	0 (0)	2 (29)	1 (10)	0 (0)	0 (0)	6 (8.0)
d. Once a week	2 (6)	0 (0)	0 (0)	2 (20)	0 (0)	0 (0)	4 (5.4)
e. No answer	4 (12)	2 (11)	0 (0)	0 (0)	0 (0)	0 (0)	6 (8.0)
7) Are you interested in recycling food waste to use for agriculture in Guam?	No. (%) (N=43)	No. (%) (N=19)	No. (%) (N=17)	No. (%) (N=10)	No. (%) (N=6)	No. (%) (N=17)	No. (%) (N=112)
a. Yes	28 (61)	17 (89.5)	10 (59)	7 (70)	5 (83)	16 (94)	83 (72.1)
b. No	15 (33)	2 (10.5)	7 (41)	3 (30)	1 (17)	1 (6)	29 (25.2)

whereas 16 farmers did not collect food waste and the average number of pigs at their farms was 4. It is assumed that there are about 50-70 pig farmers on Guam who has operating in very small scale integrating farm system. Table 2 presents the summary of the survey to those farmers who collected food waste. Some farmers picked up food waste at more than one place. It is necessary to remove objects such as plastic utensils from food waste before cooking and feeding to animals.

Table 2. Summary of responses of hog farmers who currently use food wastes. (N=13)

Where do you pick up food waste? (More than one answer)	No. (%)
a. Restaurants	12 (92.0)
b. Hotels	5 (38.0)
c. Schools	0 (0.0)
d. Vegetable/Fruit farmers	2 (15.0)
e. Supermarkets/Stores	4 (31.0)
How often do you pick up food waste?	No. (%)
a. Daily (every day)	5 (38.0)
b. Every other days	2 (15.0)
c. 2-3 times per week	2 (15.0)
d. Once a week	4 (31.0)
How many gallons of food waste do you collect on daily bases?	No. (%)
a. Less than 5 gallons	0 (0.0)
b. 6-10 gallons	5 (38)
c. 11-20 gallons	2 (15)
d. 21-30 gallons	3 (23)
e. More than 30 gallons	3 (23)
Are there seasonal differences in the amount of food waste?	No. (%)
a. More food waste in the dry season	1 (7.7)
b. More food waste in the rainy season	1 (7.7)
c. No change between seasons	11 (84.6)
How do you use food waste?	No. (%)
a. Feed animals (pigs)	10 (76.9)
b. Make compost	1 (7.7)
c. Both	2 (15.4)
How often do you need to remove any objects such as plastic utensils from food waste?	No. (%)
a. Always	4 (30.8)
b. Sometimes	8 (61.5)
c. Never	1 (7.7)
Do you cook food waste before feeding to animals?	No. (%)
a. Always	9 (69.2)
b. Sometimes	4 (30.8)
c. Never	0 (0.0)

Table 3 shows the responses of questions if farmers would support the production of pelletized feeds by recycling waste in Guam.

Table 3. Responses of questions if farmers would support the production of pelletized feeds by recycling food waste in Guam.

Questions	Farmers currently collect food waste (N=13)	Farmers currently do not collect food waste (N=16)
Are you interesting in recycling food waste in agricultural uses?	No. (%)	No. (%)
a. Yes	12 (92.0)	16 (100.0)
b. No	1 (8.0)	0 (0.0)

Support the idea of production of pelletized animal feeds to distribute to growers?	No. (%)	No. (%)
a. Yes	13 (100.0)	15 (94.0)
b. No	0 (0.0)	1 (6.0)

Do you agree to pay for pelletized animal feeds originating from food waste materials?	No. (%)	No. (%)
a. Yes	11 (85.0)	14 (87.5)
b. No	2 (15.0)	2 (12.5)

Table 4. Farmers' comments in the survey.

<p><i>A. Farmers currently use food waste.</i></p> <ol style="list-style-type: none"> <li>1. Food waste on Guam should be recycled rather than going to the dump.</li> <li>2. The food waste I collect is free and I can't afford to purchase it as pellets.</li> <li>3. I would buy pelletized food waste animal feeds if they are cheaper and have good nutrition.</li> </ol> <p><i>B. Farmers currently do not use food waste.</i></p> <ol style="list-style-type: none"> <li>1. Food waste from suppliers is inconsistent.</li> <li>2. There is a need for a system that has designated pick-up spots for farmers.</li> <li>3. Pellets (commercial animal feeds) are expensive.</li> <li>4. Cost of animal feeds (pellets) is high.</li> <li>5. Need local feeds.</li> <li>6. Current system needs improvement.</li> <li>7. Agricultural waste should be used for feed, compost, mulch, etc.</li> <li>8. I am not a commercial producer and the pigs are for home consumption. If food waste were pelletized I would purchase it.</li> <li>9. My kids are responsible for feeding pigs and pig slob is too messy.</li> <li>10. I feed (commercial) pellets and whatever is in season such as mangos, avocados, breadfruit, banana, and taro.</li> <li>11. Food waste that is not collected should be used as nutrients (feeds) for farms. I do not collect food waste because I am a full-time employee and do not have time to do it.</li> <li>12. Feed pellets and supplements with local food sources.</li> <li>13. Fee household and neighbor's food waste, breadfruit, taro, and banana.</li> <li>14. Hog farmers could reduce costs by supplementing feed with local fruits and vegetables.</li> <li>15. I would like to see more recycling for waste to go to farmers rather than the dump.</li> <li>16. Food waste can be sent to a composting site where farmers can benefit.</li> </ol>
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The majority supported the idea of production of pelletized animal feeds to distribute to growers. However few disagreed to pay for pelletized animal feeds originating from food waste, even although the idea of recycling food waste to produce pelletized was well accepted. Their comments indicated that farmers tried to get cheaper animal feed to sustain their small-scale operation. The survey also indicated some problems in current food waste collection and utilization by hog farmers. First, objects such as utensils in food waste were potentially hazardous to animal health and farmers always needed to remove those before feeding animals. Secondly, cooking food waste needs to be done according to a regulation of Guam Public Health, however there was no monitoring system for this process.

Comments of farmers who participated in the survey are listed in Table 4.

### **Summary**

This study revealed a current status of food waste utilization by hog farmers and participation of food waste providers such as restaurants and hotels in Guam. The idea of production of pelletized animal feeds using food waste and distributing to hog growers was well accepted. Our next step will be to conduct a pilot study of production of pelletized animal feeds using food waste in a small-scale operation. We hope fermentation-dehydration-pellet production process will be mechanized. The study on feed safety and feed quality will also be a focus in our future research of waste management in Guam.