PROCEEDINGS OF THE DISSEMINATION WORKSHOP ON UTILIZATION OF MARKET WASTES HELD ON 15-16 APRIL 2004 AT FAIRWAY HOTEL, KAMPALA, UGANDA.

Edited by E. N. Sabiiti and J. Karungi

Supported by Sida/SAREC and Makerere University

List of acronyms

FA	Faculty of Agriculture
KCC	Kampala City Council
MCW	Market Crop Wastes
MU	Makerere University
MUARIK	Makerere University Agricultural research Institute, Kabanyolo
NGO	Non Governmental Organizations
SLU	The Swedish University of Agricultural Sciences

1.0 OPENING CEREMONY

The Dean Faculty of Agriculture, Professor Mateete Bekunda chaired the opening session. He welcomed guests and participants. He also thanked Professor Sabiiti for taking the initiative and convening such a workshop.

1.1 Workshop highlights by convener: Professor E.N. Sabiiti

- He welcomed members and indicated that he was encouraged by the response by participants a clear sign of the desire to address the garbage problem.
- He informed participants that the idea to address the garbage problem was conceived in 1999, presented to Sida/SAREC personnel who showed interest and later agreed to sponsor 4 PhD students to study potential areas in which the garbage can be utililised and the socio-economic implications.
- Professor Sabiiti introduced the Swedish team (eight researchers) collaborating on the project. He also introduced the Ugandan team of researchers working on the project.
- He argued participants to join the two teams to form a bigger international research team to address the garbage problem.
- He informed members that the project has now finished two years. He stated the fact that since the project is doing well, continued funding is guaranteed.
- He thanked the Vice Chancellor, Professor, J.M. Ssebuwufu for the attachment he has for the project portrayed in his presence.
- He expressed his gratefulness to His Excellency the Swedish Ambassador to Uganda, Mr. Eric Åberg for honoring the occasion by his presence and through him to the Swedish government for proving the funds.
- He informed the participants that the Swedish team was here to share about how they have handled the garbage problem.
- He the ended by thanking members for coming in such great numbers.

1.2 Remarks from the Vice Chancellor, Makerere University

- The VC started by thanking the convener of the workshop, he informed members that he was involved in the project since its inception. He admitted that he quite skeptic at the

beginning but experience has shown him that noble ideas are often born from such beginnings.

- He then thanked His Excellency, the ambassador for the devotion he has shown to the collaboration with the project by honoring it with his presence.
- He thanked Professor Erasmus Otabbong, who resides in Sweden, for being a good representative there. He also congratulated him on the recent promotion to professor and told him that 'we are proud of you'.
- The VC thanked the Swedish team for being willing and committed partners and expressed the desire for even better things coming out of the collaboration with the team.
- He expressed his gratitude to Sida/SAREC for the funds and for the generosity of the taxpayers in Sweden. He pledged that the University will use the funds fruitfully. He said, "When you support MU, you are supporting a supportable institution".
- He argued participants to think globally but act locally. Research should lead to usable results locally as well as globally published results.
- He agreed that garbage is a problem in urban areas but indicated that most of it is organic and can therefore be a resource in agriculture. People have already started getting enlightened and are using some of the waste (peels) for animals.
- He commended the garbage utilization project and thanked Prof. Sabiiti for being innovative and planning the research on utilization.
- Utilizing the organic part of the waste would help KCC in that it would only dispose the waste that cannot decompose. This would also help to alleviate the problem of stench that the people neighboring the landfill area are complaining about.
- He finished by thanking everyone for coming. He sent regards to the Rector of SLU.

1.3 Opening speech from the Swedish Ambassador

- The Ambassador started by informing members that he was very happy to be at the workshop, he said that its good proof of the collaboration Sweden has with Uganda. He was also happy to see many of his countrymen and women present.
- He informed members that this research is a small part of the total collaboration that Sweden has with Uganda (= $35,000,000/year).
- He delivered special greetings from Hanna Akufo. Informed members that she was sorry not to have participated in the workshop.

- The ambassador gave an overview of the support it gives Makerere University and of the agriculture project.
- He informed members that recycling of waste is working well in Sweden and hence collaboration with Sweden researchers will help broaden the research.
- He argued for more linkages with stakeholders like KCC and other NGOs.
- He stated that such workshops show how academic research with empirical data can help address community problems.
- He then declared the workshop open.

2.0 SESSION TWO

2.1 Handling of garbage in Kampala City Council – The Mayor, KCC

- The Mayor thanked organizers for the invitation and for moving down from the ivory tower to the people.
- The Mayor informed members that Kampala was originally planned for 200,000 people yet today, the population stands at 2.5 million people, and hence the deficient services. Also, that the eating habits of the population promote garbage accumulation.
- He informed members that on a daily basis, 1000 tonnes of garbage are generated in Kampala.
- The Mayor told members that the landfill at Kitezi is the third after filling the ones in Kololo and wakaliga respectively. He also indicated that the nature of garbage has changed, with today's garbage having more polyethylene bags that are a problem. He said that he hoped somebody would initiate research to look into that.
- The Mayor said that currently, all the waste is dumped at Kitezi. After many complaints from residents of Kitezi about the stench, seepage into water sources and the dust from the trucks felling the garbage. KCC has intervened by spraying the garbage to alleviate the stench, tarmacing the road to reduce dust and erecting boreholes in the area to provide safe water. In addition, the liquid seepage is now being treated.
- He indicated that managing the garbage in this way is very costly (= 25million shillings/month).
- He clarified that he would like to see the 1000 tonnes/day being turned into something useful and hence was very happy about the on-going research at Makerere University.

- He informed members that KCC is in the process of exploring opportunities to help in recycling the garbage such as biogas production.
- He also said that KCC is devising a system to make households to pay for transportation of the garbage.
- He informed participants that though there is still a lot to be done, KCC has achieved quite a lot. He reminded members of when garbage in Katwe and Kisenyi has formed 'mountains'. Nowadays, KCC makes sure that most of the garbage is collected.
- The Mayor ended by thanking MU for the initiative and for the opportunity to address participants.

2.1.2 Discussion on the Mayor's talk

Participants had the following queries/comments/suggestions for the Mayor:

- There is a need for a community education program on garbage management. This should go hand in hand with soil erosion management in the city.
- The hazards from using paper from garbage to wrap food items
- Explore ways of benefiting from human waste
- More than 65% of the springs in Kampala are polluted. Boreholes not practical in Kampala, hence, tapped water should be the way to go.
- How do we handle the diverse wastes?
- A framework/forum where organizations can come together and share ideas with KCC would be greatly appreciated.
- A lot of sensitization needed on proposed levy on garbage.

The Mayor's feedback:

- Tax proposed – to divide city into sections depending on financial ability. In fact, in some parts of the city, people are already paying for garbage removal.
- Soil erosion - problem is because water cannot sink due to the so many developments in the city.
- Using paper from dumps – no longer putting skips in areas where the offices are. (Offices are the sources of paper that goes in the dumps). Also removing the skips at regular intervals.
- Human waste – convincing the people is the biggest hurdle! However, will collaborate with Prof. Sabiiti on the issue.

- Pollution of water sources – agreed that piped water would be the best alternative
- Appreciated the idea of bringing together all the stakeholders in the garbage problem. 'Discussion of the problem is half the solution'.
- Sensitization is very crucial and should not be left to KCC alone. So, he thanked the organizers of the workshop on sensitization/dissemination. He said that solutions that are developed here would work better here.
- KCC is very happy to work along with this project.

2.2 PhD students' presentations

The students gave overviews of the on-going work:

i. Effects of utilizing urban market crop wastes as soil fertility amendments in integrated pest management in peri urban farming systems (J. Karungi)
ii. Urban market wastes for soil fertility improvement (A. Amoding)
iii. Effects of feeding varying levels of urban crop wastes on the performance of lactating dairy cows (J. Nambi)
iv. Assessment of waste situation and potential for reuse in urban and peri urban areas of lake Victoria crescent (W. Ekere).

The Effect of Utilizing Market Crop Wastes as Soil Amendments in Integrated Pest Management in Peri-urban Farming Systems in Uganda (J.Karungi)

Background

- High rates of urbanization (4%/year), along with urbanization of poverty caused by lagging employment and income levels
- Urban and peri-urban agriculture (UPA) a survival strategy (food + income)
- In 2000, a survey of HH in Kampala indicated that 100% respondents planted beans for food as well as for income (David, 2003)

Problem Statement

- Farmers problems:
  - Farmers in Kampala face numerous constraints but high on the list there is pests and diseases (68%), shortage of land (66%), lack of/expensive inputs (53%) and low soil fertility (43%) (David, 2003).
- Urban dwellers/councils problem:
  - Garbage accumulation/disposal – garbage is mostly organic

The Approach

- There is a need to return the organic wastes back to the farms so as replenish the declining soil fertility
- There is evidence that soil fertility management affects crop pest infestation
- Assess the potential of utilizing MCW soil amendments as a tool in integrated pest management

Objectives

- To assess:
  - i) the effects of using MCW as soil amendments on occurrence and activity of insect pests and their natural enemies
  - ii) the cost effectiveness of using MCW as soil amendments

Questions???

- Can the utilization of these MCW amendments promote crop pests infestations?
- Can the plants derive enough nutrition from the MCW amendments so as to withstand the pests infestation?
- Is it profitable for the farmer?

Materials and methods

- **The study was done at the Makerere University Agricultural Research Inst.**
- **Study crops: beans (K132) and cabbage (Drumhead)**
- **Treatments:**
  - **MCW compost incorporated in the soil,**
  - **Un-composted MCW incorporated in the soil,**
  - **Un-composted MCW applied as a surface mulch,**
  - **NPK incorporated in the soil, and**
  - **the untreated control.**

Data Collection:

Data collected on:

- insect pests
- Insect pests' natural enemies
- Plant's physical attributes
- Yield
- Economic returns

Bean yield parameters

Treatment	Shoot yield (gm)	Grain yield (kg/ha)	Marginal returns
Composted MCW - incorporated	182.75	662.6	0.3
Un-composted MCW- incorporated	125.50	622.6	0.8
Un-composted MCW- surface applied	189.25	540.0	0.9
NPK - incorporated	139.00	651.6	1.6
Un-amended (control)	142.50	613.6	-
P	**0.284**	**0.887**	-

Cabbage yield parameters

Treatment	Number of marketable head/plot	Yield of marketable heads kg/plot	Marginal returns
Composted MCW - incorporated	64.33a	59.47a	4.8
Un-composted MCW- incorporated	58.67a	59.67a	15.3
Un-composted MCW- surface applied	57.33a	42.73a	13.4
NPK - incorporated	48.00ab	34.73ab	16.5
Un-amended (control)	33.33b	27.33b	-
P	**0.048**	**0.009**	-

Summary of season's results

- The only insect pest that was influenced by the MCW amendments so far was the bean aphids (*Aphis fabae*)
- Also, on beans, aphids natural enemies occurrence was significantly influenced by the MCW amendments
- There was no variation in bean yield among the treatments whereas there was a significant variation in cabbage yield among the treatments.
- Using MCW amendments was not cost effective on beans but was very so on cabbage.

Urban market wastes for soil fertility improvement (A. Amoding)

INTRODUCTION

- Decline in soil fertility - a mounting problem in Uganda

  - Lack of awareness of the imp. of soil mgmt
  - Absence of appropriate soil mgmt techniques
  - Continuous cultivation with no soil fertility mgmt

- Lack of access to conventional nutrient sources, namely, fertilisers

- Yet the urban environ is burdened with garbage, which is largely crop waste

- Crop waste: rich in nutrients – s/fertility input

INTRODUCTION Cont'd

- Basic information on UCW necessary:

  - What is the physical composition?

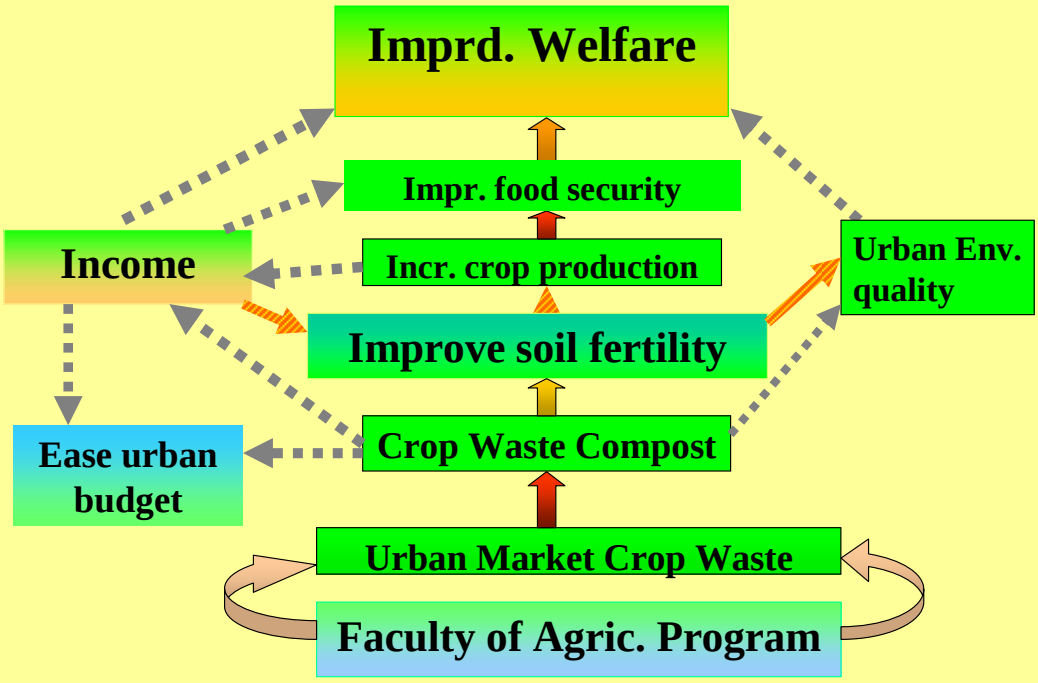
  - What is the plant nutritional quality?

  - What are the nutrient release characteristics?

  - How much is dumped per unit time?

  - What is the seasonal effect on garbage composition?

CONCEPTUAL FRAMEWORK



STUDY OBJECTIVES

- Establish the temporal variations in quantity, composition, and quality of garbage with a view to establish the supply potential of the material for soil management
- Evaluate the contribution of UCW to soil productivity (chemical and biological) in peri-urban areas
- Establish the point of synchrony between maximum nutrient release and maximum crop nutrient requirement

STUDY HYPOTHESES

- Urban market crop waste is sufficient in quantity and quality to serve as a nutrient source in a cropping system
- Composted urban market crop waste compares well with inorganic fertilisers as a soil fertility input
- A point of synchrony between peak nutrient release by composted market waste and maximum nutrient demand by crops can be achieved

Methodology

- **Field Studies - MUARIK**
- **Agronomic Experiment**

  - Evaluate the agronomic suitability of UCW waste as a soil input

  - 2 seasons done, 3rd underway

  Treatments

  - 3 rates of compost (0, 5 and 10 t ha^{-1})
  - 3 rates of N (0, 40 and 80 kg ha^{-1})
  - 3 rates of P (0, 9 and 18 kg ha^{-1})

  - RCBD (Split plot arrangement)

- Plot size – 5 m x 5 m
- Test crop - Maize (Longe 4)
- Plant parameters – LAI, height, DMY, cob weight and grain yield.
- Soil samples - pH, SOM, N, P, K^{+}, Ca^{2+} and Mg^{2+}

Table 2. Compost Quality

N	P	K	Ca	Mg	Na
0.55	0.53	2.2	4.0	2.0	1.3

Table 3. Soil analysis results

pH	O.M	N	P	K	Na	Ca	Mg	Sand	Clay	Silt
	…..%…..		ppm	…….me/100g…….				…….%…….		
5.1	3.3	0.08	6.7	0.26	0.15	2.7	1.2	49	38.5	12.5
5.2	3.0	0.2	15							

Table 3. Effect of compost, nitrogen and phosphorus fertilizers on maize yield

Treatment	Height (cm)	LAI	Plant weight	Cob weight	Grain yield
			$t\,ha^{-1}$		
N0P0C0	84.06	1.639	6.00	8.85	4.66
N0P0C10	98.47	2.08	7.50	10.81	5.78
N40P9C5	99.51	1.996	7.53	11.67	6.04
N40P9C10	108.78	2.135	8.00	11.94	6.10
N80P0C5	99.33	2.139	7.72	11.61	6.67
N80P9C5	96.27	2.157	7.48	12.24	6.64

EFFECT OF FEEDING VARYING LEVELS OF URBAN CROP WASTES ON PERFORMANCE OF LACTATING DAIRY COWS (J. Nambi)

Background

- People in cities will increase from 3-5.1 bn (60% of world popn) by 2025 (Holmer et al., 2000; Tjandradewi & Chahl, 2000)
- Wastes will also increase- environmental pollution
- It'll be worse in developing countries where most crops are marketed in raw form
- Peri-urban agric. important in sustaining livelihoods of increasing population.

- Women dominate this form of agric. but are restrained by feed availability
- Crop wastes are abundant esp. the banana peelings (BP) from matooke which is a staple food in most areas of Uganda
- Farmers already using BP but not aware of the nutritive value and the best way of utilisation
- **Objectives:**

➢ To determine the effect of feeding varying levels of banana peelings supplemented with cotton seed cake, maize bran and *Gliricidia sepium* on

- ✓ Feed intake
- ✓ Live weight changes
- ✓ Milk yield and composition

Methodology

- Four diets (BP at 0, 20, 40 & 60 % with elephant grass) were studied on station
- Each diet was supplemented with maize bran, cotton seed cake and Gliridia to meet the reqts of the cows.
- A 4x4 change over Latin Square design was employed.
- Daily feed intakes were measured and feeds were sampled fortnightly for nutrt. Analyses
- Daily milk yields recorded and milk samples taken for analyses
- Fat corrected milk yields were determined according to Maynard *et al.*, 1979

Table 1: Chemical composition of the experimental diets

	Diets (Percentage of banana peelings)			
	0	20	40	60
Crude protein	15.0	14.5	13.9	13.9
Acid detergent fibre	34.6	30.5	28.6	27.1
Neutral detergent fibre	57.8	50.5	47.3	46.1
Crude fat	7.2	7.3	7.3	6.7
Ash	8. 6	8.4	8.3	8.1
Acid insoluble ash	2.30	1.73	1.48	1.36
Calcium	0.71	0.67	0.63	0.56
Phosphorus	0.57	0.56	0.55	0.51

Table 2: Dry matter intake and average daily gain of cows fed experimental diets

	Diets (Percentage of banana peelings)				
	0	20	40	60	SE ±
DMI (kg/day)					
Basal	10.5^{c}	11.5^{c}	14.1^{a}	16.5^{a}	0.79
Supplement	5.7^{c}	6.5^{b}	7.4^{a}	4.9^{d}	0.002
Total	16.2^{b}	18.0^{b}	21.5^{a}	21.4^{a}	0.79
Total DMI (kg/kg$W^{0.75}$)	0.161^{b}	0.180^{b}	0.213^{a}	0.211^{a}	0.009
ADG (kg/day)	0.038	0.411	0.263	-0.632	0.556
Average $W^{0.75}$(kg)	100.4	100.6	101.3	101.8	0.75
Average body wt (kg)	467.7	468.3	473.2	476.5	4.88

Table 3: Milk yield and composition of cows fed the experimental diets

	Diets (%age of banana peelings)				
Parameter	0	20	40	60	SE ±
Milk yield					
Total (14 days)	150.5	142.9	159.6	155.7	4.96
Daily yield	10.8	10.2	11.4	11.1	0.36
Fat corrected milk	12.0^{a}	9.8^{b}	14.1^{a}	10.5^{b}	0.78
Milk composition					
Milk fat	4.80^{a}	3.63^{b}	5.54^{a}	3.58^{b}	0.302
Crude protein	2.79	2.68	2.69	2.56	0.097
Total solids	11.97	11.79	12.63	12.68	0.326
Ash	0.70	0.76	0.78	0.74	0.045

Conclusion

- Banana peelings (BP) are a valuable feed resource.
- BP shouldn't be fed solely b'se they are low in most nutrients.
- Increasing the level of BP should be accompanied with strategic supplementation.

ASSESSMENT OF WASTE SITUATION AND POTENTIAL FOR REUSE IN URBAN AND PERI URBAN AREAS OF LAKE VICTORIA CRESCENT LAKE VICTORIA (W. Ekere)

Introduction

- Rising rate of Urbanization in developing countries and consequent SWM problem is cause for concern in many urban governments
- Though 70 % of Sub Saharan Africa's popn live in Rural areas, average annual urban growth rate of 4.8 % has been rapid
- Tonnage of waste generated has been rising due to rising urban popn thru growth and R-U migration
- Waste problem is due to inadequate collection and poor disposal 20 - 50 % collection rate
- Uncollected waste leads to unsanitary conditions which pose serious environmental and human health risks. e.g thru cholera, tetanus diarrhea

- Communities in rural & urban Africa have long history of waste reuse and organic waste application in farming

- But in many cities Reuse of organic portions is < 50% of total waste despite good recovery potential.
- Organic materials form 50 – 90% of urban wastes in SSA cities

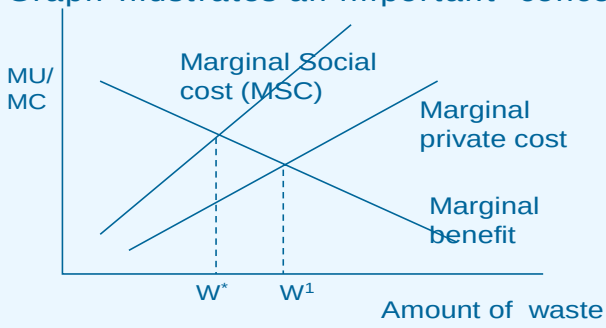
- organic portion consists of food leftovers, rotten fruits, vegetables crop residues etc from Households, restaurants and markets
- In Accra restaurants and markets alone generated 60,000 cubic meters of organic waste a year (Landinos & Klundert 1993)

Solid waste composition(%)in Selected African cities

Composition	Kumasi	Accra	Ibadan	Kigali	Kampala
Organic	84	85	55	94	75
plastic		3.4	6.3		1.6
Metal		2.6			

- Practice of using Municipal Solid Waste has been slowly growing in other parts of Africa
- In Kano Nigeria 25 of Fertilizer needs of peri urban farmers is being met by using MSW
- In Mali farmers collect garbage from garbage dumps for use on urban farms

Graph Illustrates an important concept



W^* = Socially optimal amount of waste

W^1 = free market optimal amount

- Garbage is a by product of consumption
- As we consume we generate more waste and eventually the marginal benefit of starts declining
- The more waste we generate we increase cost of disposal
- We normally don't pay full cost of waste disposal (Don't pay at all, dump wastes, no incentive to reduce
- Essentially what we aim at is to achieve point W^* where MSC = MB to ensure society is better off .

Objective

Appraisal of urban waste situation and its reuse in urban and peri urban areas of LV crescent

Specifically

- Ascertain the waste situation in Kampala area
- Assessing the waste generation , collection and disposal within the urban markets of Kampala
- Characterizing the market for crop waste in Kampala
- Gain an understanding of private companies involvement in waste collection and disposal in the city
- Understand the current farming activities &, crop waste use among farmers plus current soil fertility management strategies they employ

Methodology

- Covered the districts of Kampala Mukono and Wakiso
- Done through interviews and group discussions with various categories of respondents using a prepared checklist and a review of documents
- Discussions with Private companies involved in waste disposal, NGO.s involved in environmental management (UEPF) and KCC officials dealing with solid waste
- Purposively selected 10 markets & interviewed market management and few vendors
- Surveyed a randomly selected sample of crop waste sellers
- Interviewed 50 randomly selected farmers

RESULTS

Waste situation in Kampala

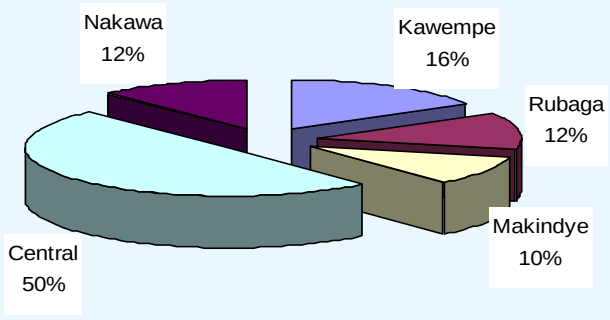
- With a popn of nearly 1.5 million day time and 1.2 million at night Per capita waste generation is approximately 1.2 kgs per cap per day.
- Aveg household size 4 person.
- Nearly 40 000 tonnes generated monthly
- New solid waste management ordinance has about changes in way waste is managed .
- Collection has improved from 13% in 1991 to nearly 40 % to date.

Waste Generation and collection trends 1969 -2002

Year	Population	Aveg Monthlu waste generation in tons	Aveg qauntirty collectd	% coverage	Disposal method
1969	330,700	8929	7000	78	
1980	485,500	13755			Open dump
1991	774,241		3500	13	Open dump
2002	1,208,544	36256	14000	39	Land filling

- Present trends are still inadequate coz many dispose off waste through indiscriminate dumping, burning and burying
- Skips can't be emptied frequently hence overflows and accumulation at container locations

Proportion of wastes disposed off by divisions in Kampala to Kitezi Land field 1999



- Central division accounts for half the waste disposed off at Kiteezi
  - Generates more waste than other divisions (hotels ,businesses most economic activity)
  - Efficient in collection and disposal

- Present composition of Kampala's waste stream is 80 % biodegradable organic components and easily composted
- No waste recycling currently done though KCC encourages waste reduction reuse and recycling by private sector.
- Only option for disposal now is land filling
- Disposal of a ton of waste at the land fill costs KCC shs 9,600
- This is quite high

PRIVATIZATION OF WASTE DISPOSAL

- Privatization of waste service is currently underway following the 1999 SWM ordinance.
- Surveyed 6 private waste collectors who provide a door to door service including garbage bins or bags to households for a fee. I
- Include Norema services, Bin It, Nabugabo Shauri Yako ,D & M Aron waste, Sheila investments (Works in its Markets
- Handle between 2 to 12 tonnes on a daily basis
- Only handle 10% of waste generated per month
- Fees structure varies with location and frequency of collection.
- Thus end up serving the upper & middle income areas
- KCC needs to continue providing service in low income areas

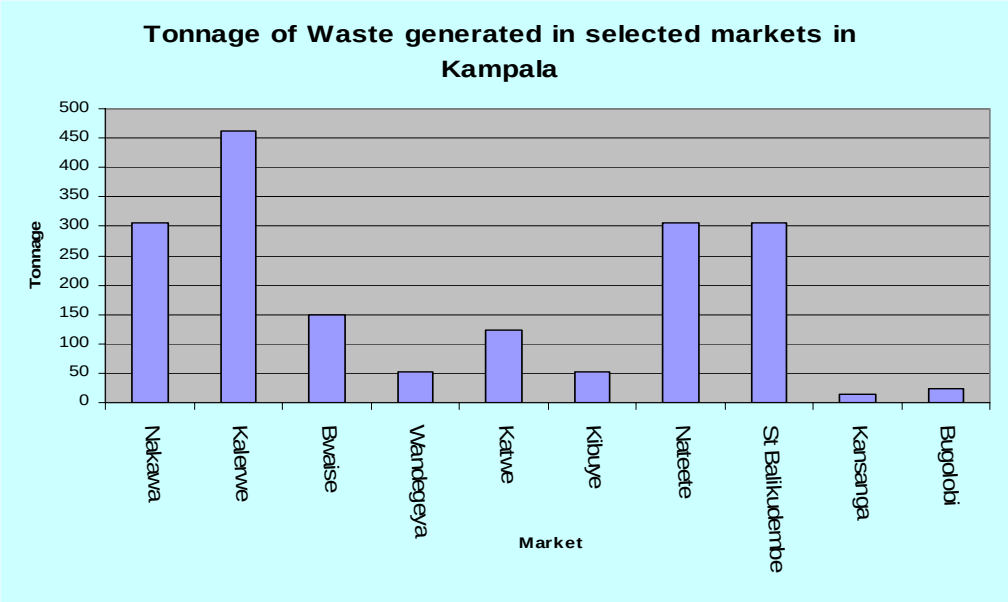
Urban markets

- Ten Markets were surveyed and waste generation levels estimated
- Markets spread across the 5 divisions of Kampala include Nakawa, Balikudembe, Kalerwe,Nateete, Wandegeya, kibuye katwe, Bwaise ,Bugolobi , Kansanga.
- 4 are under Buganda land board, two are still under KCC management while rest are tendered out to private magt.

- Major source of crop wastes in markets is fresh produce from farmers and vendors

- Most garbage generated during Farmers day when farmers sell fresh produce from farms
- 3 categories of people generate waste .

- Farmers thru the way they package produce (banana leaves, grass, pseudostems, vines) and materials used
- Consumers when the eat in the markets
- Traders through trimming roots of vegetables, sorting nd the way they present
- Major components of waste in markets are
    - Matooke leaves & pseudo stems
    - Grass & palm leaves
    - Potato vines
    - Vegetable roots
- Wastes disposed off in Skips located in the markets.
- Each market has a skip which overflows frequently as collection frequencies vary .
- Collection is 2 to 3 times per week on average



- Approximately 1794 tonnes of waste are generated monthly
- 80 – 90 % is biodegradable this can result into cost savings for KCC of approximately Shs 19 million if composted

CROP WASTE SELLERS

- Eleven crop waste sellers were randomly selected interviewed
- Most common commodity they traded in was Matooke peels.
- Most are new businesses 2 years old. one started 1960
- Other wastes sold include sweet potato vines and peels cabbage leaves
- Mostly bought by urban farmers rearing dairy cows under zero grazing system, pigs, rabbits ,goats
- Prices vary with season lowest was 300 shs a bag in dry season to 1500 shs in dry season
- Price variation is reflection of shortage of fodder in dry season

CROP WASTE SELLLERS

Sorted Cabbage and Bean pod waste at St Balikudembe market

Bagged Matooke peels ready for sale at kaluintusi location katwe

- On average they sell 5 bags in dry season and 10 in dry season
- Average weekly income is Shs 60000 in dry season and Shs 31000 in wet season

Composting firms

- Two Ngo's have been active in composting efforts
- Talent calls club in Seeta and Uganda Environmental protection forum
- UEPF has trained community in Nansana in community composting using Sorted waste from Kalerwe market for composting at Namere.
- Have worked in partnership with Kalerwe vendors association whom they trained in sorting waste delivered to Namere by KCC truck . Not active now due to lack of transport
- Make around 10 tons of compost per round which is used by the community or sold to the at 70 Shs per kg
- Resulted into rel. clean market , Sensitized community, new source of income from sales of compost and polythene bags
- Talent calls compost sold at 10000 shs a bag & contributes to income of the club while solving the garbage problems of Mukono and Seeta town councils

Farmers

- Survey involved interview with 50 farmers randomly selected from the districts of Wakiso and Mukono
- Socio demographic charateristics indicated that
  - Sex : 64% males while 32 % were female
  - Age: mean age was 51 Min 22. and max. 71 relatively mature . Few youth involved in farming
  - Educ level; majority (45%) had formal education up to primary 9 % no formal educ while 23% had secondary educ.
  - Aveg household size 6.7
- Mean Land area cultivable was 1.4 ha with min o.2 and max. 5.8 ha
- Farm experience varied from years 1- 40 years .
- Experience in composting was around 6 years

Farmer explaining the composting process to the survey team

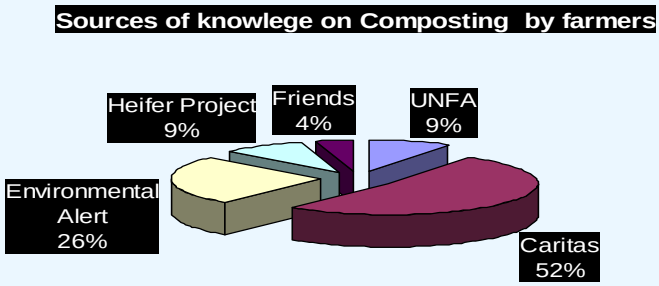
Proportion of Farmers using compost

• 65 % of the farmers used compost as major soil amendment while 35 % used other methods

•Sources of compost

• 8% bought compost from Talent calls while 50 % made their own . The rest used other methods

- Whereas sales of compost among farmers was not common, one farmer had reportedly sold I tipper full at 50,000 Shs
- I f there was a buyer some could be sold at approximately 2000 Shs a wheel barrow. while others had never thought of it as a product for sale
- Attitude towards compost was positive due to improvements in yields seen compared to time before application.
- Compost making became popular approximately 7 years after training offered by NGO's and declining soil fertility
- Sources of Knowledge for compost making was predominantly the training offered by NGO's



Conclusions

- There is a rising need for compost due to the declining soil fertility in the peri urban and urban zones.
- Given the ready availability of composting materials, it offers a alternative solution to the waste problem coz of the benefits it brings to the environment and increases in agricultural productivity.
- The few NGO's currently engaged in handling waste and composting are an important asset
- Recycling wastes is environmentally friendly as it reduces waste transport costs prolongs life span of landfill and reduces pollution.
- If properly organized and managed can lead to gainful employment

General discussions

- The results so far indicate that as far as integrated pest management is concerned, the MCW amendments promoted biodiversity (pests as well as natural enemies). The situation seems to be in a balance. We need this knowledge for proper management.
- Compost is not a substitute for the conventional fertilizer. With compost, the first crop you may not get the direct effect, but the subsequent crops might get a better effect.
- The link between the four projects is that each tries to add value to the garbage such as yield, pest management, animal feed/milk production, etc.
- Socio-cultural aspects need to studied together with the socio-economic ones for example feeding habits
- Let's not look at the profits to the farmer alone but also profits to the environment should be emphasized.
- Think further than urban and peri-urban areas. What about the countryside (hinterland) where some of the produce comes from?
- The students need to realize how to work together as a system.

2.3 Papers on experiences/prospects in utilization of garbage/wastes (Uganda/Sweden)

Uganda experiences:

a) Commercialization of composted urban market crop wastes in Uganda – experience of Talents Call Club- TCC (Wilson Serunjogi)
b) The state of Biogas systems in Uganda – Betty Nabuuma and Mackay Okure, Faculty of Technology, MU
d) Proposed utilization of banana stalks wastes in Bushenyi District – Mr. Nsimeki

Commercialization of composted urban market crop wastes in Uganda – experience of Talents Call Club- TCC (W. Serunjogi)

Background

TCC garbage recycling project began in 1996 after a problem was expressed by the community of Seeta town, Mukono District, on how to manage the garbage in the small ungazetted area. The idea was to utilize garbage profitably through generating compost that could be sold to farmers to replenish the soil fertility of the community. Funds to start the project were solicited from donors notably, the African Development Foundation (ADF) who financed the establishment of the recycling structure, purchase of a skip loader, a tractor and other tools and equipment. The compost would be packed in bags of 100kgs and sold to farmers at 5000 shillings per bag. Later, due to high demand for the compost, mainly by vanilla farmers, the price per bag rose to 10,000 shillings. TCC generates a net profit of 4,301 shillings per bag. To the farmers, the compost is cheaper than artificial fertilizers, does not pose any safety hazards and improves soil physical properties. The farmers can testify to the increase in yields that the compost has enabled.

Challenges

The project is overwhelmed by the demand yet production is still very low due to:

- Although the project carried out intensive community education on garbage management, the community did not completely change their cultural habits as regards sorting. Culturally, our people do not sort garbage. At first, the project gave out two plastic containers to each household in Seeta, one for the biodegradable and the other for the non-

biodegradable. However, the communities did not use them as indicated. As such, sorting was not done as expected, and hence the project had to incur the high expense of sorting at the site.

- The project lacks the technology to chop the waste into uniform-small sized bits that could decompose uniformly. As a result, not all materials are fully decomposed after the expected six weeks.
- Most of the work is done manually leading to low output which can not meet the high demand.

Conclusion

Commercialization of composted urban market crop wastes has proven to be a marketable venture with a high potential of expansion. However, for its continued success, further research, information dissemination and monitoring and evaluation are essential.

THE STATE OF BIOGAS SYSTEMS IN UGANDA (B. Nabuuma)

- Biogas: A gaseous product consisting primarily of methane and carbon dioxide obtained by anaerobic fermentation of organic materials.

- Biogas technology: Tapping of biogas and effluent for useful purposes

Overview of Biogas Systems

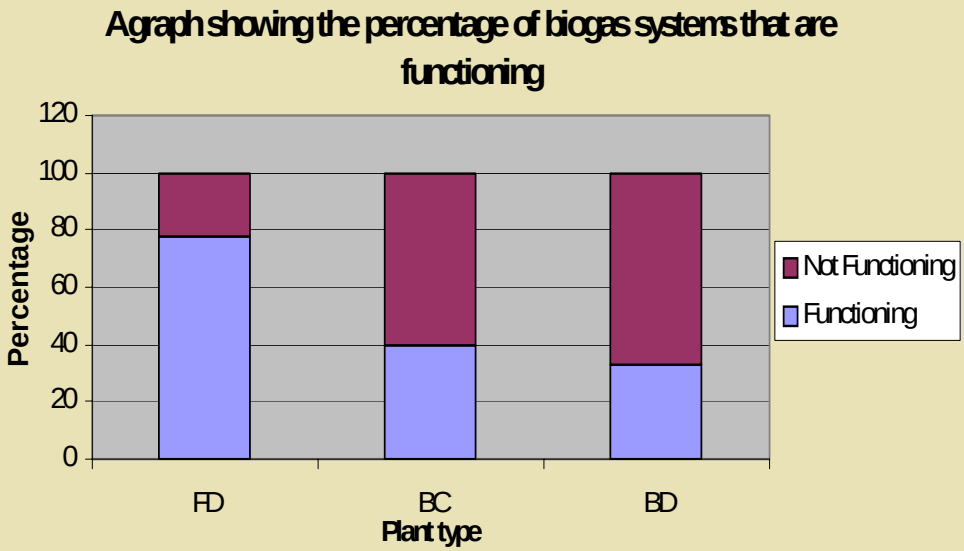
- Biogas systems may be considered an integrated resource recovery strategy since in involves several components:
- Energy system,
- nutrient recycling,
- public health or the environment.

Benefits of biogas technology

- Biogas systems are appropriate for small scale decentralized energy systems which are typical of the country's pattern of rural and agricultural setting.
- Biogas is a renewable energy resource (fuel), since organic wastes are generated on a renewable basis,
- Facilitates agriculture and animal husbandry through provision of slurry containing high concentration of nutrients making them especially valuable as fertilizers.
- Improving public health through killing of pathogens sometimes found at high concentrations in waste.

Organizations in Uganda active in disseminating biogas technology:

- Ministry of Energy and Mineral Development (MOE&MD)
- Agricultural Engineering and Appropriate Research Institute, Namalere (AEATRI)
- Heifer Project International (HPI)
- Heifer Project, Jinja
- Integrated rural Development Initiative (IRDI)



Conclusion

- The benefits of biotechnology are real and tangible
- The major economic benefit of biogas technology is in the convenience associated with using energy obtained from a biogas plant
- In order to achieve the benefits of biogas technology, the owner/users should be given all the necessary information regarding inputs required for good performance of a biogas system. These are:
  - labour
  - substrate
  - O&M
- All farmers involved in animal husbandry should be encouraged to have a biogas plant.

Proposed utilization of banana stalks wastes in Bushenyi District (Mr. Nsimeki)

Problem

Due to growing popularity of banana fingers instead of bunches among banana traders due to their convenience; trading centers are experiencing an increasing accumulation of banana stalks and other related garbage. While the stalks are becoming a menace in the trading centre, there is also a one-way traffic, draining soil nutrients from banana plantations.

Objectives

Mainly, to improve people's health and environment in the trading centers, and to promote higher banana production for food security and household incomes.

Specifically, to keep Kabwohe and Itendero banana markets free of banana stalks, to return nutrients contained in the stalks back to the banana plantations, and to commercialize the recycling venture for sustainability.

Approach

- To identify farmers groups or individuals to participate in the recycling enterprise
- Avail them with knowledge and skills in making and handling high quality compost
- Sensitization of the communities
- Establishment of small-scale compost business.
- Seek support

Sweden experiences:

e) Swedish policy on recycling of resources – Stig Ledin, SLU, Sweden

f) Biogas digesters in small scale, on farm applications - experiences and examples from South East Asia – Stig Ledin

g) Hovgården Landfill, an overview. Handling of leakage water. Composting of household waste - Cecilia Ekvall, Sweden

h) The benefits of composting. Different ways of composting. The composting process, what is really happening? Important aspects to consider at composting, e.g. moisture, structure of material. Research on composting – Cecilia Sundberg, Sweden

i) The biogas plant in Uppsala. Overview of the process, use of gas and waste – Cecilia Ekvall

Swedish policy on recycling of resources

Stig Ledin

The ”umbrella” is the Swedish environmental policy

The parliament has decided on 15 national environmental quality goals, defining the state of the Swedish environment, goals reached within one generation.

These 15 goals are based on 5 basic values: An ecologically sustainable development shall promote the health of people, protect biodiversity and other natural values, take care of the cultural environment and cultural historic values, and safegard a good use of natural resources.

The parliament has also decided on strategies to reach the goals. We are looking for measurements that give synergetic effects and contribute to the reaching of several of the environmental goals.

The ”Recycling strategy” – strategy for poison free and resource effective recycling is one of those strategies.

The ”Recycling strategy” includes the flow of material and products during the whole life cycle. In the context, also energy use during the life cycle is included.

The intention is to – at first hand - diminish the generation of waste through changed consumption and production patterns

Secondly, the resource that waste represents, should be used as far as possible and at the same time the influence on and risk for environment and human health should be minimized

EU-states, with Sweden included, has agreed on an hierarchy when handling waste:

The waste should be reused or regained, e.g. through **use of the material** or **burning for energy**. Use of material has a higher priority than burning for energy.
Dumping on landfill has the lowest priority.

It is not always easy to decide on reuse or burning

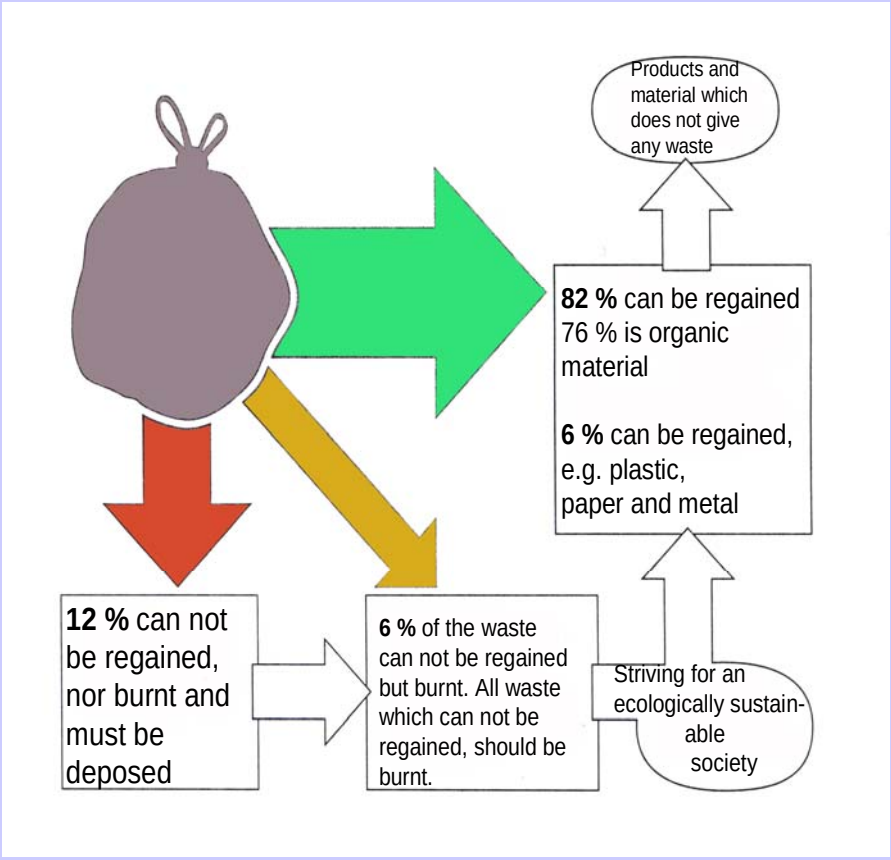
Malfuntioning reuse of material can result in diffuse spreading of dangerous substances, e. g. compost must be ”clean”

The public must accept the system used
It must be easy to sort and get rid of waste

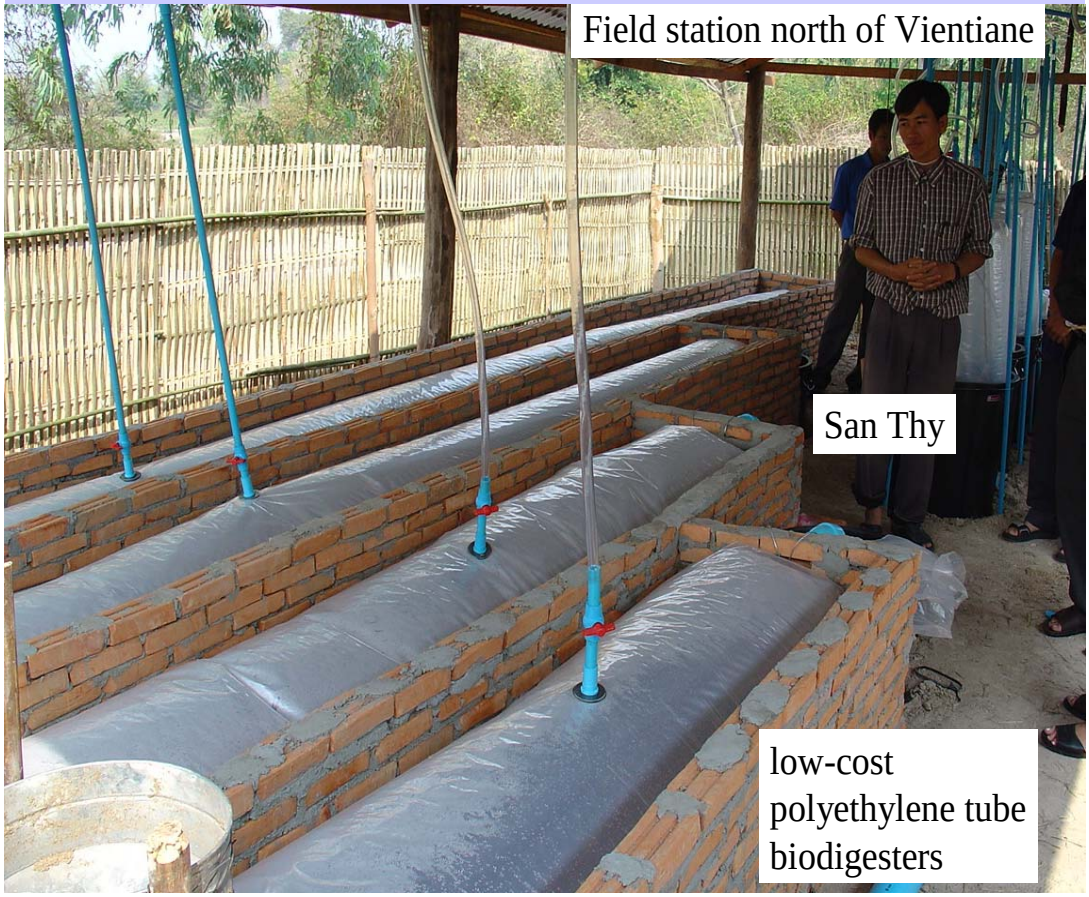
Suggested by the government:
By the year 2010 at least 35 per cent of the food waste from households, restaurants, large kitchens, shops, shall be regained through biological treatment. The aim includes sorted at the source foodwaste for home composting as well as for central composting.

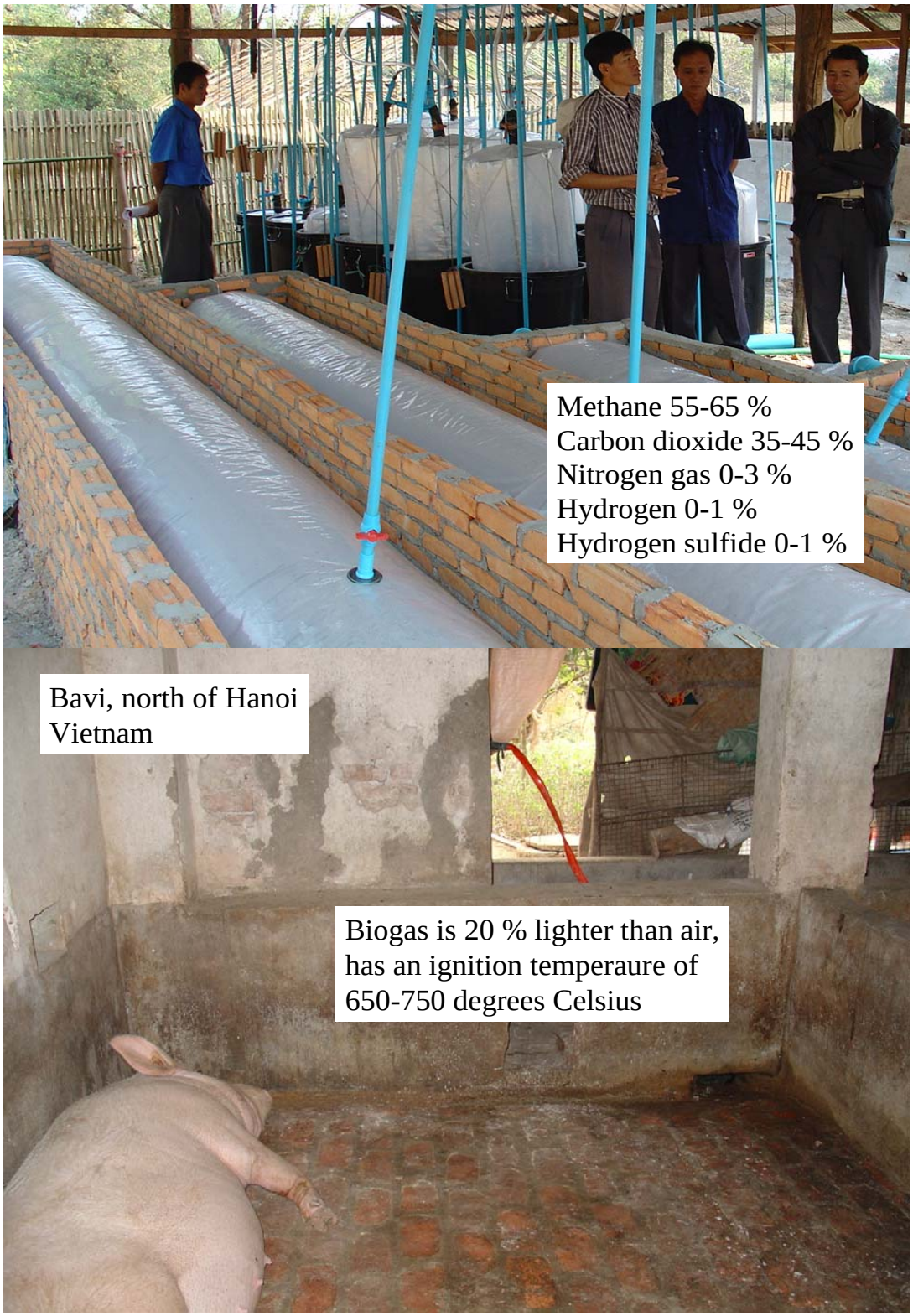
By the year 2010 foodwaste and comparable waste from food industries (and similar places) shall be regained through biological treatment. The aim includes such waste that is not mixed with other kinds of waste and has such a quality that it is suitable to return to food producing land.

Since the year 2002 it is forbidden to put sorted material, that can be burnt on landfill



Biogas digesters in small scale, on farm applications
– experiences and examples from South East Asia
Stig Ledin




Methane 55-65 %
Carbon dioxide 35-45 %
Nitrogen gas 0-3 %
Hydrogen 0-1 %
Hydrogen sulfide 0-1 %
Bavi, north of Hanoi
Vietnam
Biogas is 20 % lighter than air,
has an ignition temperaure of
650-750 degrees Celsius

Bui Xuan An, 1996. The impact of low-cost polyethylene tube biodigesters on small scale farms in Vietnam

San Thy, 2003. Management and utilization of biodigesters in integrated farming systems.

Tubular plastic biodigesters for anaerobic digestion to convert organic matter to biogas and effluent.

Factors that influence biogas production:

- Temperature
- Concentration of solids
- Retention time
- Volitile solids (VS) and loading rate
- Inoculation
- pH-values
- Feed material and nutrients
- Mocrobiologi and biochemistry

Biodigester effluent

The quality of effluent coming from a biodigester depends on the charging rate and retantion time, while the quality of the fertiliser depends on the nature feedstock, its composition, the loading rate and retention time

Temperature
Bacteria are clasified according to their preferred temperature:
Spycrophilic 10- 20 degrees Celsius
Mesophilic 20-30 ←
Thermophilic 45-60

Concentration
In temperate latitudes (China) 6% in summer, 10-20% in winter and spring

Optimum concentrations for pig manure 60 g/litre with a retention time of 10 days (San Thy et al., 2003)

Retention time
"97 % of the total yield of gas from fermenting cattle manure will be produced in a period of 50 days at 35 degrees Celcius (Chinese experience)

San Thy tried 10, 20 and 30 days

Volatile solids (VS) = fermentable solids, and loading rate
Typical values between 0.2 and 2 kg VS/cubic metre and day

Inoculation
Taking some of the effluent (10 –30 % of daily input) and putting it back into the digester is a way of inoculating the fresh manure with the active microbial flora

pH values

Neutral pH
Below 6 and above 8, the process will be inhibited

Feed material and nutrients
Large number of feedstock, including animal manure, human waste, crop residues, food processing- and other wastes, or a mixture of one or more of these

Microbiology and biochemistry
In the mesophilic digestion, pathogenic organisms like enteric bacteria, fungal spores, parasite eggs are reduced

Hovgården Landfill

- Established in 1971
- An area of 3,5 hectare
- Incoming waste from households and industries are
  - sorted
  - treated
  - sent to landfill

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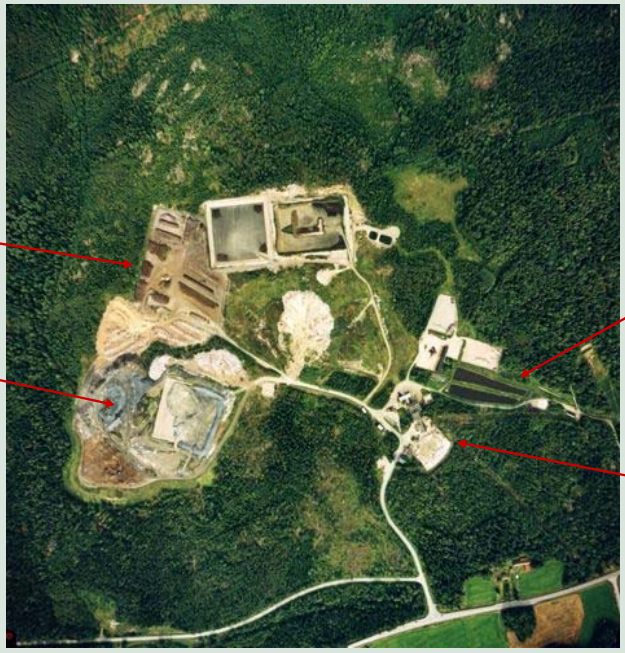
Aerial photograph of Hovgården



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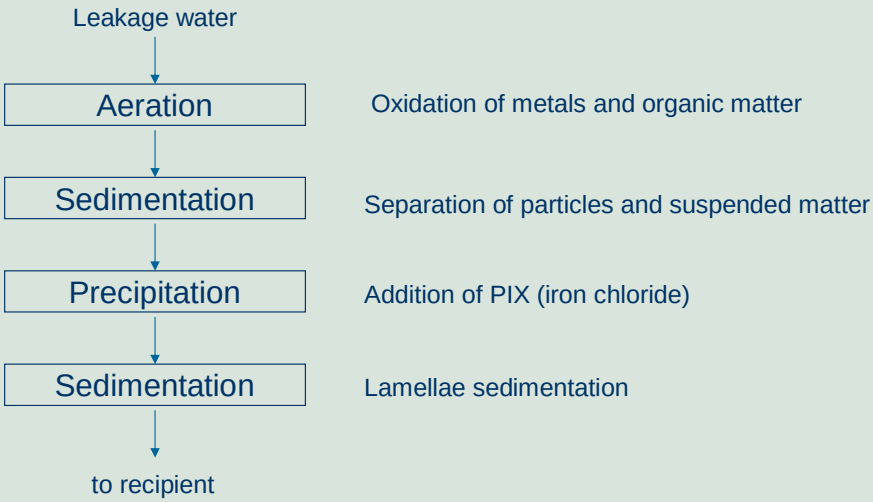
Treatment of leakage water



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Composting system in Uppsala

- A municipal responsibility
- Collected in separate containers at the house with separate cars
- Treatment of source separated organic house hold waste

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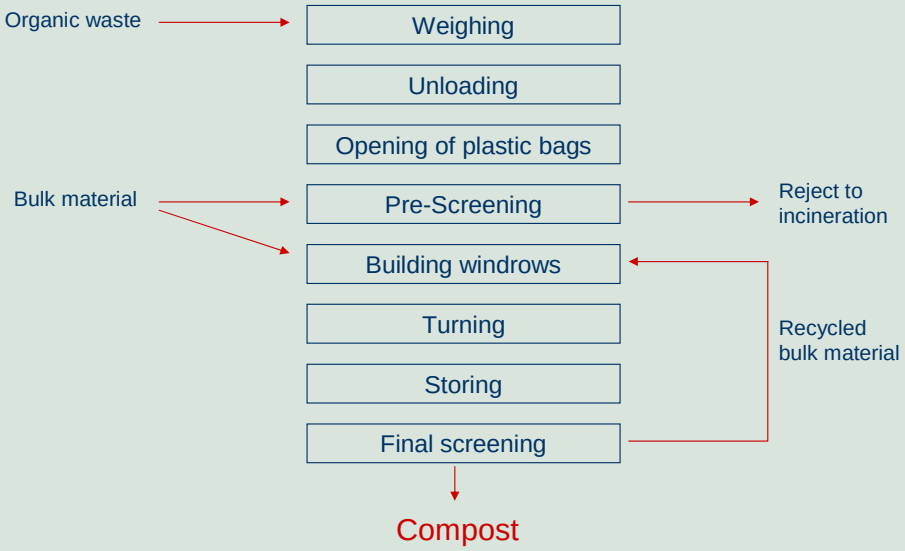
Composting system in Uppsala

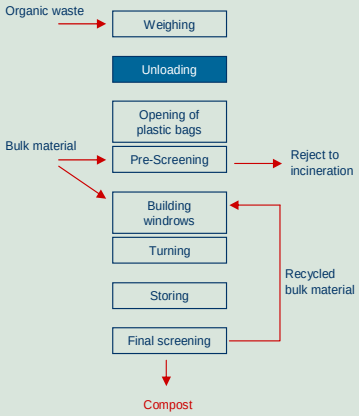
- Organic household waste – 8 000 tons per year
- Green waste – 4 000 tons per year
- Windrow system, non forced aeration
- Compost – 2 500 tons per year

Generalized process diagram



Unloading

- About 20-25 tons per day



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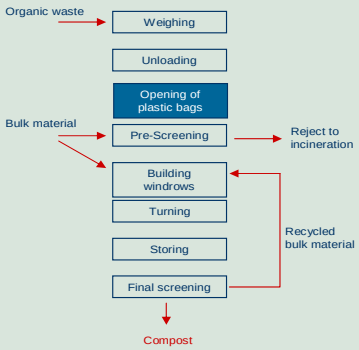
Loading and opening of plastic bags



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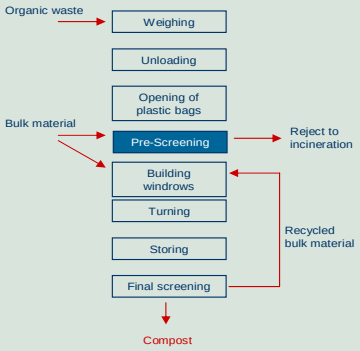
Pre-screening

- Separation of plastic bags
- About 1 200 tons of reject per year



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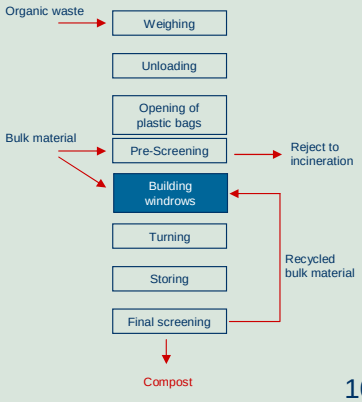
Composting process

- Periodically turning
- Full treatment in 6-8 months



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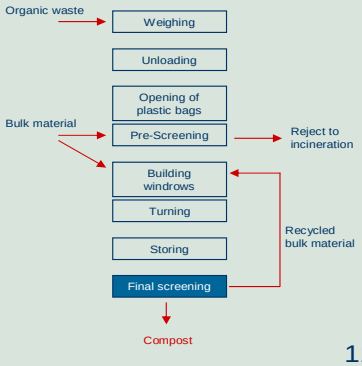
Final screening



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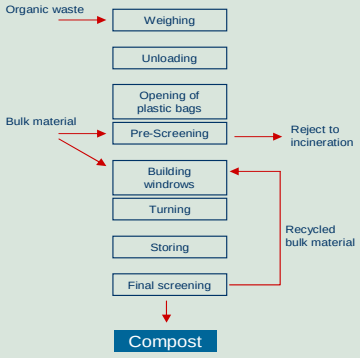
Compost

pH = 8 DS = 50-55%

Nutrients in the compost

Nitrogen (N)	20 kg/ton DS
Phosphorus (P)	4 kg/ton DS
Potassium (K)	10 kg/ton DS



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Composting of biological waste

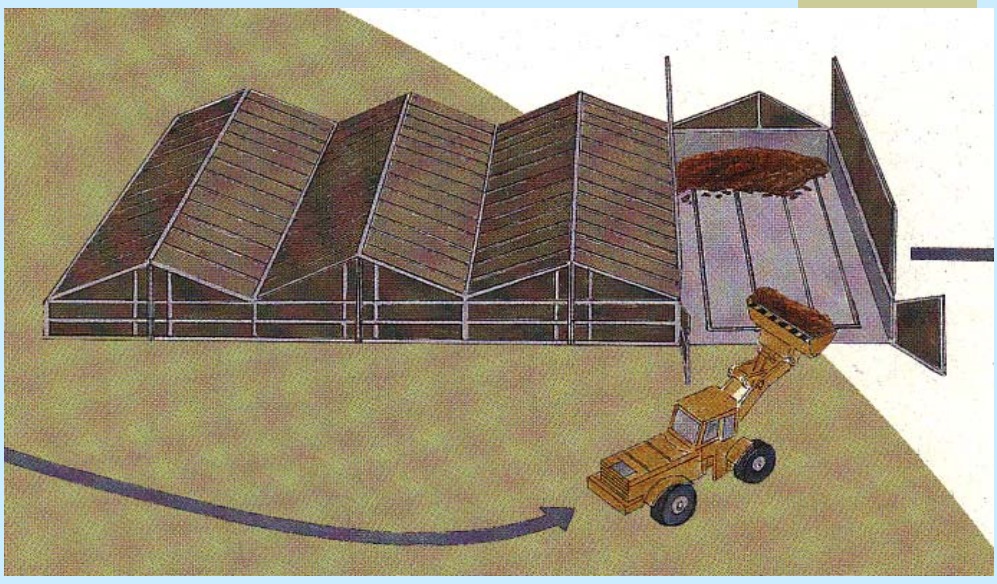
Cecilia Sundberg
Swedish University of Agricultural Sciences, SLU

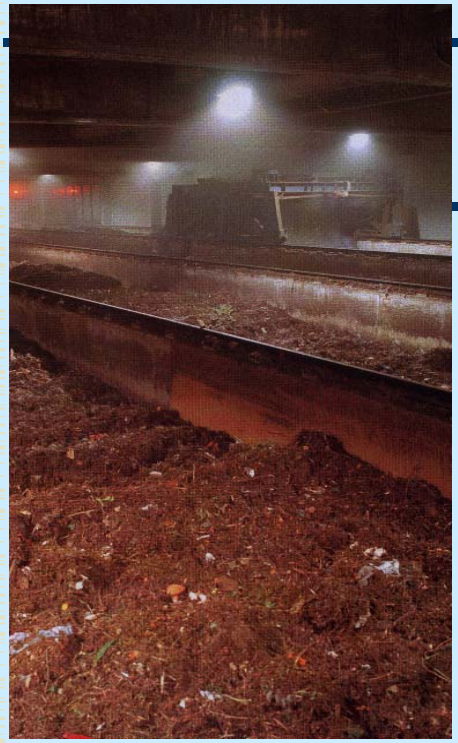
Why composting?

- Technology
- Economy
- Environment
- Waste to resource
- Health

Windrow composting

Membrane composting





Mechanised composting

Back-yard composting

Back-yard composting

- Very simple technology
- Local use of compost
- No transport of waste
- Public information required
- Promoted in many municiplities
  - Reduced waste collection fee

How does it work?

- Living process
  - Microorganisms - bacteria, fungi
  - Moisture, oxygen, temperature, pH
- Energy processing
  - Heat
- Transformation of organics
  - Waste to soil

Aerobic microbial decomposition

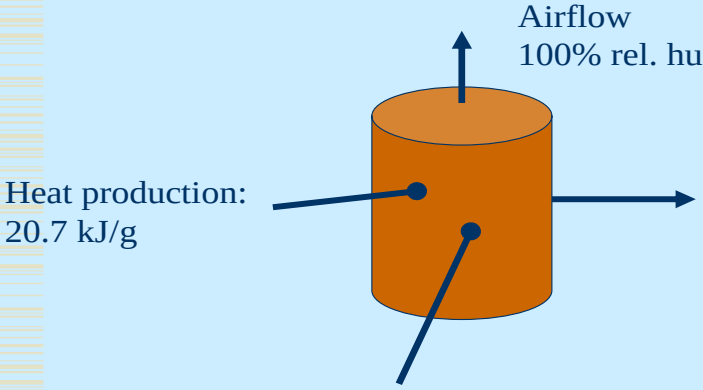
organic matter + oxygen → carbon dioxide + water + heat

- The rate of degradation is determined by the factors that affect microbial growth:
  - Oxygen, temperature, substrate, moisture, pH

Substrate preparation

- Energy
  - Organic matter: crop waste, leaves, wood
- Structure
  - Aeration
    - Cooling
    - Oxygen supply
- Moisture

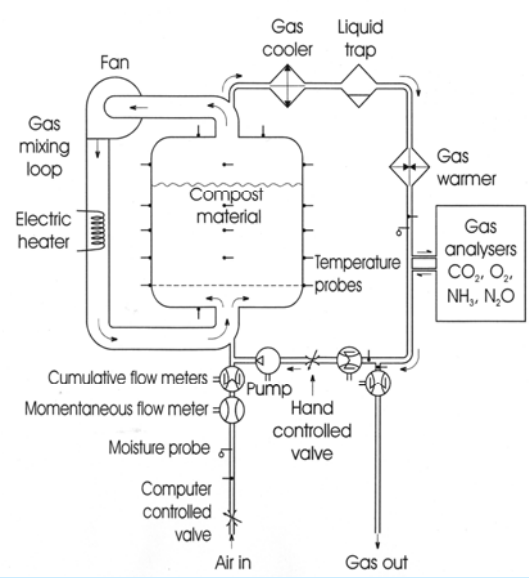
Heat & scales



Composting research at SLU

- More composting in Sweden– need for knowledge
- Fundamental process understanding
  - Temperature, oxygen
  - Carbon, nitrogen
  - Microbial processes
- Better processes in practice
  - Efficiency
  - Environment

Research reactors



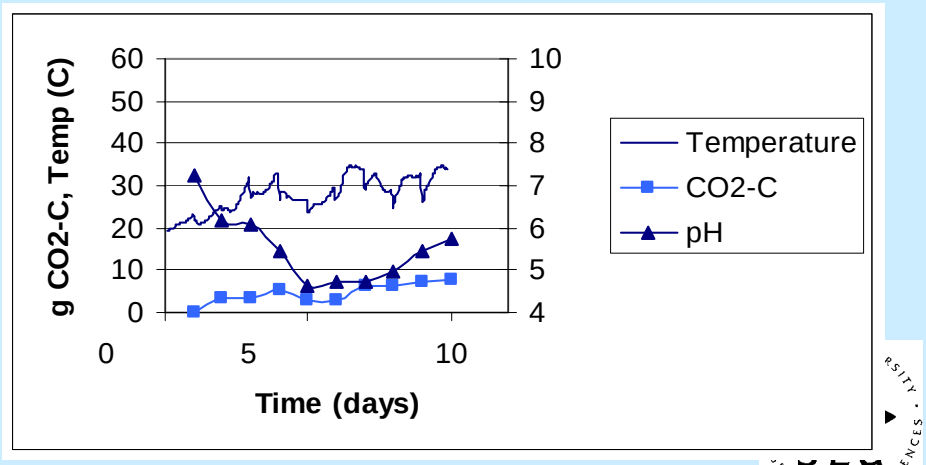
Research reactors

Research reactors

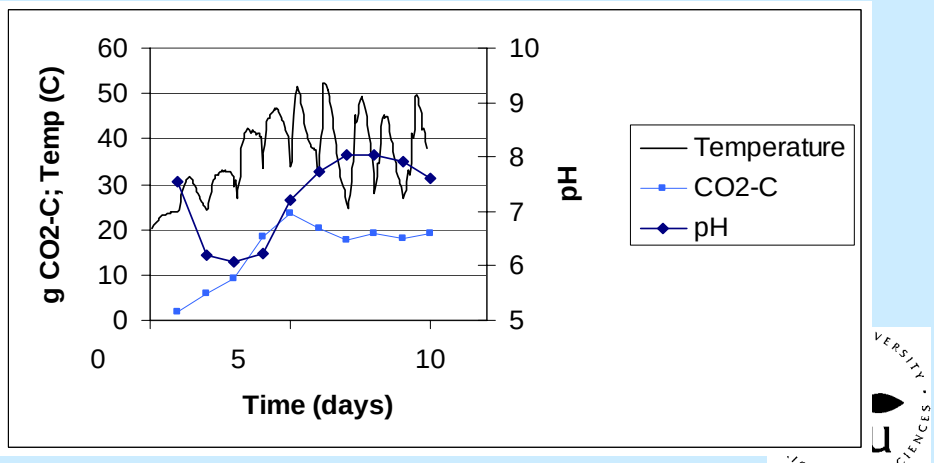
Research project – low pH

- Possible to handle low-pH compost without chemical additives?
- Starting culture of active compost
  - Structure
  - Microorganisms

Little starting culture - Failing process



More starting culture – Well-functioning process



Concluding remarks

- From waste to compost
  - Efficient waste management
  - From landfilling to recycling
- Composting research
  - Fundamental understanding
  - Improved process strategies

Uppsala Biogas plant

Biogas: Why ?

- Waste treatment
- Energy recovery
- Recycling of nutrients

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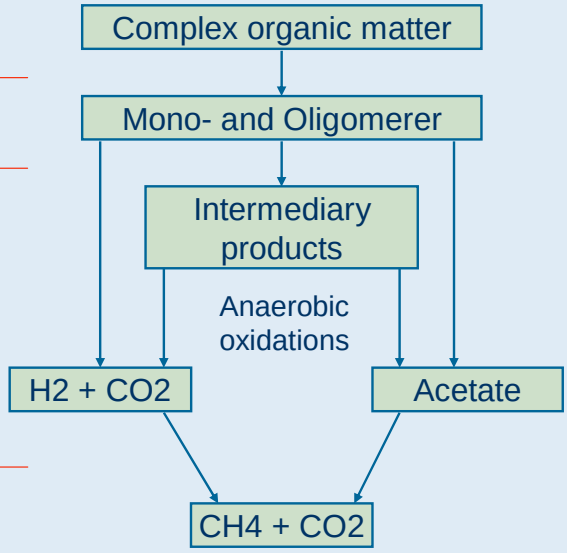
The Biogas process

Hydrolysis

Fermentation

Methanogenesis



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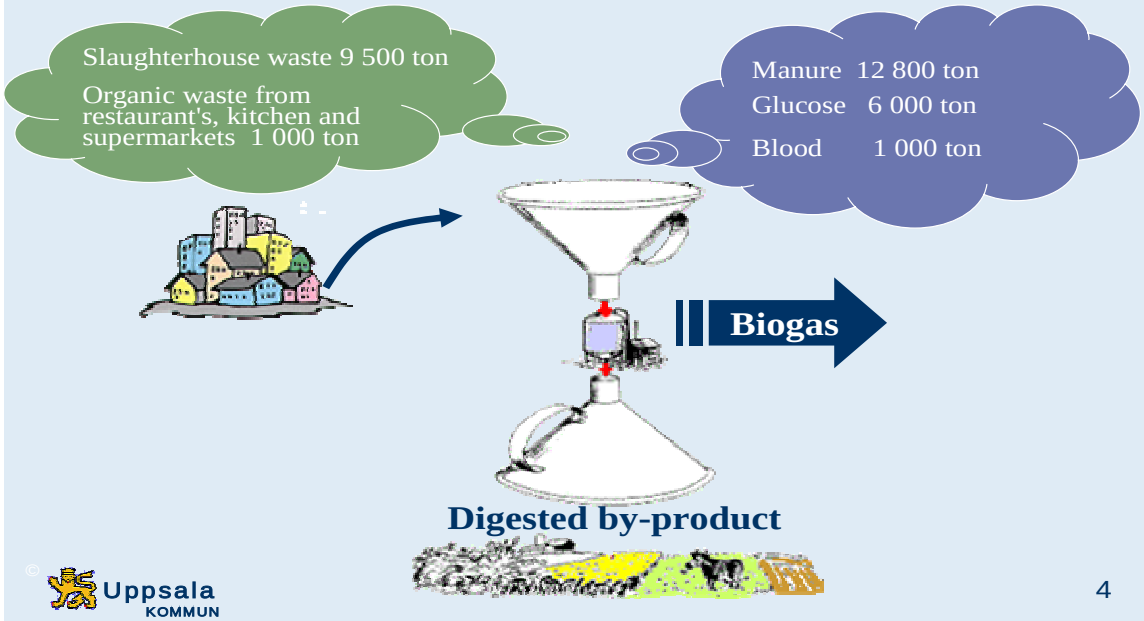
Input to the biogas plant



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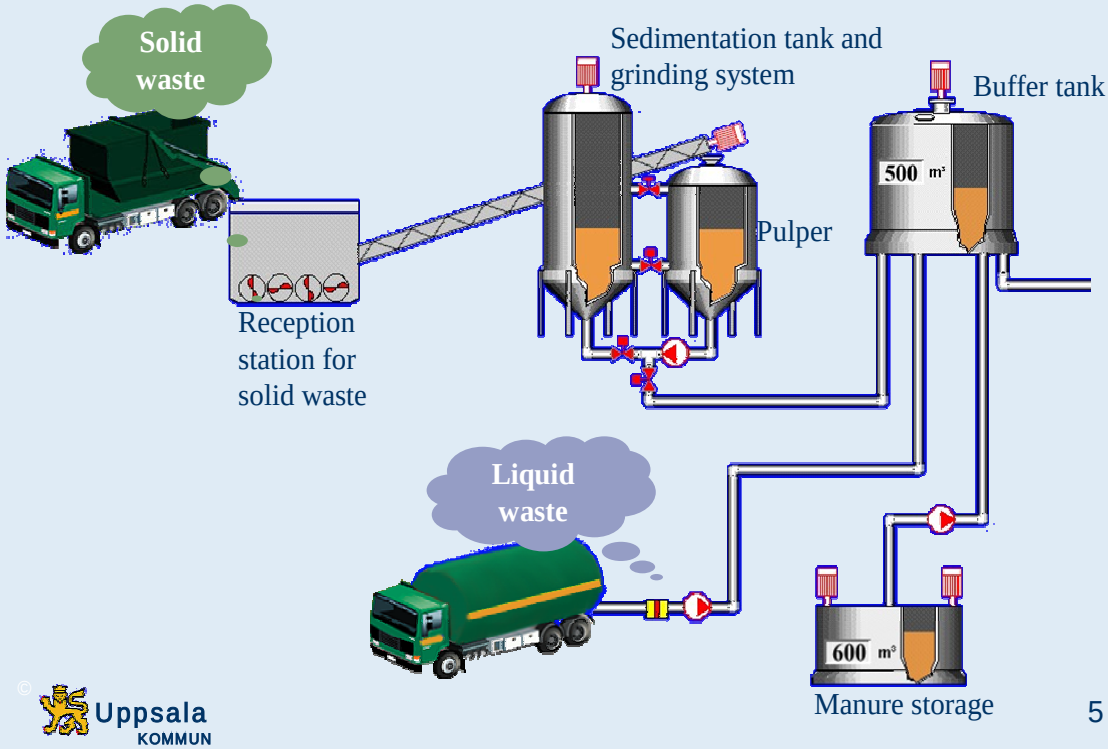
Reception equipment on the biogas plant



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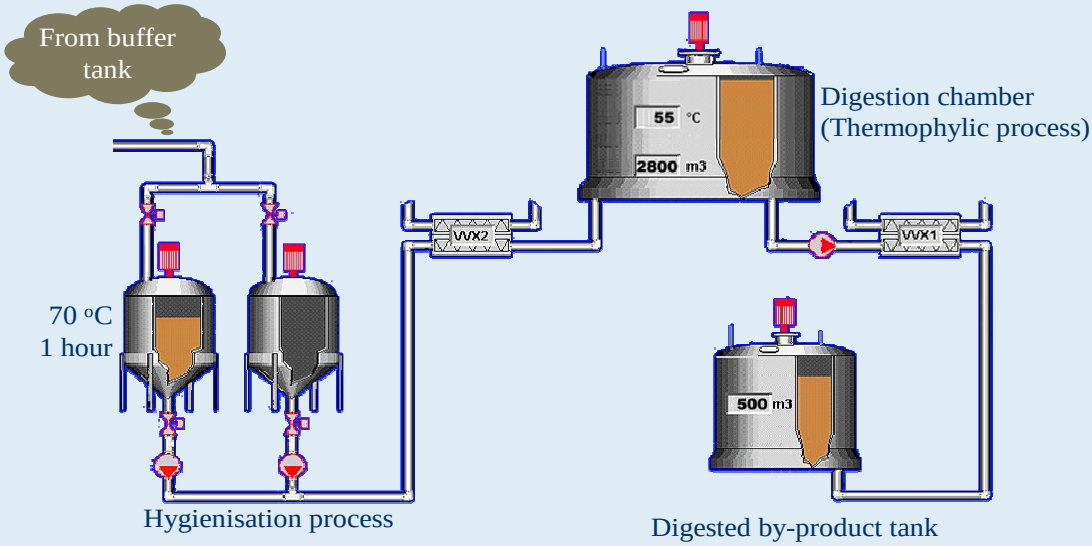
Hygienisation



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6

The digested by- product

Nutrients in the bio-manure

Nitrogen (N)	2,9 kg/ton
Phosphorus (P)	0,6 kg/ton
Potassium (K)	1,4 kg/ton

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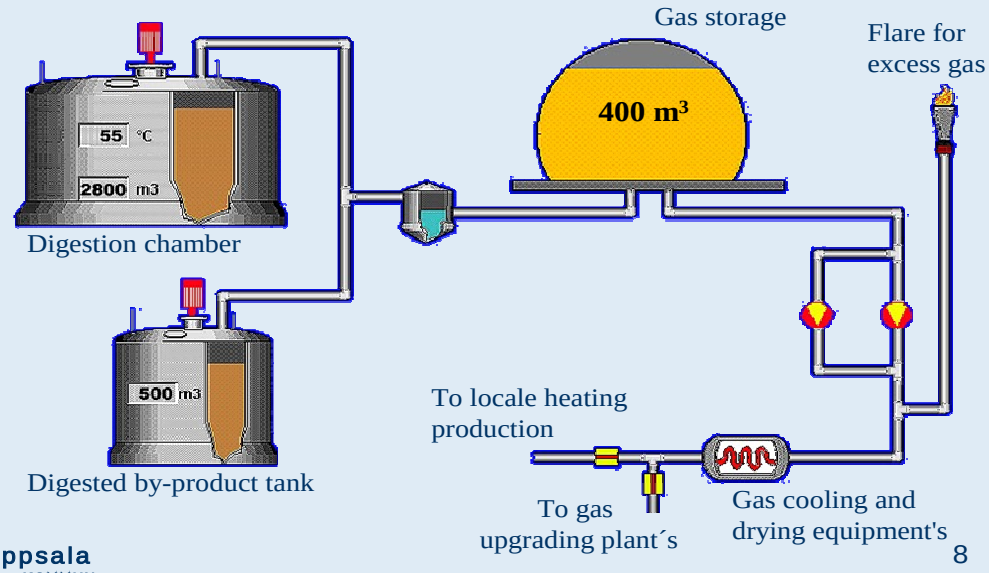
7

Gas equipment in the biogas plant



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Gas upgrading plant and LNG-plant

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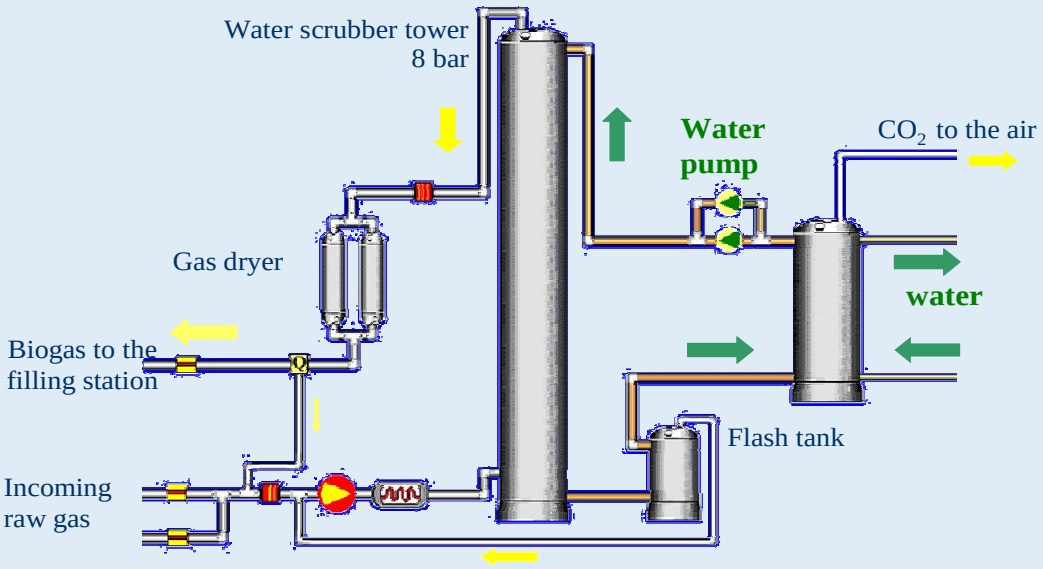
Gas upgrading plant



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Filling station

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11

Biogas vehicles

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City of Uppsala

City council

Boards

Board of Water and waste

Board of Direct Services

Offices

Water and waste office

Tommy Högström

Water and waste director

……..

Waste department

Magnus Källman

Chief of waste department

Direct service office

Ulla Holmgren

Managing director

……..

Water and waste services

Hans Andersson

Head of water and waste department

Commissioned work

Uppsala KOMMUN
VA-OCH AVFALLSKONTORET

General discussion

- Participants observed that garbage utilization/disposal in Uppsala Sweden was very well organized and handled, so, they asked the Swedish team to give Uganda some pointers, and these were some of the recommendations
  - Involve people in decisions
  - Disseminate/sensitize a lot, include primary schools e.g. through use of pictures
  - Start early, for example, the process of discussing the environment have been going on for a very long time]
  - Levy taxes for removal
  - Encourage education of communities, educated people adopt such ideas more quickly
  - Landfills should be used as a last alternative
  - Uganda should opt for low-technology options if they are to sustain or break even in recycling programs
- The discussion on biogas – The debate hinged on suggestions for further research, such as, looking at ways in which market/urban garbage can be processed to enhance its decomposition and hence its use in biogas production. Since the effluent in the biogas system has been found to be a good fertilizer, research efforts should be directed to that part also.
- On the issue of composting, the views of the people were divided: some believed composting for sale to be a profitable venture, whereas others had experiences of not breaking even. The advice was that though composting is a very good method of recycling garbage, it should not be the only focus. Members were argued to look at different options/steps of recycling garbage, identify the different players and then assess remunerations and incentives.
- It was the agreed that problems are challenges, so what is needed is to look for ways around the problems and not to give up. Let knowledge (research) lead us, explore different ideas, and if potential areas are identified, then make sure that communities are educated accordingly.

3.0 FIELD TRIPS

On the second day of the workshop participants were divided into two groups depending on what tour members preffered. Members were argued to make observations and relate the situations to the discussions of the previous day.

- Group A, visited Kalerwe market to observe the garbage situation; they then proceeded to Kitezi which is the KCC landfill site where they were given a guided tour through the different processes. The last stop was at MUARIK where they visited the experimental facilities/animals of the livestock project on garbage utilization.
- Group B, visited Nakawa market to assess the garbage situation, and then proceeded to Mukono where they visited a composting plant (Talents Call Club) and also visited a farmer who had benefited from the compost.

Plenary discussion of field trip experiences

Members thanked the organizers of the workshop for having included the field trips to assess the situation firsthand. Most of the discussion was in the form of suggestions for the way forward.

- Talent call club requires precise information on perfecting the art of composting.
- Garbage as animal feed – the research need to go further in aspects of drying and packaging best combinations.
- KCC should start a culture of giving tenders to groups with the objective of utilizing the garbage e.g. composting it. This would reduce on the amount going to the landfill and at the same time help in promoting soil fertility management on farms that would use the compost. This should go hand in hand with sensitization of the communities as a way of marketing the composting idea.
- Kavera (polyethylene paper) was given as a big problem as far as waste management is concerned. Members suggested that the onus of recycling plastic materials should be put on the firms that produce them, as is the case with many developed countries.
- On the issue of sorting, members argued that as far as the current situation goes, people don't see the need to sort garbage since everything ends at the dumpsite. If people were made to realize that sorting is for a good cause, then they would be more inclined towards it. In fact some people are already sorting garbage in Kampala, what is missing is

effective demand for the sorted product. Communities should also be sensitized to sort at source.

- KCC ordinance: KCC states that waste should be sorted however to compost tit, you need a license! So, where will the sorted waste go? Such things need to be ironed out.
- Members agreed that there is a need to form a lobby group to knock at the doors of policy makers, local authorities and other stakeholders to see how to integrate waste management their plans. There is need for a policy to govern garbage.
- Members observed that the landfill approach is not sustainable as the garbage is already "a mountain" at Kitezi. KCC will be forced to shift to another site in three years time. KCC needs to think twice before leaping at the plan to find another landfill. Let KCC explore better options first.
- In conclusion, the plenary agreed that the way forward should be in the form of:
  - Redefine 'waste'. According to the law in Uganda, 'waste' cannot be used.
  - Look at such laws and see how to amend them
  - Networking is the way to go. Lets gather more information, sensitize people, and clearly identify areas of focus from our discussions and observations.
  - NGOs that want to be part of the network should make sure they are officially registered.

4.0 CLOSING CEREMONY

4.1 Remarks by workshop convener

- Professor Sabiiti informed members that in planning, they were skeptic about peoples' interest but were optimistic and some people were calling and indicating interest. He was very impressed by the turn up and took it as an indicator of the interest in the program, which gives great hope.
- He informed members that the project has University, local, international, political and donor support. On behalf of the University team, he pledged to keep mobilizing the people. He argued NGOs to get together and solve this problem.
- He thanked Dr. Hannah Akuffo who gave the consent to hold the workshop using funds that had been meant for something else.
- He thanked the team and students. He informed members that students are the core of the program. He argued the students to strive for success and to take the opportunity to work with some of the participants as collaborators.

- He thanked the media for their participation and said “together we can talk and be heard”. He argued them to pick the points that would capture society.
- He informed members that MU has changed, we now do research that addresses real problems of communities. The key is to combine the science of research with applicability to communities. He argued for cooperation on both sides.
- He thanked Dr. Stig Ledin for agreeing to collaborate on the program when first approached. He also thanked him for finding supervisors for the students.
- He ended by thanking the Faculty for the support they have rendered to the project.

4.2 Remarks by one of the participants Mr. Biretwa

- He started by thanking the organizers for the opportunity to participate in the workshop. Thanked the convener for initiating this venture and bringing people together.
- He said that the workshop portrayed participatory as well as educational aspects, which should be the way to go.
- He said that for any venture to succeed, beneficiaries have to be involved and that nobody has monopoly of knowledge.
- Mr. Biretwa thanked the students who will sustain the program because the more capacity built, the better. He argued MU to continue and build more capacity, have exchange programs and in future, give opportunity to other disciplines such as social sciences and management a chance also.
- He argued researchers to find the best method to utilize the garbage.
- He ended by thanking all for their participation. He wished the students the best in their programs.

4.3 Remarks by the Swedish Coordinator – Stig Ledin

- Dr. Stig thanked the hosts for the good care they have extended to him and his team. He informed members that they were a team of eight (8) from Sweden including one born in Uganda, Erasmus Otabbong, who was also the initiator of the collaboration with the project.
- He said that since members had seen and defined the problem, suggested solutions, the way forward was form a Board representing all groups.

4.4 Remarks from the Dean, FA: represented by Prof. F.B. Bareeba (Deputy Dean)

- He thanked members for the participation and the good ideas.
- He informed members that the Dean could not make it himself as he was at another function.
- Thanked the convener for creating the good environment and for initiating the project. He also thanked the team and the students.
- Thanked the donors for facilitation the research as well as the workshop
- Thanked the visitors from Sweden for agreeing to come here and share with us. He argued them to get time and tour some nice places, “see more than garbage”.
- He thanked participants for the good ideas, which he pledged to use to strengthen the program and the networking.
- He closed the workshop at 5.30 p.m.

Appendices:

Program for the Dissemination Workshop on Utilization of Market Wastes in held on 15-16 April 2004 at Fairway Hotel

Day one: April 15, 2004

Session one:	**Chairperson - Dean, Faculty of Agriculture**
8.00 – 9.00 a.m.	Registration
9.00 – 9.15 a.m.	Remarks from Project Coordinator, Dr Hannah Akuffo
9.15 – 9.30 a.m.	Remarks from the Vice Chancellor, Makerere University
9.30 – 9.45 a.m.	Remarks from the Mayor, Kampala City Council
9.45 – 10.00 a.m.	Opening speech from the Swedish Embassy Representative
10.00 – 10.30 a.m.	Health Break
Session two:	**Chairperson – Dean, faculty of Agriculture**
10.30 – 10.50 a.m.	Overview of the utilization of urban market crop wastes in crop/livestock production systems in the Lake Victoria Crescent region. E.N. Sabiiti
10.50 – 11.10 a.m.	Effects of urban market crop wastes on insect pests and their natural enemies on beans. Karungi, J., S. Kyamanywa and B. Ekbom.
11.10 – 11.30 a.m.	Urban market wastes for soil fertility improvement. Amoding, A., J.S. Tenywa, S. Ledin and E. Ottabong
11.30 – 11.50 a.m.	Effects of feeding varying levels of urban crop wastes on the performance of lactating dairy cows. Nambi, J., E.N. Sabiiti, F.B. Bareeba and E. Spondly.
11.50 – 12.10 a.m.	Urban market crop waste utilization potential in urban and peri-urban areas of Lake Victoria Crescent region. Ekere, W., J. Mugisha and L. Drake.
12.10 – 12.30 p.m.	Discussion
12.30 – 1.30 p.m.	**Lunch**
1.30 – 1.50 p.m.	Commercialization of composted urban market crop wastes in Uganda – F. Lukooya (NGO).
1.50 – 2.10 p.m.	Handling of urban garbage in Kampala City Council – Mayor, KCC
2.10 – 2.30 p.m.	Biogas production from coffee husks – Dr. Ekure, Faculty of Technology.

2.30 – 2.50 p.m.	Utilization of banana stalks wastes in Bushenyi District – Mr. Nsimeki (NGO)
2.50 – 3.10 p.m.	Discussion
3.10 – 3.30 p.m.	**Health Break**
3.30 – 3.45 p.m	Swedish policy on recycling of resources – Stig Ledin.
3.45 – 4.00 p.m	Biogas digesters in small scale, on farm applications - experiences and examples from South East Asia – Stig Ledin
4.00 – 4.15 p.m	Hovgården Landfill, an overview. Handling of leakage water. Composting of household waste - Cecilia Ekvall
4.15 – 4.30 p.m	The benefits of composting. Different ways of composting. The composting process, what is really happening? Important aspects to consider at composting, e.g. moisture, structure of material. Research on composting – Cecilia Sundberg
4.30 – 4.45 p.m	The biogas plant in Uppsala. Overview of the process, use of gas and waste – Cecilia Ekvall.
4.45 – 5.00 p.m.	Discussion

Day two: April 16, 2004

9.00 – 1.00 p.m.	Field tours Group A: Kalerwe market, Kitezi dump sites and MUARIK Group B: Mulago, Nakawa market and Talent call – Mukono
1.00 – 2.30 p.m.	Lunch
2.30 – 4.30 p.m.	Plenary session/presentation by the groups and wrap up by rapporteurs.
5.00 – 5.15 p.m.	Remarks by the workshop convener – Prof. E.N. Sabiiti
5.15 – 5.30 p.m.	Remarks from collaborating institutions – Dr. Stig Ledin
5.30 – 5.45 p.m.	Remarks from Dean Faculty of Agriculture
5.45 – 6.00 p.m.	Remarks from Director – Graduate school
6.00 – 6.15 p.m.	Remarks from Sida/SAREC – Dr. H. Akuffo

List of participants

Name	Designation
1. His Excellency Mr. Eric Åberg	Swedish Ambassador to Uganda
2. His Worship Mr. Sebbana Kizito	The Mayor, Kampala City Council
3. Professor J.M. Ssebuwufu	The Vice Chancellor, Makerere University
4. Professor Mateete Bekunda	Dean Faculty of Agriculture
5. Professor E.N. Sabiiti	Workshop convener
6. Mr. E.R. Nsimeki	RUASSA, Mbarara
7. Mr. A.K. Tumusiime	Urban planner, Appropriate Technology
8. Mr. Klaus Kenpo	IPS, Kampala
9. Mr. Elijah Kirumira	COBSS, Uganda
10. Mr. M.A. Mbaziira	COBSS, Uganda
11. Dr. H. Jonsson	SLU, Sweden
12. Mr. Joel Masembe	Box 3159, Kampala
13. Mr. Moses Katu	Deforestation Assoc, Kayunga
14. Professor Erasmus Otabbong	SLU, Sweden
15. Mr. J.A. Biretwa	Box 9564, Kampala
16. Mr. Banadda Nswa	UEPF, Kampala
17. Prof. F.B. Bareeba	Faculty Agriculture, MU
18. Prof. Barbara Ekbom	SLU, Sweden
19. Dr. Eva Spondly	SLU, Sweden
20. Dr. Valentine Kasenge	Faculty Agriculture, MU
21. Ms. Frances Nakakawa	Postgraduate, Faculty Agriculture, MU
22. Ms. Cecilia Ekvall	Uppsala Kommun, Sweden
23. Ms. Cecilia Sundberg	SLU, Sweden
24. Ms Kristina Skoog	MFS student, SLU, Sweden
25. Dr. Johnny Mugisha	Faculty Agriculture, MU
26. Dr. Lars Drake	SLU, Sweden
27. Dr. Stig Ledin	SLU, Sweden
28. Mr. Stephen Misango	Box 5593, Kampala
29. Ms. Betty Nabuuma	Faculty of Technology, MU
30. Mr. Mutebi-Mulwanira	Faculty of Technology, MU
31. Mr. Bazira Besigwa	LCIII Councillor, Makindye
32. Mr. Wilson Serunjogi	Talents Call Club, Seeta, Mukono

33.	Mr. Andrew Lutaaya	Physical Planner
34.	Mr. Isaac Katureebe	Homeklin Uganda LTD
35.	Mr. Steven Mugisha	Box 45, Kampala
36.	Mr. Innocent Musinguzi	Journalist
37.	Ms. Patricia Kabatabazi	NAPE Uganda
38.	Mr. David Umbe	Finance, Uganda
39.	Mr. Patrick Turyatunga	Faculty of Forestry, MU
40.	Mr. W. Kiggundu	KCC
41.	Mr. Robert Kiggala	Faculty of Arts, MU
42.	Ms. Sarah Nantale	Faculty of Arts, MU
43.	Mr. M. Eserait	Nakawa, Market
44.	Mr. John Kaganga	Box 9461, Kampala
45.	Prof. Adipala Ekwamu	Faculty Agriculture, MU
46.	Mr. Arthur Namanya	MU
47.	Mr. Ronald Mugenyi	KCC
48.	Mr. Peter Wambulisa	CASEDEV
49.	Mr. Abraham Wasswa	Makerere College School
50.	Mr. Emmanuel Ruguuza	Kabale Municipal Council
51.	Mr. A. M. Rushere	Abantu for Development
52.	Mr. Paul Serwada	Green Hope Uganda
53.	Ms. B. Tibenkana	CASEDEV
54.	Mr. J.B. Kawongolo	MU
55.	Dr. Richard Edema	Faculty Agriculture, MU
56.	Mr. Godfrey Longa	YRNT Uganda
57.	Dr. Margaret Nabasirye	Faculty Agriculture, MU
58.	Mr. Sam Angedakin	MU
59.	Mr. Sam Wamuwala	MU
60.	Mr. Wilson Okaka	Kyambogo University
61.	Mr. Gastone Mogai	NUPA Uganda
62.	Mr. Francis Eilu	MU
63.	Mr. R. Twinomuhangi	Geog Dept. MU
64.	Mr. Robert Wasswa	Journalist
65.	Mr. Arthur Wasukira	Student, MU
66.	Ms. Caroline Arinaitwe	Journalist
67.	Mr. B.V. Byendaimira	Physical Planner

68.	Ms. Alice Amoding	PhD student, MU
69.	Mrs. Nambi Kasozi	PhD student, MU
70.	Mrs. J.K. Tumutegyereize	PhD student, MU
71.	Mr. William Ekere	PhD student, MU
72.	Mr. Francis Ogwang	Student, MU
73.	Mr. Ivan Rwomushana	Student, MU
74.	Mr. Francis Mukunya	Student UMI
75.	Mr. Sula Kigongo	Kalerwe market
76.	Mr. M. Mutumba	JEEP
77.	Mr. Martin Wambede	Box 2551 Kampala
78.	Mr. Edward Semakula	Faculty of Agriculture, MU
79.	Mr. John Kabalizi	Journalist
80.	Mr. Arnold Ntungwa	Buganda Road Primary Sch.
81.	Mr. Martin Kibirige	IIBMS
82.	Mr. E. Kabishanga	Uganda Land Alliance
83.	Mr. O.P. Kwesiga	Student, Busoga University
84.	Mr. Ronald Mupali	Student, MU
85.	Mr. Fred Waiswa	Planner, Jinja
86.	Ms. J. Muhumuza	Karoli, Jinja
87.	Mr. A.B. Kyenji	Health Inspector Mu
88.	Mr. Charles Makinoth	Y&E, Nakawa
89.	Mr. C. Rwami	IPH
90.	Ms. M. Lubega	KCC
91.	Mr. Kasimba Bisangwa	Box 10820 Kampala
92.	Dr. S. Kyamanywa	Faculty of Agriculture, MU
93.	Dr. J.S. Tenywa	Faculty of Agriculture, MU
94.	Dr. M.M. Tenywa	Faculty of Agriculture, MU
95.	Mr. L. Ssempija	Journalist