

**PROCEEDINGS OF THE SYMPOSIUM ON ALTERNATIVE APPROACHES TO
URBAN MARKET CROP WASTES MANAGEMENT HELD On JULY 14, 2005
AT HOTEL EQUATORIA, KAMPALA**

Edited by E N Sabiti-Coordinator and J Karungi PhD Student

JULY 2005

Program for the Symposium on Alternative Approaches to Urban Market Crop Wastes Management held on July 14, 2005 at Hotel Equatoria, Kampala

Session one: Chairperson - Dean, Faculty of Agriculture

- 8.00 – 9.00 a.m. Registration
- 9.00 – 9.15 a.m. Remarks from Workshop Convener, Prof. E.N. Sabiiti
- 9.15 – 9.30 a.m. Remarks from the Vice Chancellor, Makerere University
- 9.30 – 9.45 a.m. Remarks from His Worship, the Mayor, Kampala City Council
- 9.45 – 10.00 a.m. Remarks from His Excellency the Ambassador of Sweden to Uganda
- ~~10.00 – 10.30 a.m.~~ **Health Break**
- 10.30 – 10.50 a.m. Video Documentary on the garbage situation in Uganda
- 10.50 – 11.10 a.m. Overview of the urban market crop wastes utilization Program **Prof. E.N. Sabiiti**
- 10.10 – 11.30 a.m. Crop wastes soil amendments as a tool in integrated pest management of vegetables. **Ms. J. Karungi**
- 11.30 – 11.50 a.m. Urban market wastes for soil fertility improvement. **Ms. A. Amoding**
- 11.50 – 12.10 a.m. Effects of utilization of urban crop wastes on the performance of lactating dairy cows. **Ms. J. Nambi**
- 12.10 – 12.30 p.m. Socio economic implications of urban market crop waste utilization in urban and
peri urban areas **Mr. W. Ekere**
- 12.30 – 1.00 p.m. Discussion
- ~~1.00 – 2.00 p.m.~~ **Lunch**

Session two: Chairperson - Director, Graduate School

- 2.00 – 2.30 p.m. Way forward, Coordinator Prof. E.N. Sabiiti
- 2.30 – 3.30 p.m. Plenary session
- ~~3.30 – 4.00 p.m.~~ **Health Break**
- 4.00 – 4.15 p.m. Wrap up by the workshop convener – Prof. E.N. Sabiiti
- 4.15 – 4.30 p.m. Remarks from Dean Faculty of Agriculture
- 4.30 – 4.45 p.m. Remarks from Director – Graduate school

List of participants

Name	Designation/Institution
1. Mr. Jens Berggren	Programme Manager, Swedish Embassy to Uganda
2. Dr. Christine Dranzoa	D/Director, School of Graduate Studies, MUK
3. Prof. Mateete Bekunda	Dean, FA, MUK
4. Prof. E.N. Sabiiti	Convener, MUK
5. Prof. F.B. Bareeba	D/Dean (Training), FA, MUK
6. Dr. Margaret Nabasirye	Deputy Dean (Research), FA, MUK
7. Mr. John Behangaana	Secretary General, Urban Authorities Association
8. Mr. Patrick G. Okae	Associate Higher Educ. Officer, NCHE
9. Mr. Patrick Ojiroi	Journalist, Radio Uganda
10. Mr. Peter Walekwa	Lecturer, MUK
11. Mr. Paul Sendi	Teacher, Baptist High, Kitebi
12. Mr. Job Mwaka	Graduate Student, MUK
13. Mr. Patrick Kyambadde	Agricultural Officer
14. Mr. Tali Peter Driliga	Student (077836566)
15. Mr. David Abiti	Associate Coordinator
16. Dr. S. Kyamanywa	Associate Prof., MUK
17. Mr. Patrick Jaramogi	Journalist, New Vision
18. Dr. Imelda Nalukenge	Lecturer, MUK
19. Mr. Elijah Kirumira	Director, GSLM
20. Mr. Steven Mwirumbi	Researcher
21. Mr. Idd Busajja	Principal, Health, Entebbe
22. Mr. Moses, H. Lubinga	Student, MUK
23. Ms. N.B. Turyasingura	Headteacher, Buganda Road PS
24. Mr. Stephen Ntambi	teacher, Buganda Road PS
25. Mr. Moses Kato	Rural Devt
26. Ms. Rene Murwaje	Researcher, CRM
27. Mr. William Ekere	Lecturer, MUK
28. Mr. Francis Ogwang	Student, MUK
29. Mr. J. Kalyesubula	Journalist
30. Ms. Alice Amoding	Graduate Student, MUK
31. Dr. M.S. Rwakaikara	Lecturer, MUK
32. Mr. John Oteba	Agent
33. Mr. Francis Aduka	Environmental alert
34. Mr. Morris Okeny	Student
35. Mr. Abel Atwiine	Agent
36. Mr. Enoch Mutabazi	Ultimate Media
37. Mr. Richard Kirembeki	Journalist, Bukedde
38. Mr. James Bakunzi	Journalist, Daily Monitor
39. Mr. Mike Kitara	Student
40. Mr. Michael Kamugisha	Student
41. Mr. Samuel Okello	
42. Mr. Steven Kwesiga	Centre for Basic Research
43. Mr. Moses Ndhaye	Journalist, K-FM
44. Ms. Lilian Parmu	Journalist
45. Ms. Jane Nafula	Journalist, Daily Monitor

46. Ms. Justine Nambi Kasozi	Lecturer/Graduate Student, MUK
47. Mr. Anatoli Kirigwajjo	Agric. Teacher, St. Balikuddembe SS
48. Mr. Dan Mivule	Kampala District Farmers' Assoc.
49. Mr. Jod Masembe	C/Person, Uganda farmers Assoc.
50. Mr. Francis Lakidi	Communications Officer, Gulu University
51. Mr. Alex Akona	Program Officer, UCSD
52. Mr. Danson Nabaasa	Journalist, Radio West
53. Mr. Steven Kamaanya	Prog. Coordinator, YACA
54. Mr. Innocent Muhereza	Proj. Coordinator, Uganda Coop Alliance
55. Ms. Z. Nakabuggo	Journalist, K-FM
56. Mr. Ismail Mubiru	Prog. Officer, UPEN
57. Mr. Sam Musiime	Researcher, Kawanda (NARO)
58. Mr. Dan Mukiibi	Researcher, TWPM
59. Mr. Milton Mugizi	Journalist, Impact FM
60. Mr. S. Semakula	Reporter, Power FM
61. Mr. Richard Bwanika	Researcher, CADI
62. Mr. Stephen Lwasa	Manager, MUARIK, MUK
63. Mr. M. Wasswa	Manager, MUARIK
64. Mr. G. Juru	Prog. Coordinator, Wednet
65. Mr. Roger, Kamugasha	Exec. Sec, Wednet
66. Dr. J.S. Tenywa	Senior Lecturer, MUK
67. Mr. Samuel Muwanga	Researcher, MUK
68. Mr. Simon Nampindo	Scientist, Wild Life Conservation Society
69. Mr. Abdallah Gwaivu	Health Inspector, Iganga Town Council
70. Mr. Boniface Orum	Lecturer, MUK
71. Mr. Richard Miiro	Lecturer, MUK
72. Mr. Wilson Serunjogi	Manager, Talents Call Club
73. Ms. Joy Namirembe	Researcher, Talents Call Club
74. Mr. James Muheirwe	ECOTRUST
75. Mr. William Kasozi	Agr/Dairy Farm
76. Mr. S. Banonya	MOH, Jinja
77. Mr. Tom Mugisa	Prog. Officer, PMA
78. Mr. Robert Fingo	Graduate Student, MUK
79. Ms. Jeninah Karungi T.	A/Lecturer/Grad. Student, MUK
80. Mr. James Onyango	Social Worker, Owino Market
81. Mr. Moses Nameta	Town Health Inspector, Ntungamo
82. Mr. J.B. Tumuhairwe	Assist. Lecturer MUK
83. Mr. Pierre Pita	Agro-economist, CIMS
84. Ms. Ruth Nakatudde	Urban Officer, Wakiso District
85. Mr. Robert bariyanga	Student, MUK
86. Mr. Francis Emorut	Journalist, New Vision
87. Ms. Jackie Acan	Journalist, daily Monitor
88. Ms. C.M.K. Nantumbwe	Student, MUK
89. Mr. Sam Sessanga	Lecturer, MUK
90. Ms. Berina Owimbabazi	E/A Officer, NEMA
91. Mr. Joseph Bakaki	Farmer

List of acronyms

CAEC	Continuing Adult Education Centre
FA	Faculty of Agriculture
KCC	Kampala City Council
MCW	Market Crop Wastes
MU	Makerere University
MUARIK	Makerere University Agricultural research Institute, Kabanyolo
NEMA	National Environment Management Authority
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, and called upon the convener to offer the basis of the symposium.

1.1 Remarks from the convener of the Symposium: Professor E.N. Sabiiti

- He welcomed members.
- He thanked the ambassador for always supporting the project and coming whenever invited.
- He thanked the Dean of the Faculty of Agriculture where the project is housed for the mandate.
- Professor Sabiiti informed participants that the project on waste utilization had started in 2000 with the aim of assessing different ways through which the waste could be turned into a resource in crop/livestock production; and that this June 2005 marked the end of Phase I of the project. The purpose of the symposium was therefore to disseminate the findings from Phase I as well as share views on the way forward. He also informed participants that because of the good work done in Phase I, the donors (Sida/SAREC) agreed to fund Phase II of the project.
- He argued participants to read the distributed publications accruing from the project and help to spread the message. He especially urged personnel from the media (journalists) to ensure that the information was delivered to the communities.
- Prof. Sabiiti the introduced the four PhD students and the scientific team who had been carrying out the research on potential areas of waste utilization and their implications and were going to present their findings and recommendations.
- He urged participants to think about market crop wastes in terms of a resource and hence use it accordingly. He said, "Change usually starts somewhere, and its you and I to start the process".
- He ended by informing participants that this was the third dissemination workshop through which the team has been sensitizing people on the merits of garbage as a resource.

1.2 Opening speech from the Representative to the Swedish Ambassador to Uganda

- The Ambassador was represented by the Program Coordinator, Mr. _ who expressed his happiness at being present at the symposium.
- He informed members that it is not waste but something in the wrong place and said that poor countries should exploit it as a resource citing the example of Tanzania where an entrepreneur is exporting Sisal waste to northern Sweden.
- He informed members that he had observed some ingenious ways in which some wastes search as plastic are being re-used as toys by small boys and yet how come that the people who are good at re-using other materials can not do the same with crop wastes.
- He wondered whether it was the sheer amounts that were discouraging re-use since had observed that when something is not rare, then it is not given great importance.
- He advised that when working with waste, you can kill two birds with one stone. You just need change in the mind set, and you require knowledge to do this and hence the reason such a project is so good.

2.0 SESSION TWO

2.1 Overview of the urban market crop wastes utilization Program Prof. E.N. Sabiiti and PhD Students' Presentations



**THEME:
SYMPOSIUM ON ALTERNATIVE
SCIENTIFIC APPROACHES TO
URBAN MARKETS CROP
WASTES MANAGEMENT**

Sabiiti¹, E.N. and Ledin², S.

¹Makerere University

²Swedish University of Agricultural Sciences

14TH JULY 2005 – HOTEL EQUATORIA

GENERAL PROGRAMME OVERVIEW

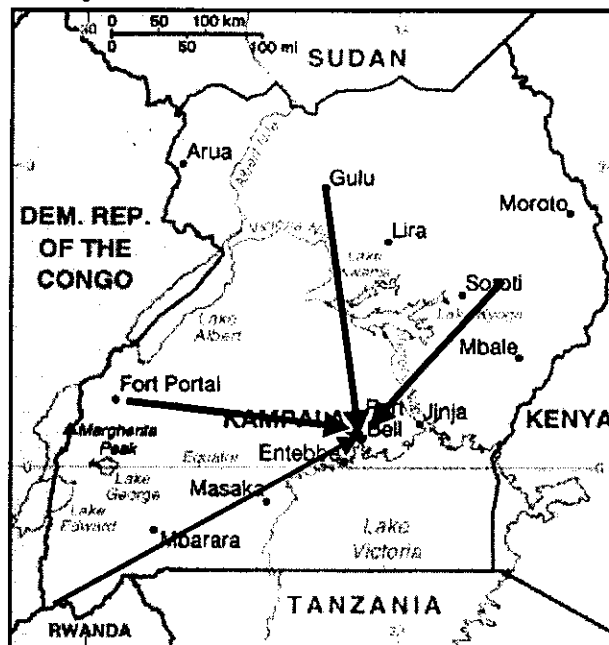
Background

- Programme started 2000 with major objectives of building PhD supervisory capacity, generate and disseminate technologies & enhance research culture at Makerere University in collaboration with Swedish scientists (SLU).
- The overall goal of the programme is to eradicate poverty of the urban/peri-urban small holder agriculture through research.
-

THE PROBLEM

- Kampala's population of between 1.2 to 1.5 million generates approximately 1000 tons of garbage daily
- Translates to nearly 1.2 kg of waste per capita per day
- Monthly about 40,000 tonnes are generated
- Huge expenses incurred by KCC to dispose some of this
- Environmental Pollution
- Nutrient depletion from Production areas
- Many small holder poor farmers within urban/peri-urban areas could recapture these nutrients for increased production
- Waste generation has been increasing as shown in table

Map of Uganda Showing flow of domestic agricultural produce

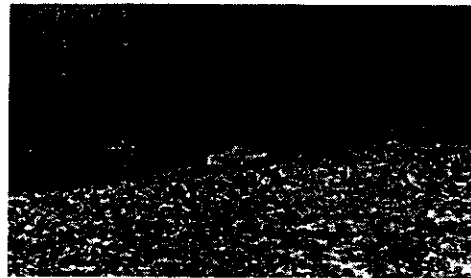
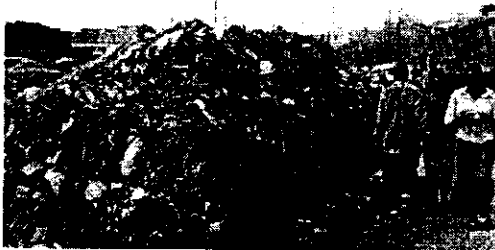


WASTE GENERATION TRENDS

Year	Population	Average Monthly waste generation in tons	Average quantity collected	% 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

Source : PCU KCC (2002)

TYPICAL WASTE SITUATION

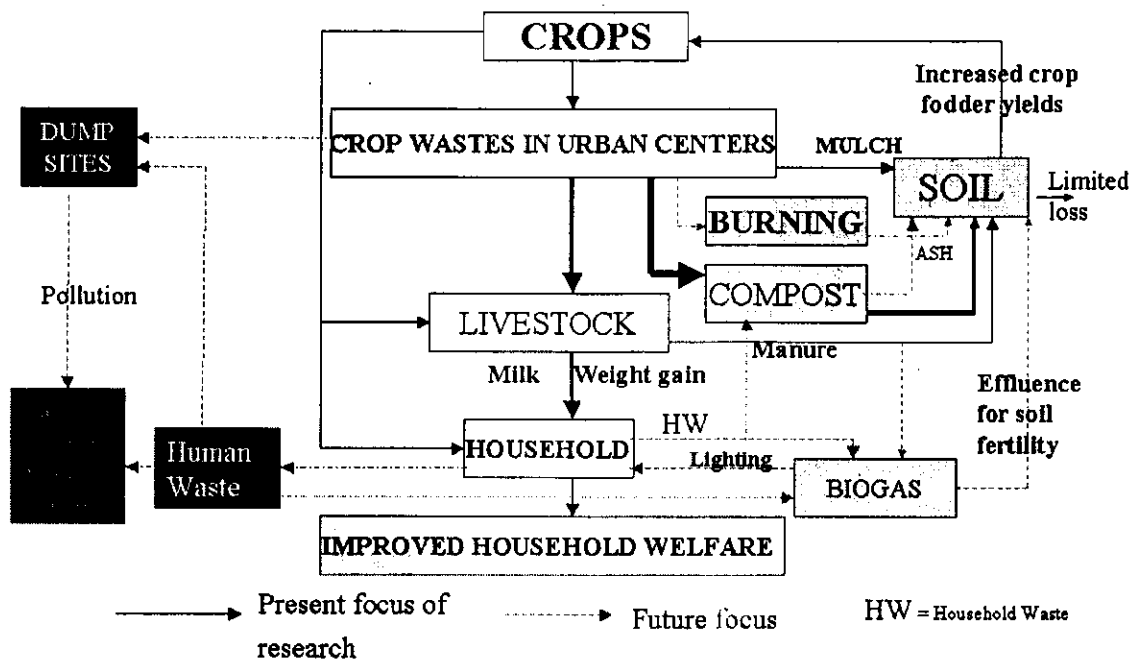


APPROACHES

- Presently Garbage collection and disposal is managed by KCC
- A big proportion of waste is land filled at dump site at Kitezi by contracted private collectors and KCC
- Apart from plastic recycling, little waste recycling is done as no specific site is allocated for the purpose.
- And some of the garbage remains scattered/heaped on road sides or markets.

SCIENTIFIC APPROACH

CONCEPTUAL MODEL OF MARKET WASTE UTILIZATION IN CROP LIVESTOCK SYSTEMS IN URBAN & PERI- URBAN AREAS



VALUES OF GARBAGE PROGRAMME

Covers Social, Environmental and Economic values

Social value

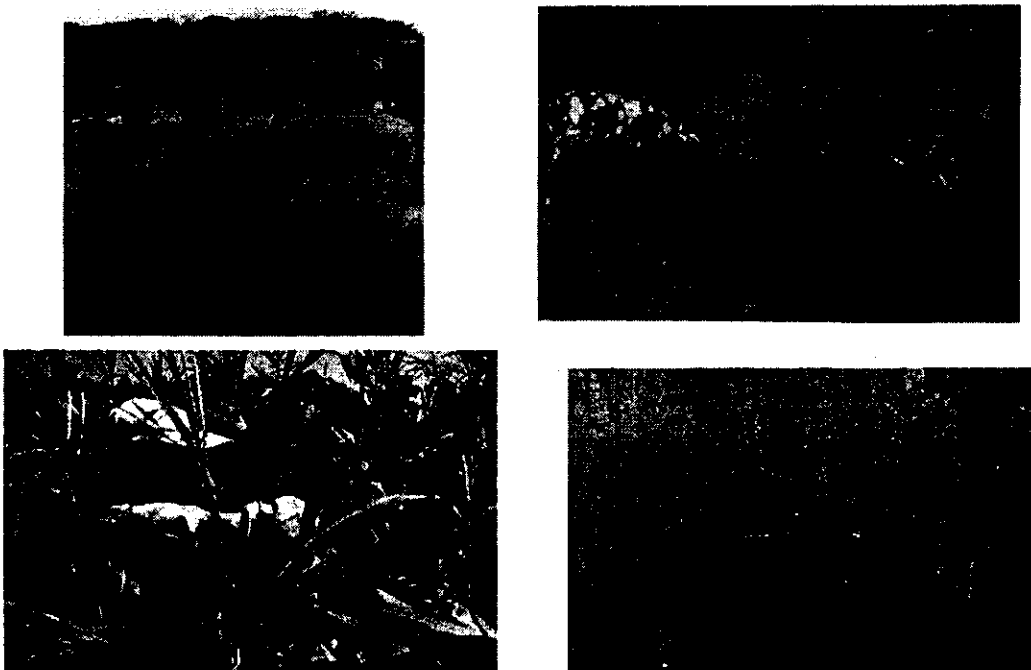
- Involves capacity building training– 4 PhD students

Environmental

- Involves recycling of nutrients lost in order to improve soil fertility
- Reducing the problem of garbage accumulation

Economic value

- Sale of sorted wastes e.g. banana peels and sweet potato vines for cash
- Increased crop/milk production as a result of
- utilization of the market wastes



RESEARCH PROGRAMME

Sub- programme 1: Utilization of Urban Market Crop Wastes in Livestock Production Systems

Scientists:

J. Nambi-Kasozi¹, E. N. Sabiiti¹, F. B. Bareeba¹ and E. Spornly²

¹ Makerere University.

² Swedish University of Agricultural Sciences.

Sub programme 2: Urban Market Crop Waste For Soil Fertility Management

Scientists:

Amoding¹, A., Tenywa¹, J.S., Ottabong², E. and Ledin²,
S.

¹ Makerere University.

² Swedish University of Agricultural Sciences.

Sub programme 3: Market crop wastes derived soil fertility amendments: a tool in integrated pest management in Uganda

Scientists:

Karungi¹, J., Kyamanywa¹, S. and Ekbom², B.

¹ Makerere University.

² Swedish University of Agricultural Sciences.

Sub-programme 4: Socio Economic Implications of Waste Utilization

Scientists:

Ekere¹, W., Mugisha¹, J., Nakakawa¹, S. and Drake², L

¹ Makerere University.

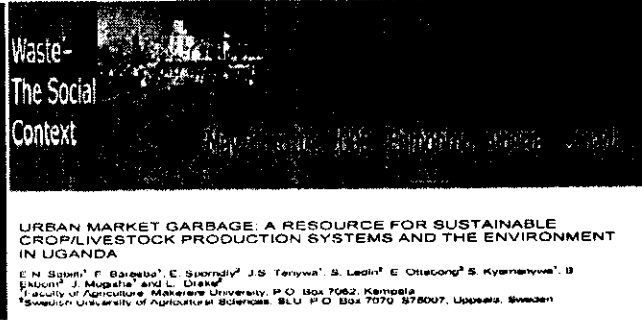
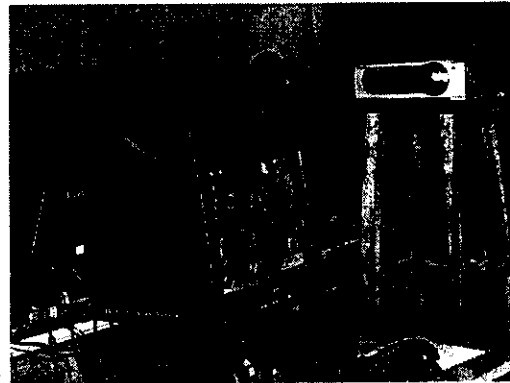
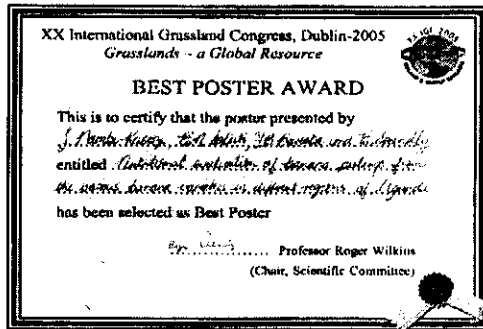
² Swedish University of Agricultural Sciences.

Sub-programme 5: Faculty Funds

- Small Competitive research projects by staff not directly benefiting from the main programme
- Supports staff to attend conferences/symposia/seminars
- Supplements publications of proceedings, Faculty journals/bulletins/abstracts

ACHIEVEMENTS

- 4 PhD students to have completed their research and one of them has submitted her PhD Thesis in record time
- Career enhancement of Faculty staff through Small Grants
- Developments and strengthening of collaboration linkages (International and National)
- Sensitization of Stakeholders through workshops
- Closer cooperation with KCC
- Several publications produced
- Research infrastructure strengthened (Computers, lab. Equipments, vehicles, internet, E-library facilities)
- Best Poster Award at XX International Grassland Congress, Dublin-2005
- Have got approval from Sida SAREC for phase II July 2005 – June 2009



URBAN MARKET GARBAGE: A RESOURCE FOR SUSTAINABLE CROPLIVESTOCK PRODUCTION SYSTEMS AND THE ENVIRONMENT IN UGANDA

E. N. Ssali¹, F. Baraboo¹, E. Suornaly², J.S. Tenywa¹, B. Ledir¹, E. Ottecong¹, S. Kyamanywa¹, B. Ekison¹, J. Mugisha¹ and L. Drake²
¹Faculty of Agriculture, Makerere University, P.O. Box 7062, Kampala
²Swedish University of Agricultural Sciences, BLU, P.O. Box 7070, Uppsala, Sweden

WAY FORWARD

- To complete phase I activities
- Form a center of Excellence in waste management
- Students to graduate
- Publications
- Refining phase II – addressing 4 gaps (crops, small ruminants, soil fertility/human excreta and social economics of Biogas technology)
- Similar approaches

ACKNOWLEDGEMENTS

- The Swedish Government through Sida/SAREC funded this research
- The Uganda government and Makerere University
- The research team
- The Audience

PERFORMANCE OF LACTATING DAIRY COWS FED URBAN MARKET CROP WASTES IN SMALL HOLDER PRODUCTION SYSTEMS

By Justine Nambi-Kasozi

Supervisors 1. Prof. E. N. Sabiiti

2. Prof. F.B. Bareeba

3. Dr. E. Spornly

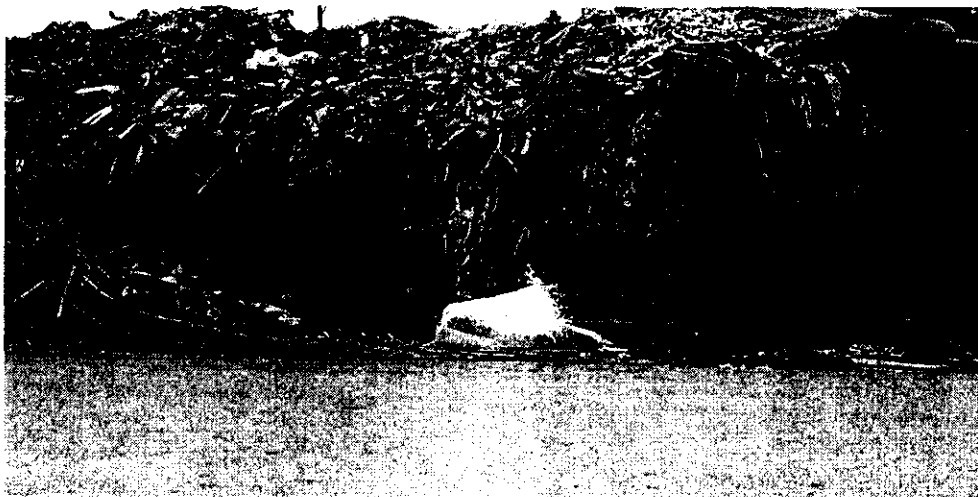
INTRODUCTION

- Popn in cities will increase from 3-5.1 bn (60% of world popn) by 2025 (Holmer *et al.*, 2000; Tjandradewi & Chahl, 2000)
- As a result, wastes will also - envtal pollution
- Worse in dev'pg c'tries where most crops are marketed in raw form
- Peri-urban agric. is v.important in sustaining livelihoods of increasing popn.

INTROD. CONT'D

- Women dominate this form of agric. but are faced with feed scarcity
- Crop wastes (CWs) are abundant esp. the banana peelings (BP) –alternative
- Farmers already CWs but not aware of the nutritive value & the best way of utilisation

Unsightly appearance of unsorted wastes



OBJECTIVES

- Evaluate performance of cows fed sorted CWs in terms of milk prodn, live wt changes & DMI
- Determine nutritive value of CWs through chemical analyses and degradability studies
- Determine crop/fodder yields resulting from cow dung manure from diff. sources

HYPOTHESES

- Urban CW utilizat'n for livestock feeding will improve milk prodn in peri-urban areas and the L. Victoria crescent.
- Cow dung manure application will improve crop yields in the urban & peri-urban zero grazing systems.

EXPT 1 : 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 Gliricidia.
- ❑ A 4x4 change over Latin Square design was employed.

METHODOLOGY CONT'D

- Daily feed intakes were recorded & feeds were sampled fortnightly for nut. 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: Milk yield and composition of cows fed the experimental diets on expt one

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

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

Diets (Percentage of banana peelings)					
	0	20	40	60	SE ±
D M I (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 D M I (kg/kgW^{0.75})	0.161 ^b	0.180 ^b	0.213 ^a	0.211 ^a	0.009
A D G (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

EXPT ONE: CONCLUSIONS

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

Basis for above conclusions

- Carried out surveys on marketing and inflow of bananas in various markets in Central, Eastern and Western regions of Uganda.
- Banana peelings from different banana varieties in different regions of Uganda were also analysed

Table 3: Chemical composition of BP from the Eastern region

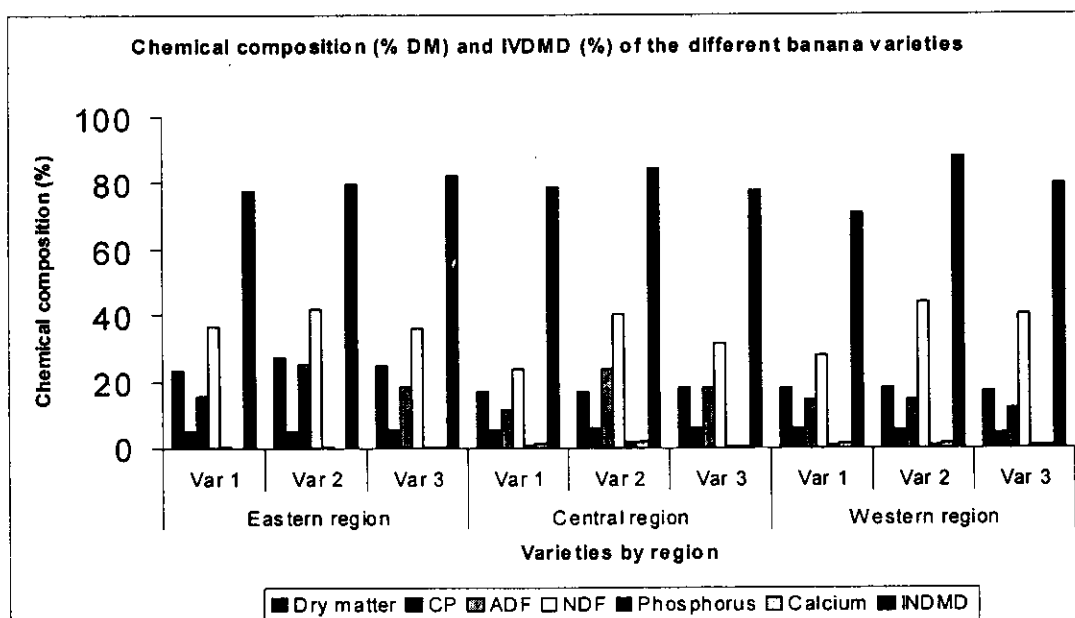
	Nakitembe	Nakabululu	Kaago
Comp't (%)			
Dry matter	23.7	27.8	24.9
CP	5.0	4.9	5.1
ADF	15.5	25.8	18.9
NDF	37.0	42.0	36.0
Phosphorus	0.23	0.21	0.27
Calcium	0.09	0.11	0.21
IVDMD	77.6	79.5	82.0

Table 4: Chemical composition of BP from the central region

	Musakala	Kibuzi	Mixture
Comp't (%)			
Dry matter	17.3	17.1	18.6
Crude protein	5.2	5.9	6.0
ADF	11.8	23.9	17.9
NDF	24.0	40.0	31.7
Phosphorus	1.00	1.80	0.34
Calcium	1.09	1.97	0.45
IVDMD	78.4	84.5	77.4

Table 5: Chemical composition of BP from the western region

	Enyeru	Mbwazirume	Entaragaza
Comp't (%)			
Dry matter	18.0	18.6	17.3
CP	6.1	5.6	4.4
ADF	14.4	14.3	12.2
NDF	28.0	44.0	40.0
Phosphorus	1.00	1.00	0.80
Calcium	1.09	1.10	0.87
IVDMD	70.6	87.7	79.5



CONCLUSIONS

- Most bananas are got from western Uganda and distributed to markets in Masaka, Wakiso, Mpigi, Kampala, Mukono, Jinja, Iganga and Pallisa.
- Banana peelings differ in dry matter, P and Ca depending on the region from which the bananas are grown so this should be taken into account when recommending feeding packages for animal production.

EXPT 2: DEGRADABILITY STUDY

- Incubation of nylon bags done in fistulated animals on station at Kabanyolo farm.
- The residues of the different feeds incubated are being analysed but preliminary results on dry matter breakdown obtained.

FISTULATED STEER ENJOYING BP



DEGRADABILITY RESULTS

- Preliminary results on dry matter incubated show that BP are far more degraded than elephant grass b'se of lower fibre levels
- Among the supplements, cotton seed cake was more degraded than Maize bran and Gliricidia whose break down was lowest.

EXPTS 3 AND 4

- Manure samples from animals on the four diets (0, 20, 40 & 60%) collected and undergoing analysis.
- Optimal feeding level of banana peelings obtained (40%) and used as basis for formulation of expt 4 diets.
- Expt 4 diets are optimal BP level either with MS, SPV, MS + SPV or no other CW.

TABLE 6: COMPOSITION (%) OF OTHER WASTES

	SPV	M/STOVER	BP
Dry matter	12.2	94.3	18.6
CP	15.8	3.9	6.0
ADF	39.8	48.4	17.9
NDF	49.4	76	31.7
Ash	8.15	6.5	8.0

ACKNOWLEDGEMENT

- Sida/SAREC for the financial support
- Supervisors
- Colleagues



ESTABLISHMENT OF THE AGRONOMIC VALUE AND SUPPLY POTENTIAL OF URBAN MARKET CROP WASTE FOR SOIL FERTILITY MANAGEMENT

By
Alice Amoding

Supervisors: Dr. J.S. Tenywa
Assoc. Prof. Stig Ledin
Prof. Erasmus Otabbong

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?

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

FINDINGS

- >80% market garbage is crop waste, mainly banana leaves, pseudo-stems, bunch stalks; vegetable waste, maize husks, bean stalks and pods (Figure 1);
- Other biodegradables include potato vines, grass, animal wastes and other plant biomass (covering tomatoes, potatoes, charcoal);
- Fruits – mainly pineapples, mangoes, oranges, & passion fruits;
- Non-bio-degradables: mostly polythene & plastics, broken bottles & ash

Urban Market Survey

- One year survey to monitor dumping patterns, composition and seasonal variation
 - Conducted from April 2004 to March 2005
 - Separate & weigh components
 - Crop waste sub samples taken to the Lab
 - Lab analysis on sub- samples taken
 - Skip dimensions – established

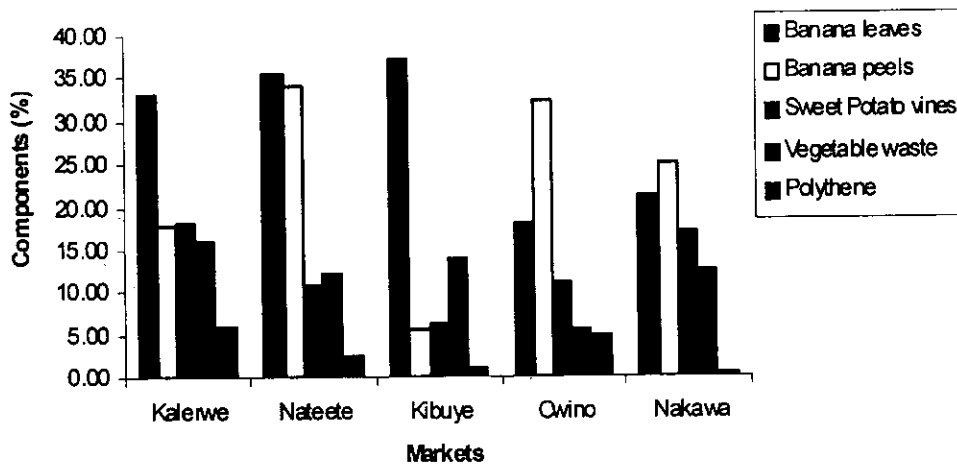


Figure 1. Major components of garbage from selected markets

Composting process



□ Garbage delivered by truck to composting site; sorted to remove non-biodegradable materials

Composting process – Talent Calls Club facility



Composting process

- 1st Windrow - 360 kg (d.w.), watered and turned manually twice a week for a period of 4 weeks.
- 3 weeks in the 2nd and 3rd windrows, and 18 days in the fourth windrow.
- Sampling at 20 and 40 cm depths – six spots.
- Temperature in the pile at both sampling depths was recorded using thermometers.
- Sub-samples combined & taken to lab for analysis
- Moisture content, pH, Total N, P, and % O.C determined

RESULTS

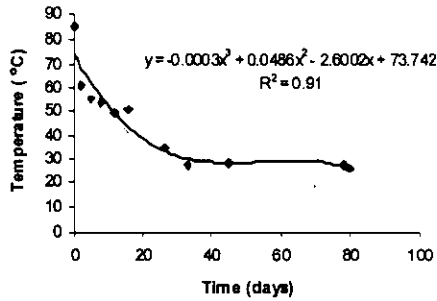


Figure 2. Changes in temperature during composting.

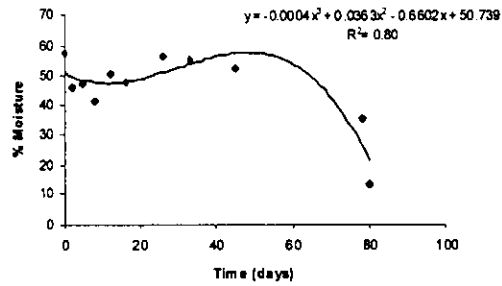


Figure 3. Changes in % Moisture during composting

RESULTS

Table 1. Changes in garbage nutrient content during composting

Compost parameter	Before composting (%)	After composting (%)	Loss (%)
Nitrogen	1.4	0.99	29
Phosphorus	0.45	0.43	-
Total garbage DW (kg)	360	113	69

Table 2. Compost Quality

N	P	K	Ca	Mg	Na
0.99	0.43	2.2	4.0	2.0	1.3

On – Station field experiments

Agronomic Experiment

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

- 4 seasons (2003 A & B, 2004 A & B)

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)

Test crop - Maize (Longe 4)

Agronomic experiment cont'd

- Plant parameters – LAI, height, DMY(SW), cob weight, grain yield and plant N,P,K.
- Soil samples - pH, SOM, N, P, K⁺, Ca²⁺ and Mg²⁺

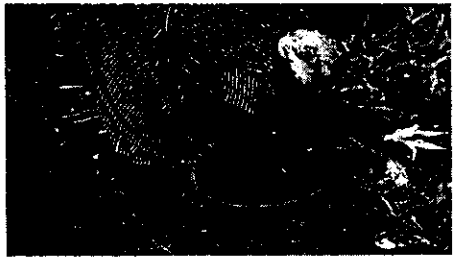


A- LAI and Height measurements

B- Stover weights

C- Cob weights

Soil sampling



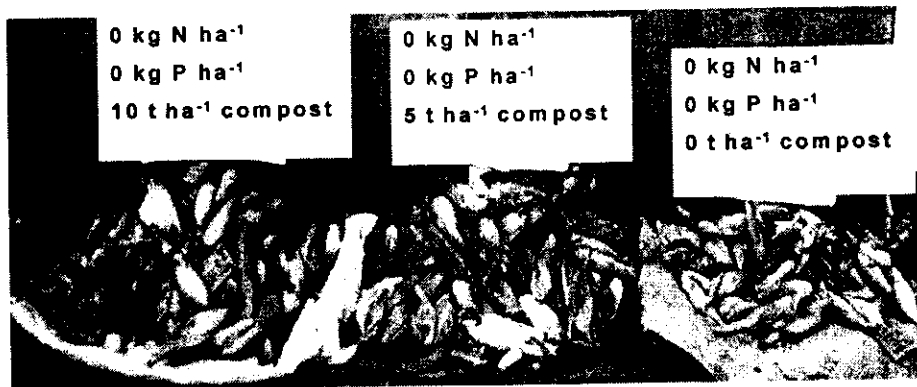
RESULTS

Table 3. Soil analysis: Site characterisation

pH	O.M.	N	Av. P	K ⁺	Na ⁺	Ca ²⁺	Mg ²⁺	Textural Name
%.....		mg kg ⁻¹		cmol. kg ⁻¹		
5.1	3.0	0.07	6.6	0.26	0.15	2.7	1.2	Sandy clay loam
5.5	3.0	0.2	15					

Agronomic evaluation of garbage compost

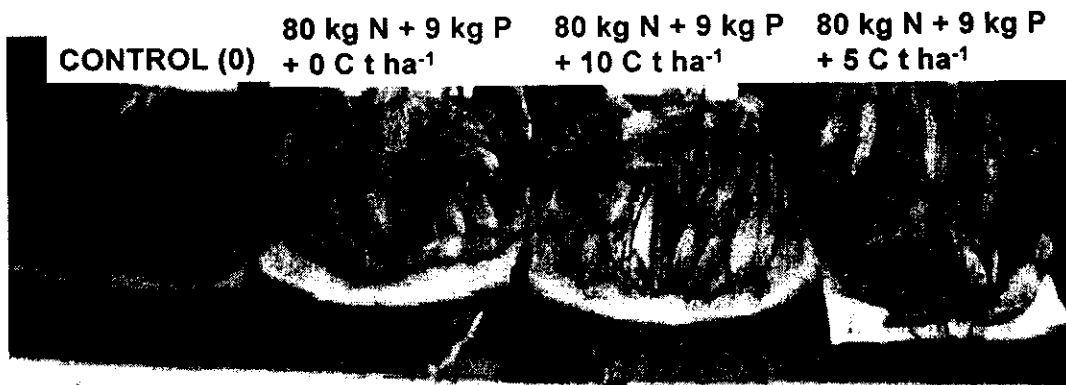
□ Up to 25% grain yield increase was recorded for the two compost rates used, namely, 5 and 10 t ha⁻¹, implying that the former is the most appropriate rate (Table 4).





CONTROL (0) **80 kg N + 9 kg P + 0 C t ha⁻¹** **80 kg N + 9 kg P + 5 C t ha⁻¹** **80 kg N + 9 kg P + 10 C t ha⁻¹**

□ Superior results were obtained with compost and N (0, 40 and 80 kg ha⁻¹) interactions. The best combination, which increased grain yield by 50% over the control, was 5 t ha⁻¹ compost plus 80 and 9 kg ha⁻¹ N and P, respectively (Table 4).



CONTROL (0) **80 kg N + 9 kg P + 0 C t ha⁻¹** **80 kg N + 9 kg P + 10 C t ha⁻¹** **80 kg N + 9 kg P + 5 C t ha⁻¹**

Table 4. Effect of compost, and N and P mineral fertilizers on maize yield

Treatment	Height	LAI	Plant weight	Cob weight	Grain yield
	cm		t ha ⁻¹		
N0P0C0	81.94	1.860	6.04	8.95	4.77
N0P0C5	87.49	1.92	6.47	9.40	5.95
N0P0C10	95.52	2.21	7.95	10.64	6.00
N40P0C5	92.94	1.99	7.37	10.76	6.28
N40P0C10	96.73	2.23	8.58	11.86	6.54
N80P18C0	91.69	2.14	7.36	11.70	6.70
N80P18C5	98.96	2.32	8.17	11.72	6.60
N80P0C5	97.57	2.30	8.21	11.79	6.81
N80P9C5	94.33	2.32	8.32	12.59	7.14

Crop Nutrient Demand vs Compost nutrient release study

- Matching peak nutrient release with peak nutrient requirement – efficiency of nutrient use

- **Crop nutrient demand study**

Treatments

- **Time of compost application**

- 2 wks before planting
- At planting
- 2 wks after planting
- 4 wks after planting

- **Compost rate**

- 0, 5 and 10 t ha⁻¹

Experimental Design – RCBD

Compost nutrient release study

- Litterbags deployed in a RCBD design – retrieved at 0, 2, 4, 6, 8, 12 weeks



RESULTS

- Time of application of compost did not influence maize yield
- The point of synchrony of nutrient release from the compost and peak maize crop demand is from 8 to 10 weeks

CONCLUSIONS & RECOMMENDATIONS

- > 80 % of the market waste is bio-degradable and has potential for use in soil fertility management
- Open composting leads to N loss of about 30%, therefore a strategy is needed to minimize this – (composting using different methods)
- Use of compost at 5 t ha⁻¹ is more feasible than 10 t ha⁻¹
- The best package is 5 t ha⁻¹ compost plus 80 and 9 kg ha⁻¹ N and P respectively

ACKNOWLEDGEMENT

- Sida – SAREC
- Coordinators
- Collaborators
- Supervisors

Background

- In Uganda, the vegetable sector is among those being prioritised because of its diversity, and income potential.
- Vegetables of economic importance include beans, peas, onions, okra and cabbage (ADC, 2001).
- However, per capita agricultural production of vegetables (and other crops) is declining in SSA (Uganda).
- Mainly due to depletion of soil fertility, along with the concomitant problems of pests and diseases.

... Background

- Depletion has been a result of increasing pressure on agricultural land and abandonment of many traditional strategies for soil fertility improvement.
- In Uganda nutrient mining is a big problem due to a primitive marketing system that ends in dumping of crop residues in markets environs.
- Reversal of soil fertility depletion and ecologically sound pest management strategies are required to increase per capita vegetable production in Uganda.

How do we increase production?

- Soil fertility management in itself is a pest management approach, healthy soils = healthy crops = pest tolerance
- Rejuvenation of soil nutrients may be achieved through the use of inorganic and/or organic inputs
- Peri-urban areas have the advantage of being near urban areas inundated with huge quantities of organic wastes (MCW) in market environs, a resource, that is currently being lost to the landfill.

Main aim

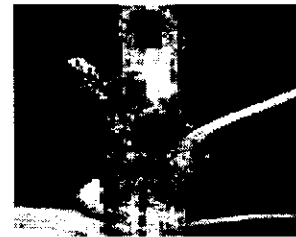
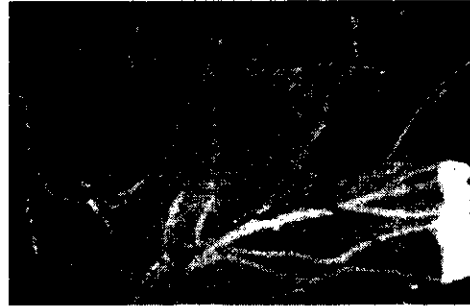
- To quantify and document the potential of utilising MCW soil fertility amendments as an IPM technique in vegetable farming systems.
 - IPM = safe and sustainable protection to crops

Approach

- Different forms of MCW (12tha^{-1}) vs. NPK or un amended:
 - MCW compost incorporated in the soil,
 - Un-composted MCW incorporated in the soil,
 - Un-composted MCW as a surface mulch,
 - NPK incorporated in the soil, and
 - Un amended

Areas of focus

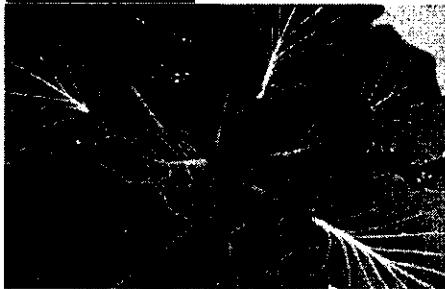
- Cabbage and beans:
 - Plant attributes
 - Insect pests – aphids
 - Beneficial insects - predators (ladybug, syrphids and spiders).
 - Yield
 - Soil properties



Findings

- Plant size:
 - MCW plots had bigger plants compared to NPK or unamended plants

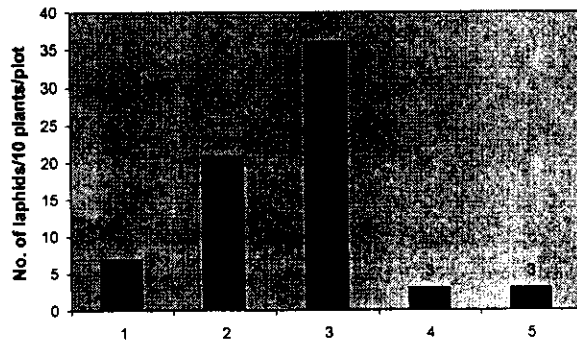
Compost



NPK



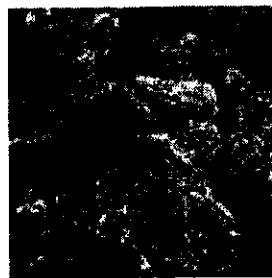
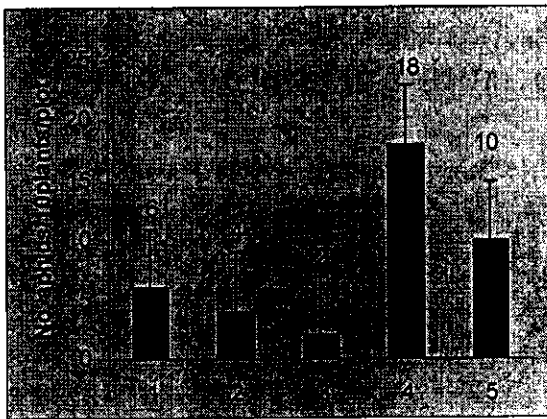
Effect of different soil fertility amendments on occurrence of aphids on beans



1=MCW compost incorporated;
 2=MCW un-composted incorporated;
 3=MCW un-composted on surface;
 4=NPK incorporated; and
 5=untreated

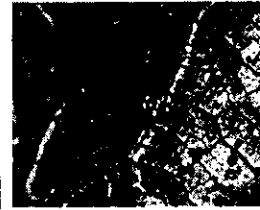
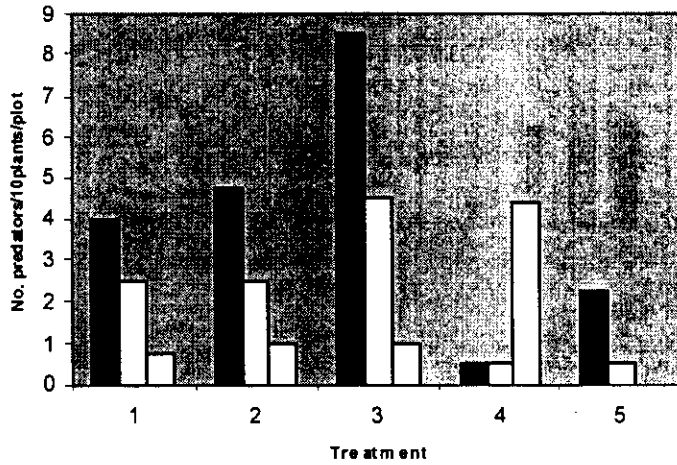
Applying un-composted MCW on surface increased bean aphids and should therefore be avoided

Effect of different soil fertility amendments on occurrence of cabbage aphids



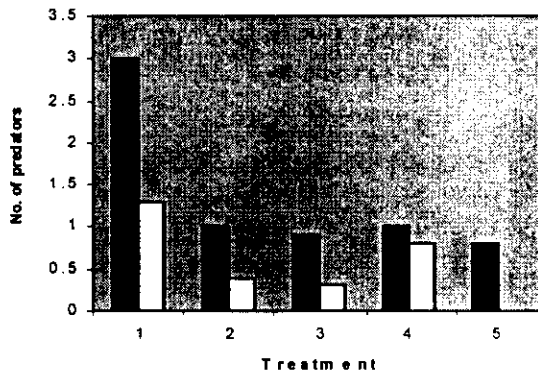
1=MCW compost incorporated;
 2=MCW un-composted incorporated;
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 4=NPK incorporated; and
 5=untreated

Predator abundance on beans on different amendments



1=MCW compost incorporated;
 2=MCW un-composted incorporated;
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 4=NPK incorporated; and
 5=untreated

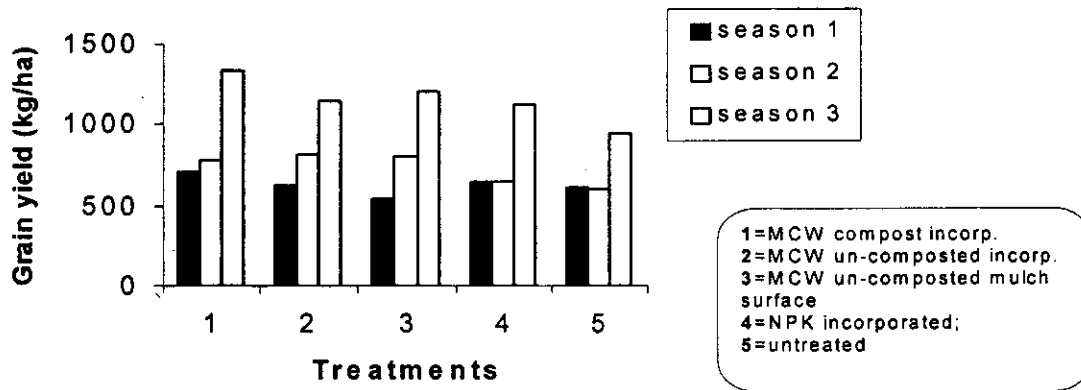
Predator abundance on cabbage on different amendments



■ syrphids
 □ spiders

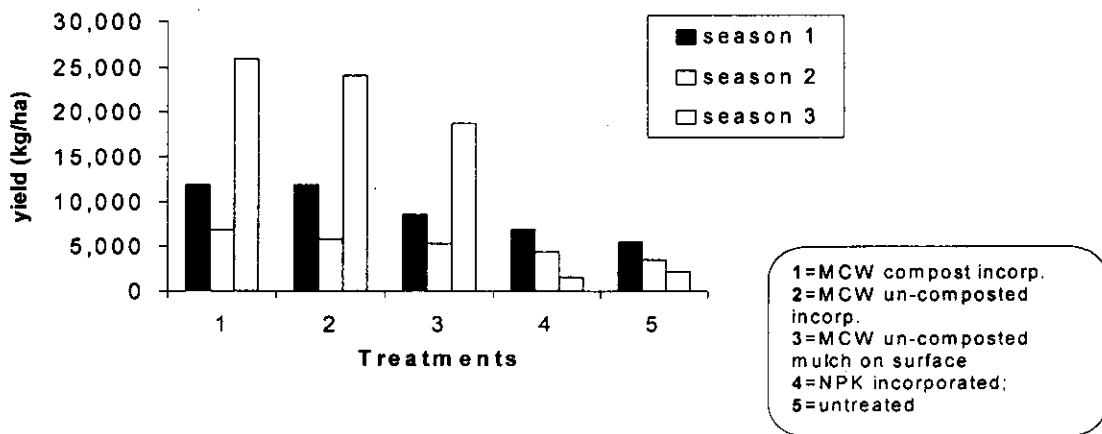
1=MCW compost incorporated;
 2=MCW un-composted incorporated;
 3=MCW un-composted on surface;
 4=NPK incorporated; and
 5=untreated

Beans grain yield



Bean yields higher in MCW than NPK in season 2, a stressful season, in other seasons, they were comparable

Cabbage yield



Cabbage yields consistently higher in MCW plots than NPK

Profits

Treatment	beans (Shs/ha)	Cabbage (Shs/ha)
Composted MCW - incorporated	791,672	6,072,834
Un-composted MCW - incorporated	41,534	6,457,200
Un-composted MCW on surface	104,757	5,197,070
NPK - incorporated	193,097	2,031,014
Un-amended (control)		

Nutrient components of soil from differently amended plots after a beans harvest (per 100g sample)

Treatment*	pH	Available P (ppm)	% O.M	% N	K (me/100g)	Ca (me/100g)	Mg (me/100g)
1	5,55	6,16	3,41	0,16	1,07	5,57	1,82
2	5,6	5,71	3,16	0,16	1,18	5,39	1,44
3	6,01	8,51	3,83	0,18	1,69	7,56	1,77
4	5,11	2,46	3,24	0,15	0,73	3,92	1,1
5	4,68	1,9	3,24	0,16	0,56	3,97	0,91

1=MCW compost incorp.
 2=MCW un-composted incorp.
 3=MCW un-composted mulch
 4=NPK incorporated;
 5=untreated

Nutrient components of soil from differently amended plots after a cabbage harvest (per 100g sample)

Treatments	pH	Available P (ppm)	% O.M	% N	K (me/100g)	Ca (me/100g)	Mg (me/100g)
1	4.96	7.80	2.98	0.143	1.07	2.84	1.23
2	4.98	7.87	3.03	0.163	1.11	3.08	1.18
3	5.01	11.64	3.11	0.163	1.37	3.70	1.27
4	4.40	7.22	2.94	0.156	0.71	2.76	1.13
5	4.56	5.28	2.94	0.156	0.46	2.19	0.83

1=MCW compost incorp.
 2=MCW un-composted incorp.
 3=MCW un-composted mulch
 4=NPK incorporated;
 5=untreated

Summary of findings

- Compared to NPK and the untreated:
 - MCW plants had bigger and taller plants (+ve)
 - MCW sustained higher aphids (-ve)
 - MCW had more beneficial insects (+ve)
 - MCW plots gave higher cabbage yields, and comparable or higher bean yields (+ve)
 - MCW plots had more enhanced soil properties (+ve).

Recommendations

- Cabbage is a high value crop and as such could be a good candidate for MCW compost.
- For beans, a relatively low value crop, un-composted MCW incorp.could be utilized.
- The MCW soil fertility amendments increased the yield performance of the studied vegetables; this provides a platform upon which other management strategies can be assessed for increased effectiveness.

Socio Economic Implications Of Waste Utilization In Urban And Peri-urban Areas Of The Lake Victoria Crescent Region

William Ekere, Dr. Johnny Mugisha
and Ass. Prof. Lars Drake

Introduction

- Rising rate of urbanization in developing countries & the consequent SWM problem is cause for concern for many urban governments
 - Though over 70 % of Uganda's popn live in rural areas, average annual urban growth rate of 4.8 % has been rapid – more waste generated
 - Waste problem is due to high generation, inadequate collection & poor disposal habits by households
 - Uncollected wastes constitute a health risk (cholera, diarrhea, vermin) which is a serious consideration in low income residential areas.
-
- Communities in rural Africa have long history of resource reuse and organic waste application in farming
 - In urban areas, reuse of organic portions is low < 50% despite good recovery potential
 - Whereas the biodegradable proportion of wastes is about 80% , plastic & polythene materials in the waste limit value addition & natural decomposition
 - Few households in Crescent sort and utilize the wastes but extent is limited

Justification

- Waste management consumes a 20-50 % of revenues of many urban authorities
- Technologies and policies for sustainable waste magt are needed
- Wastes must be disposed in ways that minimize environ. damage or harm public health
- Present system of collection and dumping not sustainable
- Extra effort is required to sort wastes, deliver non useable portions for safe disposal and reuse the biodegradable ones.
- Such schemes require establishing society willingness to make this effort
- Presently payment for collection where done is on flat fee basis – not an incentive to reduce waste

- Study establishes society's willingness to pay for waste magt and enables authorities to levy fees from an informed viewpoint

- Successful waste magt depends on household awareness, participation and attitudes . The study highlights this.

Objectives

- Explore potential alternatives of waste utilization
- Assess the benefits and costs of waste utilization alternatives
- Establish willingness of households to pay for sound waste management
- Determine the factors influencing waste utilization (Composting) in urban and peri-urban areas of lake Victoria crescent
- Assess the socio economic handling of used plastics in urban and peri urban areas of the crescent

Methodology

- Covered the districts of Kampala Iganga, Mpigi, Masaka Mukono (Seeta) and Wakiso
- Done through interviews using structured questionnaire administered to 500 respondents selected through random sampling methods.
- Respondents drawn from urban and peri-urban areas of the Districts
- Data were also collected from 240 households to assess the socio economic handling of used plastics
- Data was collected from markets, waste sellers and private firms dealing in waste collection
- Data collected included
 - Socioeconomic characteristics of households e.g age, gender etc
 - Crops grown, crop wastes generated, quantities, disposal , utilization etc
 - Extent of waste problem , Use of plastics etc
 - Willingness to pay for waste management

- Data on costs and yields were also collected from programme expts to ascertain profitability of waste use options
- CVM methodology was used to ascertain the willingness of households to pay for waste management
- A regression model was used to determine the relationship between WTP , waste utilization and various socioeconomic variables
- Gross margin analysis was used to establish the profitability of feeding dairy animals on wastes
- Correlation analysis was used to assess the relationship between quantity of plastics and socio economic characteristics of respondents

RESULTS

- **Wastes are a growing problem in urban and peri-urban areas of the districts in the lake Victoria region.**
 - **Waste generation levels per capita stand at 1.2 kg per head per day in Kampala, 1kg in Iganga and 1.3 kg in Masaka**
 - **Wastes generated comprise 80 % biodegradable wastes which could be reutilized**
 - **Ten biggest markets in Kampala alone generate approximately 1800 tons monthly .**
 - **A saving of shs 19 million could be realized monthly if this portion was separated and composted and reused.**
 - **Two organizations currently recycle waste – Talent calls compost and Mec plastics - plastics**
-
- **No waste recycling is currently done by urban authorities**
 - **A market for crop wastes has emerged mainly dealing in matooke peels, potato peels bought by livestock farmers practicing zero grazing**
 - **Initiatives by Urban authorities to privatize waste collection is bearing fruits – over 40 % collection rates**
 - **Privatization active in 2 divisions of Kampala- Kawempe and Central**
 - **Private waste collection active in other zones but limited to well of households**
 - **Other urban centers garbage is disposed of in open dumps not land filled**



Cattle feeding in an open garbage dump littered with plastics and polythene



Farmer explains Household waste composting to research team



Sorted cabbage and bean pods in a market



Sorted and bagged peels ready for sale

Crop wastes generated by respondents

Crop waste	Proportion generating
Matooke peels	91
Potato peels	64
Cassava peels	59
Vegetable remains	44
Food Remains	41
Used banana leaves	59
Banana stems	33
Sugar cane husks	2

- Biggest proportion of wastes generated is matooke peels (90%), potato peels (64%) cassava peels (59%) of households
- These are most used livestock feed supplements in the zero grazing systems prevailing in the curban and peri urban zones of the crescent

Gross margin analysis of matooke peels as a feed supplement on milk yield

ITEM	Proportion of Matooke Peels in livestock feed			
	0 %	20 %	40 %	60 %
Milk Value	2,332,800	2,203,200	2,462,400	2,397,600
TOTAL VALUE	2,332,800	2,203,200	2,462,400	2,397,600
Banana peels	-	238,140	477,360	714,150
Elephant grass	1,174,500	723,600	405,000	361,000
Cotton seed cake	202,500	226,600	259,200	340,000
Maize bran	101,250	113,400	129,600	20,250
Vet charges	40,000	40,000	40,000	40,000
TOTAL VARIABLE COST	1,518,250	1,341,940	1,311,160	1,465,600
NET BENEFITS per Year	814,500	816,260	1,151,240	932,000

- Incorporation of 40% of matooke peels in livestock feed give a net benefit of 1.15 million shs compared to 0.8 million with no matooke peels

Economic assessment of using compost as a soil amendment

Treatment	N ₀ P ₀ C ₀	N ₀ P ₀ C ₁₀	N ₄₀ P ₉ C ₅	N ₈₀ P ₉ C ₅	N ₈₀ P ₉ C ₅
Yield t/ha	4.66	5.775	5.772	6.667	6.638
Gross Field benefits	699,300	886,250	886,250	858,300	1,000,050
Total Variable costs		550,000	123,500	445,000	458,500
Net Benefits	699,300	316,000	734,800	555,050	537,200

- Results show that compost applied at a rate of 5 t per ha in combination with N at 40 kg per ha and phorus at 9 kg per ha gives positive net benefit of 0.734 million

Informal waste management

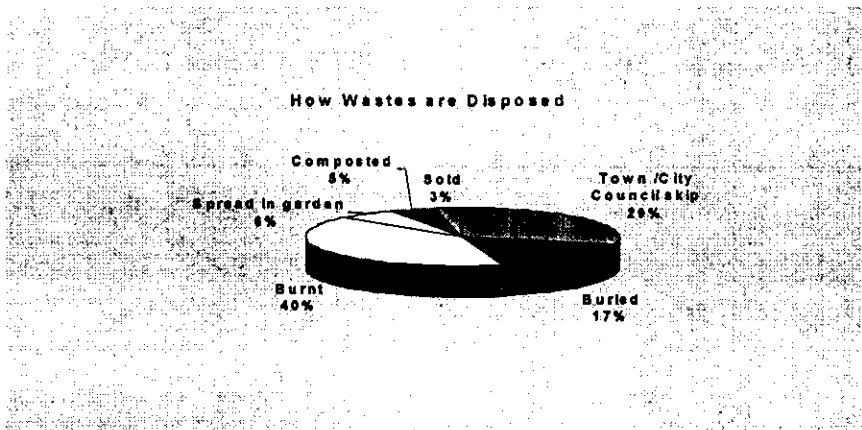


Waste pickers Scavengers busy sorting wastes

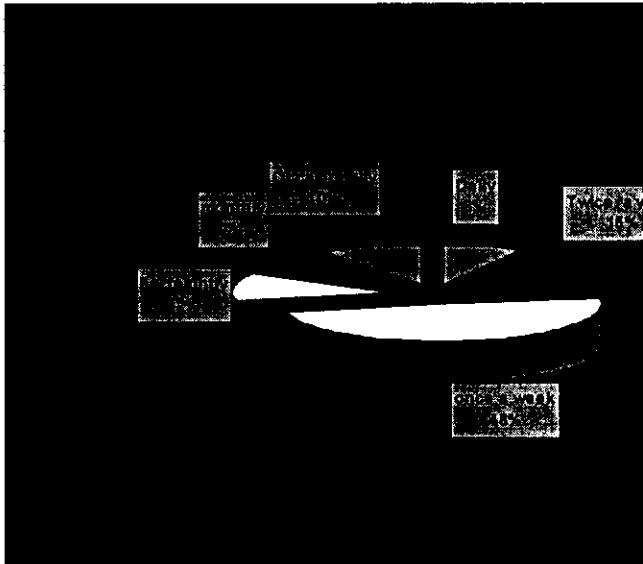


Recovered plastics containers ready for sale

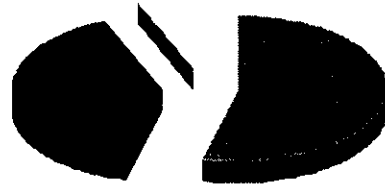
- At Kitezi land fill, a number of waste pickers are active collecting plastics cardboards and waste paper for sale
- Average prices for plastics are 200 shs a kg while waste paper fetches 100 shs per kg . Other valuable waste items are sorted and sold
- Approximately one tonne of recyclable wastes is recovered a day
- Earn some income which enables them to keep off social ills and vices



- 40% of the respondents burnt wastes while only 30 % disposed it in a an urban skip
- Only 5 % composted their wastes



Level of Service Satisfaction



- There is inefficiency in waste collection as only 8 % of respondents receive daily waste collection .
- Half of the respondents were dissatisfied with current level of service
- 70% of the respondents in the surveyed districts were willing to pay various amounts weekly for proper waste management. while 30 % were not
- Respondents were willing to pay between shs 200 -5000 weekly for sound waste management

Probit estimates of Willingness to pay (WTP) for sound waste management

Independent Variables	Coefficient	t -value	Marginal effects
Constant	1.393	1.13	
Location	0.608***	2.91	0.021
Bid	-0.07	-0.64	-0.255
Membership of organization	0.522**	2.37	0.169
Education level	-0.190	-0.65	-0.062
Sex	0.457**	1.97	0.144
Age	-0.017**	-2.07	-0.005
Household size	-0.032	-0.16	-0.056
Marital status	-0.257	-1.11	-0.082
Environment concern	0.190	0.32	0.066
Income	0.127	0.78	0.043
Log likelihood	-105.552		

* Significant at 10%, ** significant at 5%, *** significant at 1%

Variables location being urban, membership of an organization sex being male and age are statistically significant and explain variations in WTP

- 54 % of the respondents were dissatisfied with the current level of waste management and proposed a number of actions they are prepared to do to address the issue

Actions households are willing to take to limit waste disposal cost

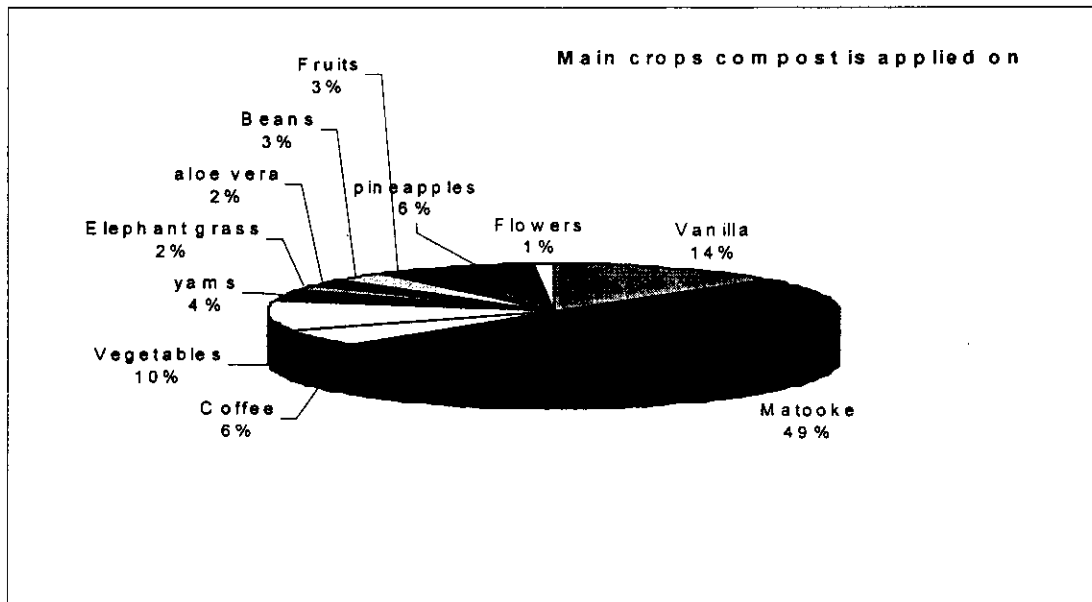
Action	%
Buying materials with less waste	10
Ensuring proper waste disposal	31
Recycling and reusing wastes	13
Teaching family members on proper waste disposal	28
Sorting & burn polythene	13

- These are buying materials with less waste (10%), ensuring proper waste disposal (31%) recycling and reusing the wastes (12.6). teaching family members on proper waste disposal (30%) and sorting polythene (13%).

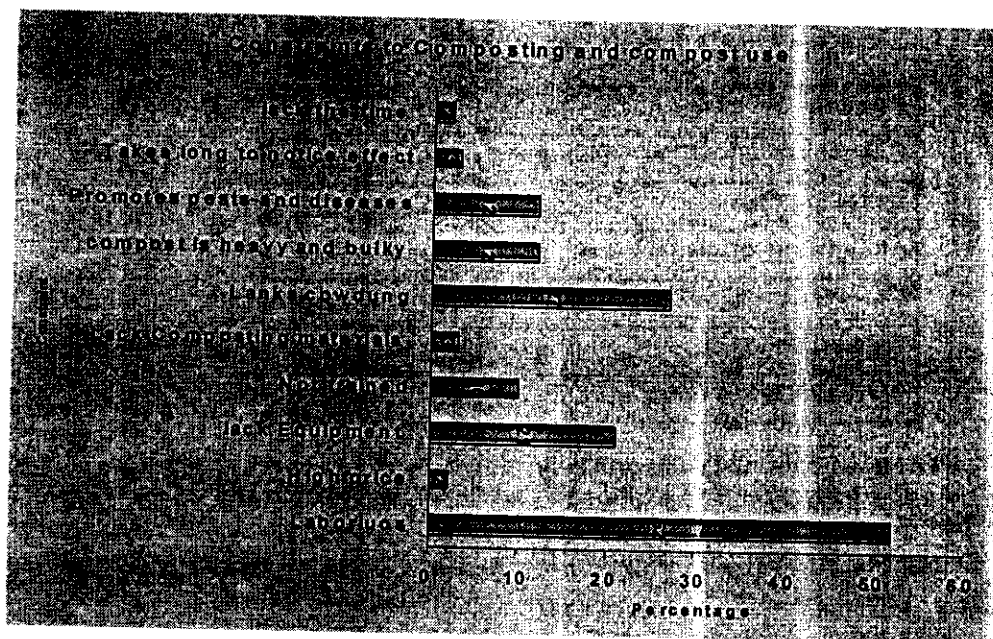
Why not willing to pay to pay

Reason	Percentage
Responsibility of Urban authorities	22
Costs too high	25
Already pay graduated tax	15
Current situation Ok	30
Waste is reused	4
Will pay if law is made	4

- 22% of households not willing to pay for waste management felt it was the responsibility of urban authorities while 27 % thought the costs were too high .
- 30 % felt the current waste situation was ok



- Compost is mainly applied on crops fetching higher returns like matooke, vanilla, Vegetables



Probit estimates of the waste utilization(Composting)equation

Independent Variables	Coefficient	t-value	Marginal Effects
Constant	0.874	-0.84	
Plot size	0.437***	3.96	0.173
Environment concern	-0.699	-0.97	-0.265
Sex	0.038	0.17	0.015
Age	-0.004	0.581	-0.001
Location	-0.406**	-1.96	-0.160
Membership of organization	0.502**	2.35	0.197
Education level	0.508*	1.81	0.202
Income	0.255*	1.67	0.101
Household size	0.05	0.849	0.002
Log likelihood	-108.28004		

* Significant at 10%, ** significant at 5%, *** significant at 1%

- Land size, location, membership of agric or environmental organization, education level and income are statistically significant and explain waste composting behavior
- Good prospects for cost recovery by urban authorities exist with households willing to pay between 200 and 500 shs weekly for improved waste services

PLASTICS

Annual average quantities of plastics materials used and dumped per household

Material	Low income		High income	
	No of pieces	Quantity kgs	No of pieces	Quantity in kgs
Polythene	2,114	8.7	2,018	8.3
Nylon Fibres	14	3.7	23	6.4
Plastic	139	3.0	79	14
Milk packs	174	1.5	158	1.4

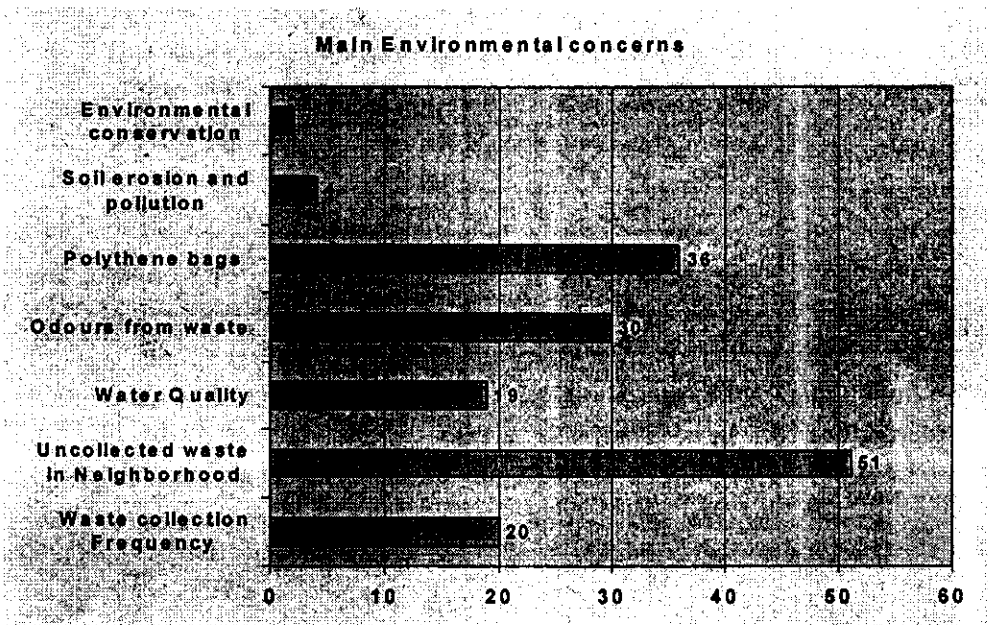
- Low income households on average use 8.7 kg of polythene bags 3 kg of plastic containers and 3.7 kg of nylon fibre sacks.
- High income households use 8.3 kg of polythene bags, 14 kg of plastic containers and 6.4 kg of nylon fibre sacks

Correlation between household characteristics and quantities of selected waste materials

	Polythene bags	Nylon fibre sacks	Plastic containers
Income class	-0.044	-0.273*	-0.171**
Sex of household head	0.088	-0.190	-0.198**
Education status of household head	-0.146**	0.028	-0.071
Household size	0.018*	0.063	-0.075

* Significant at 5%, ** significant at 1%

- A negative relationship exists between income class and no. of nylon fibre sacks used, income class and quantity of plastic containers and education status and quantity of polythene bags
- Positive relationship exists between quantity of plastic and polythene materials used and sex of household head being female and household size



Most common environmental concern centered around waste collection, frequency, odors from waste and polythene bags

Main Priority areas over next five years

Priority area	Percentage of respondents citing
Reduce waste volume	16
Develop waste sorting & recycling	17
Improve waste disposal technologies	28
Sensitize the public on waste magt	20
Ban polythene and use paper bags	32
Improve efficiency in waste disposal	19
Employ more waste collectors	13
Impose bye laws on waste	5
Pay for waste	10
Don't know	2

- 32% felt that ban on polythene and promoting use of paper bags should be main priority areas.
- This was followed by improvement of waste disposal technologies and public education on waste management

Conclusions & Recommendations

- There is ready availability of composting materials
 - This offers an alternative solution to the waste problem due to environmental benefits and agric productivity increases realized
 - Promotion of resource recovery at the household level particularly in area of composting of biodegradable wastes and recovery of other recyclable materials is necessary
 - Waste reuse is through composting and as feed for livestock is feasible and profitable and needs to be promoted.
 - Resource recovery creates employment, reduces waste volume to be disposed
 - Saves foreign currency by reducing quantity of raw materials needed in production process & promotes
-
- Middle income and even low income households are willing to pay garbage fees when assured of regular collection
 - Urban authorities still have important statutory functions to play despite the privatization initiatives in waste management .
 - Includes areas of disposal site management and enhancing quality of urban environment
 - Private operators are still small scale entrepreneurs not able to acquire develop and operate disposal sites
 - Use of informal waste management systems provided by scavengers has not received adequate attention.
 - They provide an informal system which many urban authorities can't afford.
 - Recycling waste into new resources makes both environmental and economic sense
 - Remember for every one ton of waste 1600 jobs could be created

Discussion from the presentations

Members had the following observations/suggestions to make regarding the information obtained from the overview:

- The issue of reducing on unprocessed produce through value addition right from the producing areas was brought up.
- Members urged the FA to train students in waste management and then send them on industrial training among the stakeholders as a dissemination strategy. The faculty members pledged to assess ways in which such a course could be developed to run at CAEC, and possibly how to integrate it in the existing curriculum.
- A participant from the Urban Authorities Association of Uganda (UAAU), Mr. J. Behangana, emphasized the importance of the research to the towns. He stated the need for more innovations to transform the agricultural sector so that we end up with less of the unwanted materials ending in towns. He said that he would have been happier if more towns had participated and ended by requesting participants to map a way of utilizing the findings.
- Members also requested for the findings to be put into a 'brief and simple' language for community consumption.
- Members were of the view that the livestock study should explore ways into which the MCW can be standardized say into pellets for feeding.

3.0 PLENARY SESSION

During the plenary, participants identified two main issues to address as the way forward and these were: making the policy environment more facilitating, and enhancing sensitization and outreach.

- On the issue of policy on waste management, participants were urged to assess what is available and take time and analyze by laws such as urban farming, garbage management, water and sanitation, etc. Why are they not implemented? Could it be that they are faulty? Members observed that politicians are among the major obstacles to implementation of such policies on waste management. How can we lobby for policy change? What particular policy can we advocate for? On this, the FA was encouraged to establish links with NEMA in order to harmonize. Also, that backed by the presented findings, the FA should explore avenues to influence policy. In the next phase, in liaison

with some NGOs such as Talents Call, include a pilot project to address policy issues, such as sorting. Involve social scientists.

- On the issue of sensitization and outreach, participants had the following views:
 - Continuous sensitization is necessary if waste is to be managed/utilized. Awareness programs highlighting the economic point of view should be the way to go. For instance, a participant dealing in composting as a commercial venture indicated that compost was highly demanded, yet a lot of garbage is still around?
 - Publish the findings and distribute to all towns in the country.
 - As a short-term strategy, meet with the UAAU constituency as an outreach strategy. Lets get off the ground and then refine on our way.
 - Create a direct link between FA and the District Agriculture Offices.
 - Include Religious and Cultural leaders in the dissemination process.
 - Field days to the research sites could also be a dissemination strategy.

4.0 CLOSING CEREMONY

The chairperson, Professor Mateete Bekunda thanked members for coming and contributing to the noble cause.

.2 4.1 Remarks by symposium convener

- Professor Sabiiti informed members that this had been a wonderful meeting. He informed participants that the planning was for 60 participants but 92 came portraying enthusiasm in the project.
- He emphasized the need to share the results with society and working together as partners.
- He informed participants that all their suggestions had been duly noted and pledged to address them gradually. He especially pledged to look into the suggestion about a meeting with the Urban Authority personnel.
- He informed participants that the project was coordinated by the Director, School of Graduate Studies, MUK and proceeded to introduce and acknowledge Dr. Christine Dranzoa, the deputy Director who was officiating at the afternoon session.
- He thanked the Dean, FA for chairing the proceedings.

- He thanked the PhD students for putting up an excellent performance and invited them to join the scientific team on completion of their PhDs.
- He thanked the team for the usual cooperation.
- He ended by thanking all the participants for making it a wonderful meeting.

4.2 Remarks by the Dean, FA

- The Dean congratulated the project on the different successes. He urged other members of the Faculty to learn from the day about multi-disciplinarity, and ensuring that information reaches the people.
- He informed members that he was proud to be Dean of the Faculty that was spearheading PMA. He urged participants to always come to the FA when seeking for information and to offer advice because the faculty is committed to carrying out research that is relevant to the communities.
- He thanked the Deputy Director for the management accorded to the project since the Faculty was also gaining in form of small research grants for members.
- He ended by inviting the Director, SGS to address participants.

4.3 Remarks from the Director, SGS (MUK)

- The Director was represented by Dr. Christine Dranzoa, the deputy Director SGS, who started by apologizing for the absence of the Director and her coming late to the symposium.
- She commended the achievements of the project. She said that though she had come late, she had heard interesting and important remarks from the audience. She was encouraged by the great contribution from the participants and hoped that the output will benefit the community.
- She extended her gratitude to the Swedish Government for supporting Phase I and the upcoming Phase II of the project.
- She informed participants that their office was in good cooperation with the project and thanked the team for being effective in running the project.
- She informed participants that everyone has a right to a clean environment, so when garbage is allowed to accumulate, this impinges on that right. As such the FA is helping to operationalise that statute.

- She thanked the PhD students for being vigilant and hard working and urged them to finish in the allotted time, as that is a measurable indicator. She urged the students to continue putting MUK on the world map.
- She expressed her appreciation to the dean, FA, and the Coordinator of the project for convening this workshop. “We have been blamed that we do not interface much with communities, so this is the way to go”, she said. She pledged continued support from SGS for such endeavors.
- She urged participants to embark on waste management starting with their individual homes, with MUK, and then other areas can learn from us.
- She informed members that crosscutting courses would be very acceptable to the school since they coordinate such courses. She encouraged the team to explore the same including a big socio-dimension.
- She finalized by congratulating all the participants and urged them to go out and transform the communities.
- Then she officially closed the symposium