JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY

ATTACHMENT REPORT

DEPARTMENT: HORTICULTURE

NAME: HABIB M. MRUTTU

REG.: AG231-0684/02

PLACE OF ATTACHMENT: BAOBAB TRUST MOMBASA

ATTACHMENT DURATION: 8 WEEKS

FROM: 3-5-2005 TO 24-6-2005

ACKNOWLEDGEMENTS

I would like to thank staff in the Department of Horticulture for making it possible for me to be attached for field experience. Special thanks to the Chairman of the Department Dr. Kamau Ngamau and in particular the Attachment coordinator Mr. Francis Obwara.

I am also greatly indebted to Boabab Trust and in particular Dr. Rene Haller for allowing me to use their facilities. Special thanks to my immediates supervisor Ms. Sarah Ater and other staff of Baobab Trust including Sonal, Mzee Khamis, Benard, Gabriel and Michael. Of course not forgetting other staff members at the farm, livestock section and Nguuni Sanctuary. To all of you I say THANK YOU.

BAOBAB TRUST

Boabab Trust is located within Bamburi Cement Factory compound which is in the North Coast about 10 kms from Mombasa city on the Mombasa-Malindi Road. It occupies land owned by Bamburi Cement Factory. Baobab Trust was founded in 1991 as a non profit making organization. It is run by a board of Trustees with Dr. Rene Haller as the Chief Trustee.

THE BAOBAB TRUST VISION

A world in which ecology and economy don't contradict but reinforce each other.

OBJECTIVES OF BAOBAB TRUST

1. To train local communities in the sustainable use of natural resources.
2. To create awareness of the complexity of our environment.
3. To install the spirit of sustainable development.

PROJECTS AND ACTIVIES OF BAOBAB TRUST

1. Demonstration Farm and Training
2. Nguuni Nature sanctuary
3. Environmental Education
4. Turtle Conservation
5. International Beach Clean-up

THE MTOPANGA TRAINING FARM

Organic farming is practices in this farm. The farm size is about 10 Acres. Activities on the farm include Vegetable farming, Annual crops, Fruits, Livestock and Fish farming. In addition alternative technologies such as Biogas production, Charcoal making and Manure making are practiced.

The farm is open to all who are interested in sustainable farming. Regular field days and trainings are conducted on the Farm in conjunction with staff from the Ministry of Agriculture where knowledge is shared with the public. Small scale farmers or other interested parties are encouraged to attend training sessions on relevant subjects where practical and theoretical lessons are taught these lessons include.

- Principles of organic farming
- Economic use of Land & Labour
- Soil and water conservation
- Integration of crop and livestock farming
- Alternative technologies

PRINCIPLES OF ORGANIC FARMING

In this case plants are grown using organic manures and pests controlled using organic pesticides (neem in solution). Organic manures used on the farm include;

1. BIOGAS SLURRY

This is a residue of cowdung used to generate Biogas. After the Anaerobic Bacteria have worked on the manure to produce Biogas, the resultant residue (slurry) is used as manure to grow crops. This is well decomposed manure and provide Nutrients that are easily taken up by plants.

2. COMPOST MANURE

Waste materials on the farm including crop residues are lumped together in some compartments made from coconut leaves to act as pits and regularly turned and sprinkled with water until the plant residues rot. The resultant material is then used as manure. Earthworms, millipedes and other insects help in decomposing the waste material. The plant organisms transform organic acids under moist and aerated conditions to organic nutritious matter.

3. WORM CULTURE

Hare worms are bred and used to work on waste products including Cowdung, Donkey dung and Plant wastes. The decomposed material is then used as manure. The Cowdung/Donkey dung is mixed with plant leaves and worms are introduced into this mixture. As the worms feed they help to break down the plant debris forming manure. The mixture must be moist and kept cool by sprinkling cold water so that the worms don't die due to too high temperatures. Millipedes work on the harder and stronger plant parts and break them down. The resulting manure is used to grow crops.

4. POULTRY MANURE

Wood shavings used in the poultry house after sometime break down to form manure. This manure has a high C:N ratio due to the presence of wood shavings and therefore its use has to be well controlled. Its decomposition is very slow but helps in drainage and therefore its better used in soils with poor drainage.especially clay soils.

5. FISH DROPPINGS

The farm has a few fish ponds where fish farming is practiced. Droppings from the fish is mixed with water and used as manure in water (fertigation). This water is used for irrigating crops in some form of fertigation. So one feeds the fish with pellets while the fish droppings are used as manure for growing crops.

ECONOMIC USE OF LAND AND LABOUR

Ponds on the farm are used to rear fish which are used as food by both Human beings and crocodiles. Water in fish ponds with fish droppings is used for fertigation. Inside some ponds, chicken houses have been constructed and the chicken droppings are fed on by the fish. So by feeding the chicken, the fish get their food from the chicken droppings and the fish and eaten by Human beings.

With water in the fish ponds throughout the year, then there is water for irrigation throughout the year. Small sized plots are grown with desired crops like vegetables, fruits and some annual crops. In this way the land is effectively used and the labour is kept busy all the time. Cowdung from the Dairy Animals kept on the farm is used in the Biogas plant and as well as manure.

SOIL AND WATER CONSERVATION

The trust is involved in rehabilitating one of the Hills of Nguu Tatu near Kiembeni Estate in Mombasa which has been adversely affected by soil erosion as a result of people cutting trees on this hill for charcoal burning. The hill has been left bare and when it rains the soils are eroded and transported down stream to the Indian Ocean. Awareness campaigns had to be conducted to sensitise people on the need to grow trees and build Garbions to check the speed of water, so that all the soil is not eroded downstream.

After a lot of sensitization people were convinced on the need to conserve the environment. Tree planting is being carried out right now with community participation. So far 1100 trees have been planted. Farmers are digging terraces on their farms while Garbions are being built on the Valleys. Some Dams are also being constructed to collect the excess water and use the water for Human and Animal use.

The Baobab Trust promotes a number of environmental education initiatives as part of its vision to work with communities to protect the ennvironment Farmer Field School training programs and environmental Teacher Training courses are held as well as other initiatives targeted to schools and community film shows. In addition the development of an environment education center in Nguuni Nature sanctuary is planned from which the schools and communities around can benefit.

TURTLE CONSERVATION

Baobab Trust is active in Turtle conservation programs. The Trust works with Local Fisherman, Kenya Wild life service (KWS) and Kenya Sea Turtle conservation Committee (KESCOM). The Trust assists in protecting Turtle Nests and even has its own hatchery where the Turtle eggs can be incubated after being removed from unsage nest sites. Besides the active conservation of the Turtles, the Trust works closely with the local fishing communities to create awareness of the importance of conserving these marine reptiles.

NGUUNI NATURE SANCTUARY

Only a few kilometers outside Mombasa in the North Coast near Kiembeini Estate, 100 ha of land has been leased to Baobab Trust by Bamburi cement. Here in a natural surrounding of open Acacia woodland, dotted with Doum palms small herds of Oyx and Eland Antelopes are breed. Several dams create a wetland and more than 200 bird species can be found.

The surrounding communities are involved in the sanctuary and get the opportunity to learn more about nature and conservation.

In addition the trust gives assistance to community projects such as collecting firewood. Tree planting producing and marketing energy saving stores as well as dam building.

INTERNATIONAL BEACH CLEAN-UP

Baobab Trust has coordinated the International Beach clean-up in Mombasa since 1993. During this event people concerned with the environment, particularly marine life, go to the beaches and help clean them up by collecting the accumulated rubbish. The clean-up also creates awareness of the importance of an unpolluted environment.

ALTERNATIVE TECHNOLOGIES

1. BIOGAS PRODUCTION

Cowdung from the dairy cows on the farm is used to generate biogas. One debe of cowdung is mixed with 4 debes of water and fed into the digesters. The digester has anaerobic bacteria which feed on the cowdung and give out, biogas. The digester is made of a double polythene of gauge 500 placedon at shallow trench made in the ground. The cowdung mixture is fed from one side and the excess comes out from the other side.

The biogas produced by the Anaerobic bacteria rises and gets into tubes connected to a storage container also made of double layered polythene tied on both ends which acts as the gas cylinder. As you add fresh cowdung mixture, the old digested one is pushed out as biogas slurry which is used as manure for growing crops. The biogas slurry since it has already been worked on by the Bacteria is a better manure than fresh cowdung.

Drums can also be used as Digesters but the disadvantage is that with time Drums rust and breakdown and have to be replaced quite often. Two cows can be able to produce enough dung to feed a digester 5 m long and 54 cm wide with one bucket of manure every day. A slightly higher concentration of Cowdung mixture (1:1) is used for the Drum digester since it is possible to stir the mixture regularly.

2. NEEM SOLUTION AS A PESTICIDE

Neem solution can be used to control soft bodied insect pests. The active compound in Neem solution is limonoids. This compound disrupts larvae, eggs

and pupae. The compound block larvae from molting, disrupt mating, deter females from laying eggs and also disrupt feeding.

The solution is made by filling a bucket half with crashed leaves and Neem bark. Mix the mixture with 12 litres of water and leave the solution to stand overnight and filter the solution the following day. Add 100 ml methanol (90%) 100 m/s oil and a few drops of soap. You can also use crashed seeds instead of leaves and the bark.

CHARCOAL BURNING

An oil drum is cut at the bottom to remove the bottom. It is then turned upside down with the 2 normal openings on the lid facing down. Pieces of sticks are cut 3-5 inches long and filled into the drum after loading the drum, a wiremesh cover is put on top to prevent the pieces of stick from falling off when the drum is turned. These sticks could be prunnings from bigger trees in the shamba. This means you don't cut the whole tree to make charcoal but rather use the prunnings.

Three stones are set on the ground and a fire lit. The drum with stick pieces is then turned with the open end with wiremest placed on the 3 stones facing the fire and let the fire burn for about 1 hour getting into the pieces of sticks. The fire is then extinguished by covering with mud around the fire place (around the 3 stones). Pipes commensurate with the size of the holes are then screwed on top of the drum and left in place for 8-9 hours watching the smoke. When the smoke reduces and turns blue, the pipes are unscrewed and the holes covered with mud. The drum is left standing for 12 hours for it to cool. It is then turned over and the charcoal harvested.

CROPS GROWN ON THE FARM

Crops grown on the farm included Spider plant, Amaranthus, Brinjals, African Nightshape, Cowpeas, Okra, Maize, Bulrush millet, etc. We also have fruits like coconuts, Citrus, Bananas e.t.c. Crops are grown in plots measuring 5 x 5 m as well as strips of about 10 m x 5 m. The smaller plots (5 x 5 m) are mainly used for experiments while the larger plots are used for production.

However the vegetable plots are too small for any economic profit and therefore there is need to either increase the plot size or plant more frequently, so that there is a continuous supply of vegetables for sale. It was also noted with a lot of concern that the vegetable seeds used had very poor viability, may be because they have been exposed for too long. Infact for the local vegetables like Amaranthus and African Nightshade, it was the volunteer seedlings growing on the farm that were being used. This practice poses a challenge in establishing a uniform plot of the same age hence plants were flowering at different times in the same plot. Infact some plants started flowering immediately after transplanting and hence could not produce enough leaves for harvesting.

This practice should be discourage and proper Nurseries with fresh seeds be established for the vegetables in order to monitor growth and get maximum leaves for harvesting. Moreover transplanting volunteer seedlings could result in transferring diseases from one generation to another.

The fruit trees of oranges require proper pruning and proper pest and disease control in order to obtain optimum yield. They seem to have been severely *affected by scales. Banana stools appear bushy and could do with proper pruning* and leaving optimum number of daughter plants. The banana fruits are destroyed by monkeys and have to be bagged all the time.

Planting other annual crops like maize poses a challenge due to monkey damage. A way has to be found to take care of the monkeys so that they don't damage the maize grown. There is also the threat of Birds damage on Rice and Bullrush millet grown and a proper scaring method has to be designed to scare the birds away.

PRODUCTION OF AMARANTHUS

They belong to the Family Amaranthaceae. There are 2 groups of Amaranthus which are well developed. That is grain Amaranthus and vegetable Amaranthus Grain Amaranth is used to make Amaranth porridge and therefore the interest is on flowers (reproduction stage)while the focus on vegetable Amaranth is on leaves.

There are a number of Amaranth species including Amaranthus blitum – Mediterranean Amaranthus dubius – South American, Amaranthus graecicans which is wild with no known center of origin.

It is an annual crop and grows upright most of the time, although we have some that are prostrate e.g. Amaranthus blitum. The plant is largely self pollinated and therefore good for breeding purposes. With adequate irrigation Amaranth can grow at the rate of 3 inches per day. Amaranth is a broad leafed plant that produces significant amounts of edible cereal grain. The seed contains protein high in amino acid lysine, which is good since most cereals lay sufficient amounts of lysine.

ECOLOGICAL REQUIREMENTS

It is a warm season crop (25-30^{0}c) and prefers short days (short day plant) when grown as grain Amaranth. It requires a day length of less than 12 hours for it to flower. Amaranth can tolerate a low pH (4.5) and is also drought tolerant. This is because it forms deep roots and has high osmotic potential in leaves which helps it to survive stress conditions. Amaranth is also able to close the stomata partially and hence reduce water loss through the transpiration. In this way the plant can withstand water stress.

AGRONOMY

Amaranth can be transplanted or direct seeded. Spacing depend on purpose (either grains or leaves) and a ranges from 30 x 10 to 10 x 10 cm. Spacing will also depend on harvesting method (either harvesting few leaves at a time or uprooting the whole plant).

Nutrition – The plant is a heavy feeder and requires high amounts of nutrients. Organic manures are good sources of nutrients for this crop.

The plant requires a lot of Nitrogen in the rate of 48 Kg N per hectare. Nitrogen application is also used to delay flowering in order to encourage vegetative growth.

The crop also requires a lot of water and at the coast the crop is irrigated twice a day (in the morning and in the evening). The crop grows very fast with proper irrigation (can grow at the rate of 3 inches per day). Flood irrigation is the main method of irrigation at the coast.

PESTS AND DISEASES

Aphids are the main pests, although we do have other pests. Amaranth pests mainly feed on leaves. Leaf-miners have also been found on Amaranth leaves. Other insect pests include spider mites and stem weevil (Lixus truncatulus). Seedbeds should be guarded against Ants and Termites which carry seeds away.

The common disease of Amaranth is damping off caused by pythium and Rhizoctonia fungus especially at nursery stage. We also have blight disease of leaves and flowers caused by Alternaria amaranthi. While Rust caused by Albiyo bliti in which white pustules on the underside of the leaves reduce the market appeal of vegetable amaranth.

Control: Fungal diseases can be controlled by well drained soils. Various fungicides can also be used. Manuring can eliminate some of the fungal problems.

HARVESTING OF AMARANTH

Harvesting can be done 20-45 days after planting. Harvesting involves plucking of leaves over a period of time or uprooting the whole plant. Amaranth can accumulate a lot of nitrates in the leaves. However boiling the leaves removes most of the Nitrates. Oxalic levels in Amaranth can be uncomfortably high particularly when the plant is grown under dry conditions boiling dissolves the oxalic acid in water, and therefore make Amaranthus non-toxic.

GROSS MARGIN FOR AMARANTHUS

	VARIABLE COSTS	QUANTITY PER ACRE	UNIT PRICE (KSHS)	TOTAL (KSHS)
1	Ploughing	6 times	3,000.00	18,000.00
2	Making basins			3,552.00
3	Purchasing manure	3 Seven Ton Lorries	14,700.00	
4	Spreading manuare			4,800.00
5	Seed purchases	5 Buckets	300.00	1,500.00
6.	Planting			4,800.00
7.	Weeding			960.00
8.	Spraying			34,180.00
9.	Harvesting			8,640.00
10	Transport	555 bags	20.00	11,100.00
11	Marketing (CESS) at wholesale market	555 bags	10.00	5,500.00
12	Miscellaneous 5%			7,234.00
13	Interest on working capital at 8%			12,154.00
14	TOTAL VARIABLE COSTS			156,520.50
	YIELD	55,555 Bundles	5.00	277,775.00
	GROSS MARGIN PER ACRE			121,254.50
	GROSS MARGIN PER HECTARE			303,136.25

VEGETABLE EXPERIMENTS

Vegetable experiments were set to try and establish the best manure to use for different crops. Manure types used included biogas slurry, compost, worm culture and poultry. Crops grown included maize (PH1), Cow peas, African, Nightshades. The crops were grown using different manure types and data taken on stem length, number of leaves and leaf width as parameters to gauge plant growth. Data was taken for 4 consecutive weeks and the results were as follows:

SUMMARY

CROP: MAIZE

PARAMETER: PLANT HEIGHT AVERAGES

TREATMENT: BIOGAS SLURRY

PLOT NUMBER	DAYS AFTER PLANTING			
	14	21	28	35
1	12.9cm	19.6cm	32.6cm	56.8cm
2	12.1cm	18.8cm	34.0cm	49.8cm
3	11.9cm	16.4cm	29.6cm	40.2cm
GRAND AVERAGE	**11.9cm**	**16.4cm**	**29.6cm**	**40.2cm**

MAIZE + COMPOST

1	10.3	12.8	18.2	21.8
2	8.9	12.0	17.2	26.8
3	9.1	12.8	18.8	24.0
GRAND AVERAGE	**9.4**	**12.5**	**18.1**	**24.2**

PARAMETER: AVERAGE NUMBER OF LEAVES

MAIZE + BIOGAS SLURRY

PLOT NUMBER	DAYS AFTER PLANTING			
	14	21	28	35
1	6	9	10	12
2	6	9	10	11
3	6	8	9	11
GRAND AVERAGE	**6**	**9**	**10**	**11**

MAIZE + COMPOST

1	5	7	7	7
2	5	7	7	8
3	5	8	8	9
GRAND AVERAGE	**5**	**7**	**7**	**8**

PARAMETER: LEAF WIDTH AVERAGE (cm)

MAIZE + BIOGAS SLURRY

PLOT NUMBER	DAYS AFTER PLANTING			
	14	21	28	35
1	2.7	3.9	5.9	7.8
2	2.4	3.9	6.3	7.2
3	2.2	3.2	5.6	7.7
GRAND AVERAGE	**2.4**	**3.7**	**5.9**	**7.6**

MAIZE + COMPOST

1	1.9	2.6	3.3	4.1
2	1.4	2.3	3.2	4.4
3	1.3	2.3	2.4	4.0
GRAND AVERAGE	**1.5**	**2.4**	**3.0**	**4.2**

SUMMARY

TREATMENTS	PLOT JMBER	AVERAGE AXIMUM EIGHT (cm)	AVERAGE AXIMUM NO.OF AVES	AVERAGE AXIMUM LEAF WIDTH (cm)
Biogas slurry	1	56.8	12	7.8
	2	49.8	11	7.2
	3	40.2	11	7.7
Compost	1	21.8	7	4.1
	2	26.8	8	4.4
	3	24.0	8	4.0

SUMMARY

CROP: AFRICAN NIGHTSHADE

PARAMETER: PLANT HEIGHT AVERAGES **TREATMENT**: POULTRY MANURE

PLOT NUMBER	DAYS AFTER PLANTING			
	14	21	28	35
1	10.6cm	20.2cm	27.8cm	27cm
2	15cm	22cm	32.2cm	45.8cm
3	11.2cm	21.8cm	30cm	38.2cm
GRAND AVERAGE	**12.3cm**	**21.3cm**	**30cm**	**40.3cm**

TREATMENT: BIOGAS SLURRY

1	9.1cm	16.8cm	23.8cm	34.8cm
2	7.6cm	14cm	18cm	30.4cm
3	8.4cm	15cm	23.8cm	28cm
GRAND AVERAGE	**8.4cm**	**15cm**	**21.9cm**	**31.1cm**

PARAMETER: NUMBER OF LEAVES

AFRICAN NIGHTSHADE + POULTRY MANURE

PLOT NUMBER	DAYS AFTER PLANTING			
	14	21	28	35
1	9	33	60	98
2	8	22	33	97
3	9	33	55	97
GRAND AVERAGE	**9**	**29.0**	**49.0**	**97**

AFRICAN NIGHTSHADE + BIOGAS SLURRY

1	9	17	24	35
2	8	14	18	30
3	8	15	24	28
GRAND AVERAGE	**8. 0**	**15**	**22**	**31**

PARAMETER: LEAF WIDTH

AFRICAN NIGHTSHADE + POULTRY MANURE

PLOT NUMBER	DAYS AFTER PLANTING			
	14	21	28	35
1	3cm	3.5cm	41cm	4.6cm
2	4.5cm	4.5cm	3.9cm	4.1cm
3	3.8cm	4.9cm	3.9cm	4.7cm
GRAND AVERAGE	**3.8cm**	**4.3cm**	**4cm**	**4.5cm**

AFRICAN NIGHTSHADE + BIOGAS SLURRY

1	3.2	3.5	4.3	4.3
2	2.9	3.6	4.5	4.7
3	3.1	3.2	4.2	4.7
GRAND AVERAGE	**3.1cm**	**3.4cm**	**4.3cm**	**4.7cm**

GRAND SUMMARY

TREATMENTS	PLOT JMBER	AVERAGE AXIMUM EIGHT (cm)	AVERAGE AXIMUM NO.OF AVES	AVERAGE AXIMUM LEAF WIDTH (cm)
Biogas slurry	1	37	98	4.6
	2	45.3	97	4.1
	3	38.2	97	4.7
Compost	1	34.8	35	4.3
	2	30.4	30	4.7
	3	28.0	28	4.7

ANALYSIS

Analysis of variance using completely randomized design (CRD) for maize

Treatment	Plant height			Trt total	Trt ans
Biogas slurry	32.6	34.0	29.6	96.2	32.07
Compost	18.2	17.2	18.1	53.5	17.8
Grand total				**149.7**	**49.9**

ANOVA TABLE

Source riation	Degrees of edom	Sum of uare	Mean uare	Observed F	Tabular F 5%	1%
Treatment	2-1 =1	303.882	303.882	113.47**	7.71	21.20
Experimenta rror	5-1=4	10.713	2.678			
Total	6-1=5	314.195				

Correction factor $= \frac{149.7^2}{6} = \frac{22410.09}{6} = 3735.015$

Total ss $= 32.6^2 + 34^2 + 29.6^2 + 18.2^2 + 17.2^2 + 18.1^2 - 3735.45$

$4049.61 - 3735.015 = 314.595$

Treatment ss $= \frac{96.2^2 + 53.5^2}{3} - CF$

$= 4038.897 - 3735.015 = 303.882$

CV $= \frac{\sqrt{2.678}}{49.9} \times 100 = 3.279 - 3.3\%$

There is a significant difference between the treatments with biogas slurry doing better than compost

ANOVA FOR AFRICAN NIGHTSHADE

Treatment	Number of leaves			Leaf total	Treat ans
Poultry manure	98	97	97	292	97.3
Biogas slurry	35	30	28	93	31.0
Grand total				**385**	**128.3**

ANOVA TABLE

Source of riation	Degree of edom	Sum of uares	Mean uare	Observed	Tabular F 5%	1%
Treatment	1	6600.166	6600.166	989.98**	7.71	21.20
Experimenta rror	4	26.667	6.667			
Total	**5**	**6626.833**				

Correction factor CF = $\frac{385^2}{6}$ = 24704.167

Total ss = $98^2 + 97^2 + 97^2 + 35^2 + 30^2 + 28^2$ + - 2404.167

= 31331 – 24704.167 = 6626.833

Treatment ss = $\frac{292^2}{3}$ + 93^2 – CF

= 31304.333 – 24704.16 = 6600.166

CV = $\frac{\sqrt{6.667} \times 100}{128.3}$ = 2.013

There is a significant difference between the 2 treatments with poultry manure giving more leaves

COW PEAS

PARAMETER: PLANT HEIGHT

TREATMENT: WORM CULTURE

PLOT NUMBER	DAYS	AFTER	PLANTING	
	14	21	28	35
1	8.4cm	9.3cm	13cm	16cm
2	7.4cm	8.4cm	13.4cm	16cm
3	8.0cm	9.9cm	10.8cm	14.8 cm
GRAND AVERAGE	**7.9 cm**	**9.2cm**	**12.4cm**	**15.6cm**

TREATMENT :BIOGAS SLURRY

1	9.4cm	10.8cm	10.6cm	13.8cm
2	10.6cm	14cm	15.2cm	16.4cm
3	8.8cm	11.4cm	13.0cm	14.6cm
GRAND AVERAGE	**9.6cm**	**12.1cm**	**12.9cm**	**14.9cm**

PARAMETER: NUMBER OF LEAVES

COWPEAS + WORM CULTURE

PLOT NUMBER	DAYS	AFTER	PLANTING	
	14	21	28	35
1	8	9	13	16
2	7	8	13	16
3	8	10	11	15
GRAND AVERAGE	**8**	**9**	**12**	**16**

COW PEAS + BIOGAS SLURRY

1	6	8	9	11
2	5	8	11	13
3	5	8	10	11
GRAND AVERAGE	**5**	**8**	**10**	**12**

PARAMETER: LEAF WIDTH

COWPEAS + WORM CULTURE

PLOT NUMBER	DAYS	AFTER	PLANTING	
	14	21	28	35
1	3cm	3.7 cm	6.1cm	7.1cm
2	3.3cm	4.1cm	5.5cm	7.3cm
3	3.2cm	4.2cm	5.9cm	7.3 cm
GRAND AVERAGE	**3.2 cm**	**4cm**	**5.8cm**	**7.2cm**

COW PEAS + BIOGAS SLURRY

1	3.4cm	3.6cm	3.9cm	4.1cm
2	3.4cm	3.5cm	3.8cm	4.0cm
3	3.1cm	4.0cm	4.3cm	4.5cm
GRAND AVERAGE	**3.3cm**	**3.7cm**	**4cm**	**4.2cm**

GRAND SUMMARY

TREATMENTS	PLOT JMBER	AVERAGE AXIMUM IGHT (cm)	AVERAGE AXIMUM NO.OF AVES	AVERAGE AXIMUM LEAF WIDTH (cm)
Worm culture	1	16	16	7.1
	2	16	16	7.3
	3	14.8	15	7.3
Biogas slurry	1	13.8	11	4.1
	2	16.4	13	4.0
	3	14.6	11	4.5

ANOVA FOR COWPEAS

Treatment	Number of leaves			Leaf total	Treat ans
Worm culture	16	16	15	47	15.67
Biogas slurry	11	13	11	35	11.67
Grand total				**82**	**27.34**

ANOVA TABLE

Source of riation	Degrees of edom	Sum of uares	Mean uare	Observed	Tabular F 5%	1%
Treatment	1	23.996	23.996	28.789**	7.71	21.20
Experimenta rror	4	3.334	0.8335			
Total	**5**	**27.33**				

$CF = \frac{82^2}{6} = \frac{6724}{6} = 1120.67$

Total ss= $16^2 + 16^2 + 15^2 + 11^2 + 13^2 + 11^2 - 1120.67$

$=1148-1120.67=27.33$

Treatment ss$=\frac{47^2 + 35^2}{3} - CF$

$=1144.67 - 1120.67 = 23.996$

$CV = \frac{\sqrt{0.8335}}{27.34} \times 100 = 3.3\ \%$

*There is significant difference between the two treatments with worm culture doing better than biogas slurry.

DISCUSSION AND CONCLUSIONS:

Crops performed differently depending on the manure used. In case of maize biogas slurry performed better than the compost. However, it was difficult to make a firm conclusion based on this performance because the plot of compost experienced some problems of waterlogging. The African nightshade plots had better performance in poultry manure than the biogas slurry while for cowpeas better performance was observed in worm culture than in biogas slurry.

However, since the experiments were only conducted once with attendant water logging problems, there's need to repeat the same under more ideal conditions before making final and binding conclusions.

Baobab Trust is a non profit making organisation run by a board pf Trustees. This means the organization is not involved in any profit making venture but rely solely on donors. However, I think this is a bit tricky in the event the donors pull out. It is therefore necessary to up grade the scale of operations so that atleast the recurrent expenditure is covered. It is therefore in the light of the above that some recommendations are made.

1. It was noted that the scale of vegetable production was too low and poorly coordinated. There is therefore need to increase acreage and plant at a regular interval so that yields from the same can atleast pay for the labour and seeds. The farm being near Mombasa city should not experience any problem in marketing the same.

2. It was also noted that planting was done using volunteer seedlings found growing in the field. This is a very poor way of raising seedlings as this may result in transferring diseases from one generation to the next. Moreover it is difficult to get seedlings of the same age at the same time. This therefore result in a situation where some plants flower earlier than others and some even flower immediately after transplanting giving very little vegetative growth. It must also be noted that some seeds are purchased in a hybrid state and continued replanting of the same result in reduced hybrid vigour e.g. the early flowering of plants could be an indication of reduced vigour.

3. Planting of the vegetables should be in a staggered manner to ensure that there is always plants ready for harvesting. This will ensure a steady flow of cash for paying the labour and purchase of fresh seeds. Ideally production should be at the level where it can pay the person working there and buy seeds and other continuously used inputs.

4. It was also noted with a lot of concern the damage caused by monkeys e.g. all the maize planted on the farm is destroyed by monkeys. There is therefore need to control the monkeys and avoid damage on the crop either through scaring methods using a dog and Human Labour or complete electrification of the fence in areas planted with the same. Bird damage is also another problem that need to be addressed as they destroy the rice, sorghum and bulrush millet grown on the farm. This is very discouraging to the person working on the same if he/she will plant things and never harvest anything at the end of the season.

5. The plants grown under sterile media (pumice) seen to be doing poorly. This could be due to the uncontrolled level of salts in the irrigation water. It is therefore necessary to periodically analyse the irrigation water and make the necessary adjustments as per plant requirements.