



COVAMS



# Working Paper

No. 11

## **Observation on Effectiveness of Compost** **against termites**

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Mrs. Lipato	Conservation Coordinating Officer (Agriculture)
Mr. Kasawe	Conservation Coordinating Officer (Agriculture)
Mr. Chinzukira	Conservation Coordinating Officer (Agriculture)
Mr. Thole	Conservation Coordinating Officer (Agriculture)
Mr. H. Kanazawa	Rural development Advisor

**The project for Community Vitalization and Afforestation in Middle Shire**  
(COVAMS)

Forestry department / Japan International Cooperation Agency

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## 1. Summary

Probability of controlling insect damage by termites with manure is high for certain period although it is precarious in its mechanism. COVAMS project has observed it in a maize growing experiment which conducted in 2011 / 2012 planting season. The experiment was conducted in none scientific way but empirical way since the project has no capacity to do it scientifically.

Four (4) research purpose maize garden, which the owner of the gardens claimed that they had been experiencing little harvest of maize from the same garden due to termites attack, showed outstanding asymmetry in the growth and its harvest of maize between manure applied plot and none applied plot. The yields of three gardens at none manure applied plots were in a range of 1.5t to 2.5t per hectare. On the other hand, manure applied plots yielded in a range of 3.3t to around 7t per hectare despite manure applied plots are all contiguous to none manure applied plots. Makanani research field got the most impressive discrepancy in the growth of maize. Maize in manure applied plot showed very healthy growth while the one in none manure applied plot was devastated by suspected insect damage by termites, which apparently very few harvest was expected.

All the farmers and CCOs who were involved in this research observed very few termites inside the ridges in the manure applied plots compare to that of none manure applied plots. One of the CCOs reckoned the number of termites at a point of 15cm deep of a ridge where maize stands. It was 8 versus 53 of termites population for manure applied plot and none manure applied plot respectively.

Besides, one of the extension officers of the Forestry Department reported that transplanted seedlings of a tree species, which planted at the same place where young small trees were damaged by termites previously in the same season, escaped termites attack by applying manure in the planting hole prior to transplanting.

All these empirical research results led the research team to think that manure can work to control insect damage by termites although the effect is for a certain period but enough to grow maize and harvest. This result may help CCOs and lead farmers to build good relations with fellow farmers and encourage them to practice soil erosion control technologies, since there are so many farmers who are not having enough harvest due to termites attack in the project area.

However, it is necessary for this research to be carried out scientifically to ascertain if manure really works to prevent termites attack. It is a hope of the research team that an agricultural research centre will carry out this research scientifically.

## **2. Background**

It was 2010 / 2011 planting season when the project stumbled on a startling phenomenon. A control plot of a project demonstration field which was applied manure performed far better in maize growth than that of a conserved plot with contour ridging, box ridges and swales but without manure. The result seemed to show not only the effectiveness of the manure in the growth of maize but also something as a deterrent to insect damage by termites.

The project demonstration plot was designed for measuring effectiveness of conservation technologies such as contour ridges, box ridges, swales, hedge row and agro-forestry species (*Gliricidia*) in mitigating silt erosions from a maize garden. The demonstration plot was developed in 2009. For comparison sake, the demonstration plot has a control plot which has no means of protection of the soil and ridges were made along the slope.

During the 2009 / 2010 planting season, the control plot showed very poor performance in maize growing from the beginning. Most of the germinated maize plants changed the color of their leaves to yellowish and the edges of earlier leaves became brownish. The same symptom was observed in the conserved plot although the number of such plants was far less to that of control plot. Both plots had been given the same amount of fertilizers, variety and time of planting. Inside the ridges of those plants which became yellowish, termites were observed around its roots and it was observed that the roots were less exuberant than those of healthier plants. It was suspected that the plants got an insect damage by termites. As the time went on, the gap between the healthy plants and the one having yellowish leaves became wider in growth. The yellowish ones remained very low height stunted and most of them could not form cobs or very small one with a few grains. Consequently it made very huge difference in yield. The conserve plot had a harvest of 13kgs from about 60m<sup>2</sup>, while control plot had 4kgs from the same unit of area. Moreover, the quantity of the harvest of the control plot made very little change, even harvested entire control plot because of poor growth. The condition of rain during the planting period was; “The rain falls in the 2009 – 2010 planting season was less as compared to normal year. The total volume of the rain fall was 718mm at

Chiwallo from November 2009 to April 2010, at the same time; its distribution was very erratic, as farmers experienced dry spell in November after they had planted maize.”<sup>1</sup> As a result, conservation technologies were seen to be effective as far as yield is concerned as they keep moisture in the soil and hence effective to minimize termites attack, too.



2010, far site is conserved plot and near site is control. It was suspected that many plants were damaged by termites at control plot.

In the planting season of 2010 / 2011, the demonstration plot supposed to be prepared in almost the same conditions as the one of previous year for the same maize growing, although the residues of maize stalks and some branches of Gliricidia were to be incorporated into the soil for the conserved plot. The incorporation of the said organic matters was actually done in June 2010. Besides, one thing was changed on the demo-plot management in that the project left it to the field owner to do it on her own in terms of time of applying, basal dressing and top dressing including weeding. This decision led to the owner to apply manure to the control plot, expecting improvement in the performance of maize growth and its harvest.

From the beginning of the germination, the performance of the maize of the control plot was totally different from the one in the previous year. No yellowish plants were identified at all; instead it was exuberant, while conserved plot had the same symptoms of insect damage in almost the same rate as previous year. The tendency continued up to harvesting time.

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<sup>1</sup> COVAMS working paper No.9, “The result of the project demonstration plot”



2011, the left is conserved plot, control plot is the right side



2011, control plot right, the left is outside of the project demo-plot

Table 1: Rainfall at the project demonstration field (Chiwalo village) in 2010 / 2011

Month	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Total
Rain	19mm	72mm	265mm	182mm	18mm	247mm	74mm	3mm	880mm
Days	2	4	12	13	5	17	6	2	

As a result, yield was relentlessly affected by the drought in Feb. (refer to table 1) and termites, especially on the conserved plot as table 2 shows. The yield in the control plot at Chiwalo demonstration field could have been half of the previous year as the other demonstration field (Chuma) got only half of 2010 yield. The yield of conserved plot at Chiwalo was actually less reduced to 61.7% of the previous year, as compared to the one of Chuma which had 55% reduction, despite having some distribution of rainfall at both sites had the same tendency. These factors indicate that the control plot at Chiwalo made a tremendous improvement in terms of maize yield with application of just handful manure. In estimation sense, the increase would be 6 to 7 times that of expected yield, assuming 20kg of harvest from the control plot at Chiwalo if manure was not applied.

The table 2: Maize yields of the project demonstration fields

Village	Conserved plot		Control plot	
	2010	2011	2010	2011
Chuma	238.7kg	131.7kg	171.5kg	59.8kg
Chiwalo	107kg	65.8kg	33kg	136kg

Note 1: the size of each plot is 500sqm.

Note 2: The yields of the year 2010 were estimation from the sample harvest of 60m<sup>2</sup>.

Note 3: The yields of the year 2011 were weighed the whole harvest of each plot.

While the effectiveness of handful manure intrigued us in increasing the yield significantly, a question came as to why the termites which was supposed or expected to cause damage to the maize did not do so. The termites were there in the field since conserved plot had damage of termites. What happen to them? How come they did not attack the maize at the control where manure was applied? This result gave us an intuitive idea that it could be the manure which prevented termites attack.

In 2011, the project planned to have a thwack at seeing efficacy of manure in minimizing insect damage by termites in a number of fields.

### **3. Selection of research plot**

In September of 2011, four farmers had been identified by CCOs (Conservation Coordinating Officer) and they agreed on collaboration to have research plot in their gardens. These farmers showed strong interest in the experiment as all of them have some gardens where termites disturb their maize growing. The research purpose plots were set out in their gardens where they have been experiencing termites attack on maize.

The project management decided to have three to four of research plots for this purpose, and consulted to respective four CCOs from Department of Agriculture Extension Services on their will to execute the research work with these identified farmers. Apparently, the aim of the trial induced them to be involved since they have lots of experiences that termites attack maize gardens.

The following conditions for this exercise were given to the CCOs for them to negotiate for the collaboration of farmers:

- 1) The project supply necessary fertilizers and seeds.
- 2) No compensation attached for the participation.
- 3) The harvest from the plot belongs to the owner of the gardens.

Each CCO selected one candidate and the decision was made by all the four members including the reporter after visiting the sites in plenary. During the site visit, some interviews were made to know the history and conditions of the fields. The selected farmers as participants happen to be COVAMS lead farmers, and the result of the visit was summarized in the table 3.

Table 3: Cooperating CCOs and farmers with condition of the fields

CCO	Village	Farmer	Field history
Mr. Thole	Mtema	Mrs. Cecilia Alfazema	Conserved Manure was applied in 2010 / 2011 planting season and yield increased and observed reduced insect damage.
Mr. Kasawe	Kaipa	Mrs. Maria Sinkalea	Conserved 150kg harvested from 600sqm with a seeds treatment for termites in 2011. (Moslime GT) chemical for Cotton
Mr. Chinzukira	Gavi	Mrs. Catherine Manyaba	Conserved 6 bags from about 1500sqm harvested in 2011. The field near termites' hill had severe damage.
Mrs. Lipato	Makanani	Mrs. Beatrice Kalizinje	Conserved Opened 20years ago, but termites attack had started since 5 years ago and had very poor harvest. Two years ago, the owner started crop rotation with ground nuts but termites attack did not reduced.

Apart from these research purpose plots, Chiwalo demonstration field was also included to observe the efficacy of manure. However, it was planned to apply manure to both conserved plot and control plot this time.

#### 4. Design of the research

It was empirical research on this subject since the project and the members have no capacity to do it in a scientific way. Therefore, the members agreed that what we can do was only to observe how the maize grew and existence of termites in the fields during the period from seed sowing to harvesting.

The experiment was designed as follows;

Table 4: Design of research plot

	Conserved	Control
Area	300m <sup>2</sup> (150m <sup>2</sup> + 150m <sup>2</sup> )	300m <sup>2</sup>
Seeds	SCO403	SCO403
Chemical Fertilizer	Basal dressing :3kg Top dressing:4.5kg	Basal dressing:3kg Top dressing:4.5kg
Manure	To be applied (early / late)	Not to be applied



The farmers were not given particular instructions on how to make manure. The project, rather tried to accept diversified materials and one method so that it may ease us to analyze if there were any particular type of manure which prevent termites attack.

Both control and conserved fields were conserved with contour ridges and box ridges, although swale was not always dug (only one farmer had). All the fields were set in gentle slope (less than 5% ).

The timing of application of manure was set twice to see if the timing of application affected to the termites attack to the maize plants. One is early application which applies manure three weeks before planting seeds, while late application is to apply manure just before planting seeds.

## **5. Manure**

As above mentioned, there was no instruction on how to make manure to the cooperating farmers. Hence they used what was available at that time. The materials used to make the manure of each farmer were as follows;

Mrs. Cecilia Alfazema

Materials: Maize stalks, Chicken dung and Goat dung, Maize husks, Ashes

Method: Pit

Month of made: Early June 2011

Applied day: October 12 2011(early application), October 30 2011(late application)

Applied amount per station: Two(2) handfuls every 30cm distance

Place applied at the station: Groove

Mrs. Maria Sinclair

Materials: Maize stalks, Grass, Dung from goat, and Ashes

Method: Pit

Month of made: July 2011

Applied day: November 8, 2011(early planting), December 26, 2011(late planting)

Applied amount per station: Two (2) handfuls per station

Place applied at the station: Inside the planting pit

Mrs. Catherine Manyaba

Materials: Animal dung, Maize stalks, Ashes

Method: Pit

Month of made: End of May 2011

Applied day: October 18(early application), November 3(late application)

Place applied at the station: groove

Mrs. Beatrice Kalizinje

Materials: Cow dung, Maize stalks, Grass, Ashes

Method: Pit ?

Month of made: Early August 2011

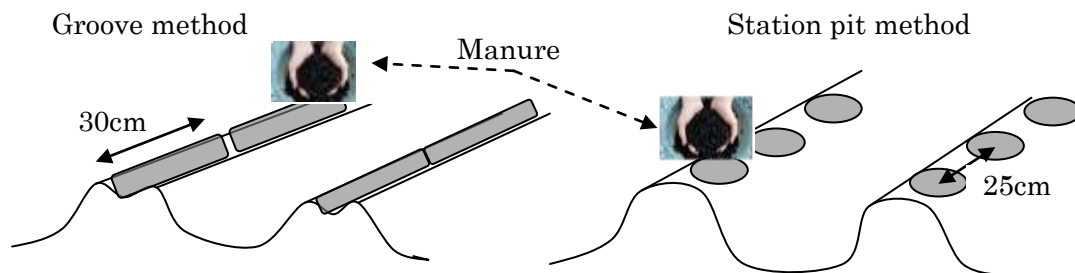
Applied day: 4th week of October 2011(early application), 3rd week of November (late application)

Applied amount per station: Applied amount per station: Two (2) handfuls per station

Place applied at the station: Inside the planting pit

Two kinds of manure application methods were found as figure 1 shows. One is groove and the other one is station pit. Concentration of manure around maize roots should be more with station pit than groove.

Figure 1: manure application method



With groove method, two handfuls manure is spread in a length of 30cm in ditches which are made atop of ridges, while two handfuls manure is put into a pit with station pit method. The applied manure is covered with soil and seeds are sown on the top of the ridges.

Mrs. Maria Sinkalea's case in manure application date is described as early planting and late planting. The CCO who explained to her misunderstood the instruction and she applied the manure as described. Meaning, she changed the timing of planting seeds and the manure was applied on the same day of planting. In this case, it should be interpreted as late application.

All the farmers incorporated ashes into the manure. Ashes were applied at the bottom of

the pit and being mixed with animal dung which amounted about 15 liters for one layer of raw materials of the manure.

The size of standard pit for manure making is 1m x 2m x 1m (depth). In one pit, around 4 layers are piled.

## 6. Observation

Observation reports produced by the CCOs who cooperated in this research are attached to this report. The report includes observations of respective CCOs and the farmers. The reports of the farmers are compiled by the CCOs through interview.

Table 5: Observation of termites' existence

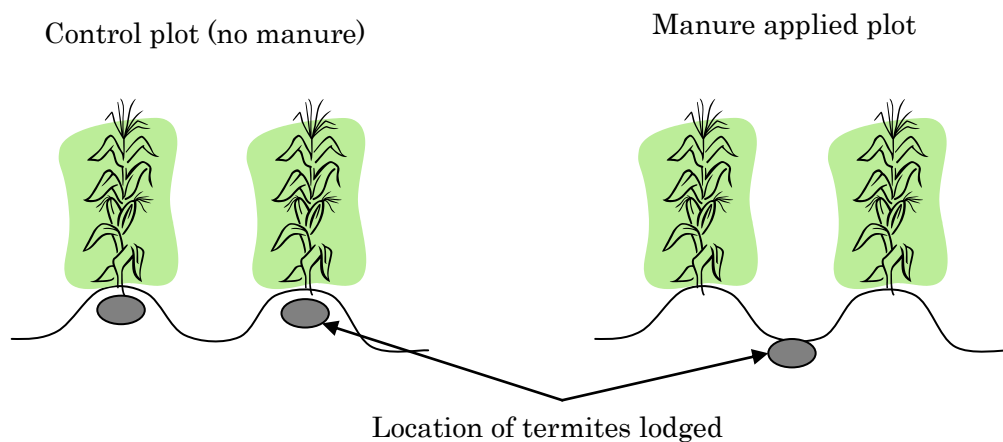
Farmer	Application Timing	Observation of termites / Weeks									
		1	2	3	4	5	6	7	8	9	10
Alfazema	Early									△	△
	Late							△	△	△	△
	Control			△	○	○	○	○	◎	◎	◎
Sinkalea	Early									△	△
	Late										
	Control			△	△	△	△	○	○	◎	◎
Manyapa	Early									△	△
	Late								△	△	△
	Control				△	○	○	◎	◎	◎	◎
Kalizinje	Early										
	Late										
	Control					○	◎	◎	◎	◎	◎

As the table 5 shows, termites appeared relatively in early stage of the maize growth in control plots. On the other hand, termites started to invade to the ridges later stage at manure applied plots but the population was ignorable until maize grains are matured.

Mr. Kasawe, CCO for Mrs. Sinkalea made tangible observations. He mentioned the location of lodging of the termites as figure 2 shows. He found the termites mostly at the furrow in the manure applied plot while they were found inside the ridges around maize roots in the control plot, although the termites were found at the furrow at early vegetative stage even in the control plot, but they gradually moved to the ridges especially at around the roots of maize from week 7. Meanwhile, manure applied plot

did not experience the same as termites remained in furrows.

Figure 2: Lodging location of termites



He also reckoned the number of termites in  $15\text{cm}^3$  on ridges of manure applied and control although he did not mention about the date of the survey. According to his report, he found eight (8) termites in the ridge of manure applied while 53 termites were found in the ridge of control. The population was quite different.

## 7. Result

All the plots with manure showed good result in their yields and less insect damage during vegetative stage up to the end of reproductive stage, while control plots had severe insect damage with low yields. Considering the differences in their yields between the manure applied plots and control plots, the effectiveness of the manure in prevention of insect damage, which assumedly was caused by termites, was quite significant.

### 7.1 Rainfalls

Normally, maize planting starts in early November, and the collaborating farmers sowed the seeds in November after having thought that rain would be enough, but afterwards, they experienced severe drought until December 2011 as table 6 shows. Therefore, germination was somehow affected. However, most of the maize in these research plots was able to recover from December, although Mr. Chinzukira, CCO for Mrs. Manyaba said that her maize did not recover fully.

As the result shows, Gavi village received quite limited rainfalls from October to December. This could be the reason the maize at Mrs. Kanyaba's field was stunted

compared to other farmers' maize of manure applied plot. However, the rainfall in 2011 / 2012 planting season was not that bad from December or it was rather good.

Table 6: Rainfalls of 2011 / 2012 planting season

Month	Salimu (for Makanani)		Gavi		Mtema		Masangano (for Kaipa)	
	days	mm	days	mm	days	mm	days	mm
10	4	37	6	28	1	7	6	34
11	5	47	4	53	3	40	5	57
12	7	125	8	88	5	191	9	142.5
1	12	323	16	302	14	525	14	252
2	13	147	10	142	8	71	10	77
3	11	103	12	187	8	119	12	263
total		782		800		953		825.5

## 7.2 Growth of maize

In all the research fields showed clear difference in the growth of maize between manure applied plots and control plots. The maize in all the control plots were stunted while manure applied plots had grown healthier or normal. The pictures below are an example of field. Both pictures were taken on the same day of 30<sup>th</sup> of March 2012, just before harvest.



Plot with manure (Mrs. Kalizinje's research field, Makanani village)  
 The growth of the maize was not disturbed by termites up to harvesting time.  
 Picture taken on March 30th



Plot without manure (Mrs. Kalizinje's research field, Makanani village)  
The maize was stunted. It is suspected that the stunt was due to termites.

As the report of Mrs. Lipato shows, the control plot is located in contiguity with manure applied plot. The manure applied plot used to have the same situation of maize as the one of control plot before. The reporter is the witness of the stunted maize of three years ago.

### 7.3 Yields

The difference of maize growth affected their yields very much. It clearly shows that the plot with manure gives enough evidence that insect damage on maize was very minor. Table 7 shows the yield of each plot.

Table 7: Maize yields

Name of farmer	Manure applied plot		Control (300m <sup>2</sup> )
	Early applied (150m <sup>2</sup> )	Late applied (150m <sup>2</sup> )	
Mrs. Cecilia Alfazema	137.5kg	95.5kg	83.5kg
Mrs. Maria Sinkalea	105kg <sup>1</sup>	231kg	63kg
Mrs. Catherine Manyaba	100kg <sup>2</sup>		50kg
Mrs. Beatrice Kalizinje	N/A <sup>3</sup>	N/A	N/A

1. It was not early applied but early planted as previously explained.
2. The farmer mixed the harvest of both plot before CCO came to weigh.
3. The farmer refused to show us the real result of harvest due to misinterpretation of weighing. Probably she thought weighing meant loan payment although the team explained the purpose. However, since the team saw the crop stand before harvest like the pictures show, it estimated the harvest at around 120 kg to 150kg (4 ~5t/ha) from 300m<sup>2</sup> of manure applied plots.

The yields of Alfazema and Sinkalea seem to be more than the capacity in its productivity, although the CCOs were the one who weighed them. The weighing was done on 30<sup>th</sup> of April and 13<sup>th</sup> May for Alfazema and Sinkalea respectively. Especially, Sinkalea's 231kg gives us a suspicion of not weighing dried grains at the time of weighing. Planting time was 26<sup>th</sup> of December and harvested at the end of March. It means only three months till harvest. However, suppose the grain had 70% of moisture, it still gives a figure of around 7t / ha. Alfazema's grain seems to be still wet, too. Nonetheless, it clearly shows that the maize growth make us forget that all the fields used to be difficult to grow maize due to insect damage before.

Sinkalea said that she used to use a chemical to protect maize from termites and harvested around 150kg from 600m<sup>2</sup> of the same field before. This means that manure application gives much better result. Another point is that putting contour ridges, box ridges and swale in place is somehow effective to reduce insect damage although it did not work at Kalizinje's field.

Chiwalo demonstration plot has got pretty good result in its yield. It is 176kg from conserved plot which accounts 3.5t per hectare while 112kg from control plot which accounts 2.2t per hectare. The yields seem to be a little low but this attributes to poor germination because of drought at the beginning. However, no symptom of termites attack was observed until the time of harvest.

## **8. Conclusion**

The result of empirical research that the project conducted and the history of the fields tell us that the manure is quite effective to reduce or prevent insect damage by termites by applying it to the fields. Chiwalo's good maize stands and their yield for two consecutive years support that it wasn't by chance but certainty, although there seems to be for just a certain period that the manure can prevent the termites attack. The period, however, is an ample time for the maize to produce its grains and mature. It wasn't by chance. Besides, it is obvious that manure is conducive to increase the yield of maize. Hence it is significant to apply it to the fields when growing maize, even though the amount of the manure to be applied is quite small like two handfuls.

The experiment for the tree seedlings which was damaged by termites gave us another piece of evidence that manure can prevent termites attack or even clobber the termites which are already damaging the trees. In this case, it would be necessary to keep on

applying manure for certain period until the tree grows enough size to survive.

What could be the possible mechanism that manure can prevent termites attack to maize or tree seedlings? One idea was emanated that manure could become feeds for the termites and while having manure around maize or tree seedlings, the termites would not attack the plants' roots, instead they eat the manure. In this case, population of the termites should have been more around the plants although they couldn't attack. However, the fact did not support the hypothesis but went opposite. The farmer and CCOs observed less population at manure applied plots compare to the one at the control plot. Moreover, no advantage in the yield was observed on the different timing of application. This indicates that the manure did not attract termites. Rather, from the observation that Mr. Kasawe did, it seems that the manure worked as if a repellent since the termites were observed mostly in the furrows only.

Could it be that moisture in the ridges is kept by of manure? It might be so. Mrs. Kalizinje said that the soil of control plot was easy to dry up as compared to manure applied plot. However, it is not so convincing because the termites started to appear in the ridges as early as December when the rainfalls increased.

CCOs are mentioning the elements of ashes might work. But the quantity of the mixed ashes in the manure is quite small and it is not sure if the ashes were distributed to each station.

Then why it happened? Unfortunately it seems to be beyond our capacity.

We should have providing more detailed information but it was difficult. It's because of inadequate commitment of the CCOs and persistent inadequate fuel availability. The inadequate commitment was somehow understandable. It was difficult to believe that termites attack would be reduced or prevented by applying manure for the extension officers including myself who have adequate knowledge on agriculture technologies. With this thought, things would not be properly done. Fuel shortage definitely affected the frequency of visit to the site. As a consequence, this report gives not enough information as to what really happened in the fields of the research.

One encouraging movement is that those CCOs who involved to this research are saying that they are going to continue this research even on the next planting season so that



more detailed information will be obtained. I'm sure they will and their commitment will be more tangible. However, what they can do will be the same research method that of empirical research.

Therefore, it is definitely necessary to conduct a scientific research to find out if the efficacy of the manure against termites is truth or false. Once it is proved that manure can prevent insect damage of termites, it is a great pleasure for the project that many farmers who are at a loss with the termites will have huge hope for their growing maize as well as trees. We are hoping that our empirical research did not produce wrong information.

The point we would like to stress after this research is that all the cooperating farmers are satisfied with the result with manure, and saying that they will continue to apply it so that they are going to have harvest even from a field which used to have nothing or very little. Impressively, one lady has started to make manure already using the maize residue.

## **Appendix I**

### **Research on the efficacy of manure against insect damage by termites in maize field**

**By Mr. W. W. Chinzukira (AEDO)**

Season : 2011/ 2012/06/05

Farmer's name : Catherine Munyapa

Name of village : Gavi

#### **Introduction**

The research conducted is not a scientific one as it is used to be done by the researchers. It was conducted by a farmer by the name of Catherine Munyapa of Gavi village, TA Kapeni in Blantyre District with the assistance of COVAMS. Farmers in Gavi village have been worrying of severe termites attack in their maize garden and this led to low crop harvest each and every year. Therefore with the assistance from COVAMS, Catherine Munyapa and the CCO in-charge thought of mounting a demonstration plot to find out effectiveness of manure against insect damage by termites.

#### **Historical background of the field**

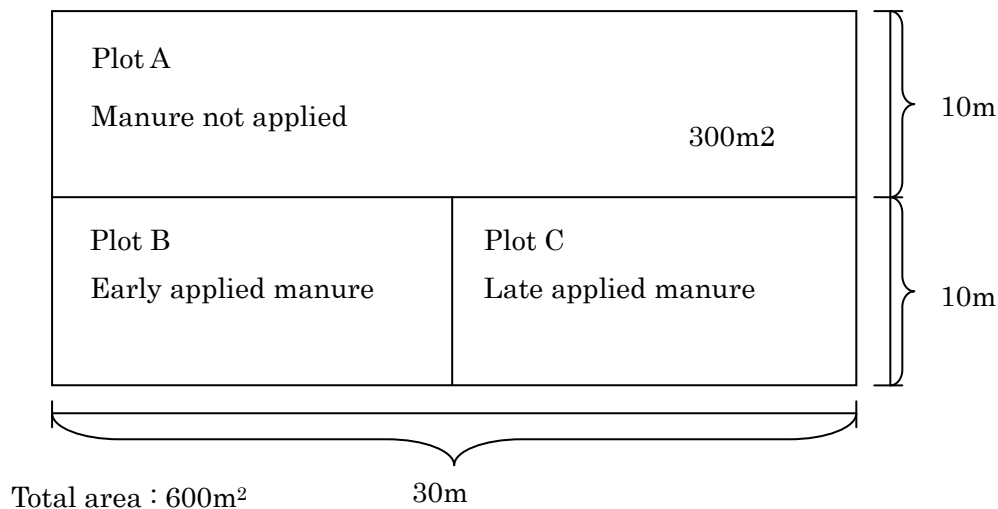
The garden was opened in the late 60s and farmer was able to harvest enough for the entire season but come 10 years later, the harvest became lower and lower up to a point of 2000 harvest. Now from 2007 / 2008 season, Catherine Munyapa attended training of conservation facilitated by COAVMS whereby farmers knew the importance of conservation and manure utilization for soil fertility improvement. The idea to mount a demonstration plot came in 2011 to find out whether manure can play a great role to control damage caused by termites.

#### **Demonstration plot preparation**

The preparation of demo plot involved the following;

- Clearing (crop residues not incorporated into the soil )
- Plot demarcation (3 plots demarcated)
- Ridge making at 75cm apart
- Box ridges

The design of the plot is the next page.



Manure mode: pit

Materials used : Crop residues (Well chopped ones)

Animal dung (15 liter oail per layer)

Ashes (Three Nsima plates applied at the base of the pit to prevent termite damaging the compost )

Water (15 -20 liters per layer)

Produce of compost was followed up until finishing point and after fully decomposed the manure was then taken to demonstration for application.

### Manure application

Plot A : Manure not applied

Plot B : Early applied plot

Plot C : Late applied plot

### Mode of application

Both plot “B” and “C”, grooves were used to apply the manure

Quantity : 2 handfuls every 30cm distance.

### Planting

The farmer planted maize after the onset of planting rains on November 18<sup>th</sup> 2011.

One-one planting at 25cm apart per station.

### Fertilizer Application

Fanta bottle top was used as a measuring cap.

Basal dressing was done on the same day of planting for plot 1,2 and 3.

Top dressing was done after three weeks from the date of planting using Fanta bottle top.

#### **Observation by both farmer and CCO**

- Healthy and fast growth of maize crop on plot “B” and “C” where manure was applied and height ranged from 100cm to 120cm.
- Stunted growth and unhealthy crop stand on plot “A” which was a control (crop were attacked with Maize grey leaf spots and Brights ) and the height was ranging 30cm to 50cm.
- Wilting of maize crop due to dry spell was sever on plot “A” control than plots “B” and “C”.
- Termite damage was severe on plot “A” and was observed from 4<sup>th</sup> week at vegetative stage.
- Termite observed damaging maize crop at maturity stage from week 9 at plot “B”.
- Termite attack on plot ”B” was mild at maturity stage.
- Termite attack on plot “C” was moderate at maturity stage which started from 8<sup>th</sup> week.

#### **Harvest**

Plot	Yield in kg
Control “A”	39kg
Early applied manure “B”	60kg
Late applied manure “C”	51kg

#### **Farmer’s opinion**

Catherine Munyapa had learnt much that manure can effectively play a big role on controlling maize crop from being attacked by termites in that gardens that has been applied to manure. Therefore she is willing to continue this research for next coming growing season and would want if possible this research be expanded to other feloow farmers since the issue fo termite attack is of great concern amongst the village members.

## **Appendix II**

### **Research on the efficacy of manure against insect damage by termite in maize field**

**By Mr. C. Kasawe (AEDO)**

Season: 2011/2012

Farmer Name: Maria Sinclair

Name of Village: Kaipa

Date of planting (DOP): 08/11/11

#### **INTRODUCTION**

The research was done following numerous complaints by farmers about termite attack in maize fields. We have known manure to improve soil structure, fertility, moisture retaining properties among other importance but little or no focus was done to look into manure effect against termite damage.

Four CCOs were assigned to select one farmer whose field has the history of termite attack to carry out the make-shift research. Maria Sinclair of Kaipa Village T/A Kapeni took part in the research for her field of which, she said has of late, being experiencing heavy termite attack.

COVAMS has been promoting soil improvement through application of compost manure and gliricidia leaves; soil and water conservation through construction of contour marker ridges and ridge realignment in association with box ridges and swales; gully control and reclamation through construction of check dams

#### **History of the field**

The field was opened in the early 80s and it has been yielding handsomely over years without serious termite until the late 2000s when she started experiencing a steady decrease in yield from 420kgs to as low as 30kgs averaging 150kgs from a 0.6ha plot with the application of chemical fertilizers. This decrease has been accompanied by the increase in the severity of termite attack. Lodging has been severe and wide spread. The soil is sandy-loam.

The farmer received inputs from COVAMS to be applied to both the control and the experiment. The following were the inputs;

- ✓ 23:21:0 +4s(NPK) 6Kgs
- ✓ Urea 9Kgs
- ✓ Maize Seed 1.2Kgs
- ✓ Manure 4-15litre Buckets

Plot size was 0.6ha in total with 0.3ha being the control and 0.3ha the experiment plot which was further divided into 0.15ha being the first applied plot and 0.15ha the late applied to plot as far as manure application is concerned.

<b>control</b>  50metres	20metres	20metres
		<b>experiment</b> 25metres (First application)
		25metres (Second application)

**Manure made**

- ✓ Pit method
  - Materials used during manure making
    - Maize stalks
    - Grass
    - Dung from goats
    - Ash

**Preparation of the field**- no incorporation of crop residues into the soil

**Date of application**- during planting (08/11/11 for early planting (applied before planting) and 26/12/11 for late planting). Maria Sinclair staggered the planting dates for the experiment instead of required method of staggering manure application dates.

**Mode of application**

- ✓ In planting stations

**Quantity**

- ✓ Two handfuls/planting stations

### Observation of growth

- ✓ Vigorous growth in an experiment against stunted growth in control plot
- ✓ Termite attack mild and late when maize mature in an experiment against severe termite attack and early when maize is at vegetative stage in control plot
- ✓ Termite activities are concentrated in the furrow in an experiment against around the planting stations (roots) in control plot

### Weighing

Control	Early planting	Late planting
63 kgs from 0.03ha	105 kgs from 0.015ha	231 kgs from 0.015ha (but it was 65% wet)

EXPERIMENT		OBSERVATION		CONTROL	OBSERVATION
Plot 1	Plot 2	Plot 1	Plot 2	plot	plot
Wk 1 Before planting	Before planting	No termite observed on the surface but in moulds	No termite observed on the surface but in moulds	Before planting	No termite observed on the surface but in moulds
Wk 2 After planting	After planting	Same as above	Same as above	After planting	Same as above
Wk 3		Termite not observed yet	Termite not observed yet		Termite observed on the surface(furrows)
Wk 4		Same as above	Same as above		Termite observed on the surface(furrows)
Wk 5		Same as above	Same as above		Termite observed on the surface(furrows)

EXPERIMENT		OBSERVATION		CONTROL	OBSERVATION
Plot 1	Plot 2	Plot 1	Plot 2	Plot	Plot
Wk 5		Same as above	Same as above		Termite observed on the surface(furrows)
Wk 6					Attack in furrows
Wk 7					Moderate attack in furrows and some isolated plants
Wk 8					Moderate attack in furrows and some isolated plants
Wk 9		Mild attack			Heavy attack in roots and lodging started
Wk 10		Mild attack			Heavy attack in roots and lodging started
Wk 11		Mild lodging to matured plants	Mild lodging to matured plants		Severe attack and serious lodging to premature plants
Wk 12		Mild lodging to matured plants	Mild lodging to matured plants		Severe attack and serious lodging to premature plants



Experiment	Control	Remarks
<ul style="list-style-type: none"> <li>✓ Height of stalk –higher than the control (1.6m)</li> <li>✓ Cob size –bigger than the control(25cm)</li> <li>✓ Termite population around maize stalk-smaller than the control(8/15cm cube)</li> <li>✓ Termite concentration in furrows</li> <li>✓ Lodging –mild and experienced at maturity stage</li> <li>✓ Cob filling-good</li> <li>✓ Higher yield as compared to control</li> </ul>	<ul style="list-style-type: none"> <li>✓ Stunted growth-shorter stalks(1m)</li> <li>✓ Small cob size(15cm)</li> <li>✓ High termite population around maize stalk(53/15cm cube)</li> <li>✓ Termite concentration around maize stalk</li> <li>✓ Severe lodging even at vegetative stage</li> <li>✓ Poor cob filling</li> <li>✓ Poor yield</li> </ul>	

<b>Milestones of the Experiment</b>	<b>Deficiencies of the Experiment</b>
1.Impact of manure on termite attack-visible	No compost manure history (ash element)
2.Maize stalk height differences-clear	Why termite still attack in both prolonged dry spell and dumpy spell
3 Attack in experiment plot observed after crop had attained maturity status	No exact amount of compost to deter termite attack
4. Clear difference in termite population to the two plots.	Not clear on mode of application that is, in planting stations or making a groove.

With the above deficiencies we are unable to conclude confidently about manure impact but rather to carry out the same experiment with the similar farmers on similar plots. Manure history should be carried out that is

- ✓ Ash element
- ✓ Material source
- ✓ Method used when making manure
- ✓ Mode of application/different quantities

### Appendix III

#### Report of a research on effectiveness of manure to insect damage by termites

By Mrs. T. Lipato (AEDO)

Name of collaborating farmer: Mrs. Beatrice Kalizinje

Name of the village: Makanani

#### Introduction

Plants grow and develop in direct response to their environment. Environmental conditions considered as the most important in plant growth for example application of manure to supply nutrients to plants as well as delaying of termites attack.

#### History of the Field

There is a garden which has been cultivated for over 20 years. For the past five years it has been planted with maize but there was very little harvest due to termite attack. In the past two years there was a rotation with groundnuts but still there was heavy termite attack.

This year, the research has been done on this field to find out the results of termite attack against manure.

#### Preparation

- Clearing of the land was done in early October 2011.
- Demarcation of the plots was done i.e. a plot of 300sqm like this.

Plot 1 Early applied	Plot 2 Late applied
Plot 3 Manure not applied	

- Ridging was done in the third week of October 2011. Ridges were spaced at 75cm apart.
- Before garden preparation, compost manure were being prepared using animal dung, grass, and ashes. It took two months to rot that is in August and September 2011.
- Planting stations were spaced at 25cm.
- In the fourth week of October, the 1<sup>st</sup> plot was applied with the compost manure and the application rate was a double handful of manure per planting station.

- In the third week of November, the second plot was applied with compost manure using the same rate of a double handful per planting station.
- Planting of maize i.e. SCO403 was done on 4<sup>th</sup> December 2011.
- Basal dressing fertilizer i.e. NPK was applied a day after planting in all three plots.
- Weeding was done seven days after germination.
- After 21 days, top dressing fertilizer i.e. Urea was applied in all three plots.
- Second weeding was done after applying top dressing fertilizer.

### Observation by the farmer and the CCO

Throughout the growing, there were differences in the following;

Plots with manure	Plot without manure
Maize grows faster	Growing was slowly
Dark green leaves throughout the growing period	Green leaves at first then changed color to yellowish
No wilting of crop	Wilt faster
Only 10% attack by termites	About 80% of maize attacked by termites
Good harvest	Very poor harvest since it was heavily attacked by termites

### Conclusion

- After these results the farmer has learned a good lesson that soil need to be fed with manure in order to control the termites attack and also to have a good harvest instead of just depending on fertilizer only.
- The farmer is willing to continue using manure instead of just relying on fertilizer.

### CCO

- There were weekly visits to the field to observe the growth and the differences in termite attack in all the plots and observe the place where the termites likely attack (i.e. part of a plant, the roots and stem ).
- There were some interviews to the farmer on the differences between this year and the past years' harvest.
- In general conclusion, Manure can play a greater role in controlling termite attack at the same time increases the harvest. A farmer should not depend on the use of fertilizer only on a place where termite do heavily attack or destroy the crop especially maize.

## **Appendix IV**

### **RESEARCH ON EFFICACY OF MANURE AGAINST INSECT DAMAGE IN MAIZE FIELD BY TERMITE**

**By Mr. M. J. L. Thole (AEDO)**

#### **1. INTRODUCTION**

This research is not a scientific one as it is done by the researchers. It was conducted by a farmer named Cecilia Afalfema of Mtema village of traditional Authority Kapeni in Blantyre. Cecilia Alfazma is one of the farmers in Mtema village who has benefited a lot from the project called The Community Vitalization and Afforestation in Middle Shire (COVAMS), through practicing improved farming methods that had been taught by COVAMS such as:

- Improvement of soil fertility through application of manure and gliricidia leaves.
- Ridge contour making and ridge alignment
- Box ridge making and SWALE construction.
- Gully control and reclamation
- River bank afforestation

Farmers in Mtema village have been complaining of severe termite attack in their fields. Therefore, Cecilia Alfazema thought of mounting a demonstration plot in her maize garden with an assistance from the COVAMS project to find out whether manure has the role to protect maize from being attacked by termites.

#### **2. HISTORICAL BACKGROUND OF HER MAIZE GARDEN**

Since the garden was newly opened in early 70s, she used to harvest a lot though it was not applied to fertilizer. The yield started to lower down in late 90s and more drastically in 2007 and 2008 though fertilizer has been applied to her garden and again her maize had been severe attacked by termites more especially in the early stages

Then in 2010, Cecilia Alfazema applied manure to her garden after COVAMS project taught her the importance of improving soil fertility by applying manure into the soil. After doing so, the result was good because there was improvement of yield and at the same time, the area which was applied to manure was not heavily attacked by termites as it was before.

### 3. DEMO PLOT PREPARATION

Cecilia Alfazema started preparing her 0.05 ha plot in September and finished on October 8, 2011. The preparation involves the following operations:

- Demarcation of the plot into 3 sub plots as seen below

#### Demo plot for Maize

10M 1  Control	10M 15M Early applied to manure
30M	15M 3 Late applied to manure

- Garden clearing which involved slashing and burning of crop residues
- Ridge making- spacing ridges at 75cm and box- ridge construction

#### Manure making used for research

The farmer made compost manure using pit method at her home early June 2011 after being trained by the project and materials used were as follows:

- Well chopped Maize stocks
- Chicken droppings + goat dung
- Maize husks (Madeya)
- Ashes
- Water

And finally she followed all the procedures when making that compost.

#### Manure application

After decomposition of the manure, it was taken to her demo plot for application.

##### (A) Early application

- Early application of manure to plot No. 2 was done on October 12, 2011

##### (B) Late application

- Plot No. 3 was applied to manure on October 30, 2011.

##### (C) Application method

- Both plots used groove method when applying manure.

(D) Quantity of manure

- Every 30cm long, the farmer applied 2 handfuls along the groove on the ridge.

**4. PLANTING**

- The farmer planted her maize after onset of rains on November 18, 2011.

**5. FERTILIZER APPLICATION**

The farmer was provided with 15 Kg and 10Kg of UREA and 23:21:0+4S respectively by the project.

- Plots No.1,2and 3 were basal-dressed with 23:21:0+4S on the date of planting (18/11/11)
- Top-dressing was done on Dec 3, 2011.
- A bottle top (fanta ) was used for both application

**6. OBSERVATIONS**

a. Growth

- Healthy and fast growth of maize on plot No.2 and 3 where manure were applied
- Stunted and unhealthy growth of maize on plot No. 1 where manure were not applied (Control plot)

b. Termite attack

- Severe attack on the control plot especially at vegetative stage that contributed to lesser number of stocks at harvesting
- Minor attack on the late applied plot especially at maturity stage (plot No.2)
- Very minor attack on the early applied plot (plot No.3)
- Availability of termite- more available on the control plot followed by late applied plot.

### Termite observation in the garden ( By Farmer)

FARMER	APPLICA TION TIMING	TERMITES OBSERVATION /WEEKS										Remarks
		1	2	3	4	5	6	7	8	9	10	
Cecilia Alfazema	Early									■		Less than 10 termites around plant station
	Late							■	■	■	■	More than 15 termites around plant station
	Control			■	■	■	■	■	■			Severe attack at vegetative & tussling stages

### 7. HARVESTS/ YIELD



After harvesting



After drying



Mrs. C. Alfazema weighing grain

After harvesting, the yield was weighed and the following were the results:

Plot	Yield (Kg)
Control (Plot 1)	83.5
Early application of manure (Plot 2)	137.5
Late application of manure (Plot 3)	95.5

### 8. FARMERS OPION

According to her observations and the results of the yield after weighing, Mrs. Alfazema says manure can effectively play a great role on controlling maize from being attacked by termites in the field should the garden be applied to manure early. She has promised to do this research for the second time (2012/2013 growing season)