Kiberashi integrated soil fertility management trials

Protocols 2010

Introduction

Limiting nutrients, identified from the results of diagnostic/nutrient omission trials conducted in Kiberashi during the March-August 2010 cropping season are nitrogen followed by phosphorus. Thus, ISFM trials will focus on options that address/provide these nutrients into the cropping system. N can be provided from sources such as manure which is readily available in this site, or from legumes already being grown in the area. These include lab lab (Dolichos), pigeon peas, and groundnuts. In this area, farmers grow Lab lab and pigeon peas within intercropping systems while ground nuts are grown in rotation with cereals. Common beans are common in the site but these will not be considered in the ISFM options due to their limited contribution of nitrogen to the soil. Inorganic fertilizers such as urea also serve as an additional source of N, and they can be included in the tested options.

Since lab lab and pigeon peas are the two priority legumes, they are the ones to be tested in the ISFM trials. In Kiberashi, farmers' practice shallow digging and hardpans are common. The planting of these legumes while therefore be beneficial as pigeon pea is very effective in breaking up hardpans. Lab lab also does this to some extent. Additionally, both legumes hardly affect the productivity of maize.

For phosphorus, Diammonium super phosphate (DAP), Minjingu Mazao and triple super phosphate (TSP) are the options considered. DAP is a better option for ISFM options for farmer testing and demonstrations as it contains nitrogen besides phosphorus. This is also the case with Minjingu Mazao. Minjingu mazao (10%N, 20%P2O5, 25%CaO, 5%S, 0.5%Zn, 1.5%Mg, 0.1%B) is as good as DAP and will soon be released to the market. Both DAP and Minjingu Mazao will be tested in the current ISFM trials in Kiberashi, with Minjingu Mazao been sourced directly from the factory. TSP will be used in a detailed trial testing crop responses to N and P.

The trials will run for 2 seasons (two years since only the main seasons will be used). The same farmers used in the diagnostic trials will be used. However those who were uncooperative will be replaced with new farmers. The section of the farm used should be different from that used for diagnostic trials.

Objectives

1. Demonstrate and evaluate promising ISFM options for farmers to adopt/adapt. This will be done through on-farm farmer and researcher managed trials by comparing effects of different ISFM options.
2. Assess the optimal levels of N and P requirements for Kiberashi through detailed response trials.
3. Contribute to increased yields from farmers' fields in a sustainable production system.
4. Improve soil fertility in the area.
5. Disseminate knowledge on appropriate/ best crop management practices.

6. Assess N contribution from legumes

Field selection

There will be a total of 24 field trials for the intercropping ISFM trials. Fields selected should be uniform in soil type and fertility status (e.g no localized gravel, anthill, rock outcrop e.t.c. in parts of the field). Previous fertilization during the last 3 seasons (especially organic fertilization), previous crops and slope will also be taken into account during field selection to avoid effects on crop yield other than the treatments effect. For example, if manure was not uniformly applied over the selected field or different crop types had been grown on separate sections that constitute the field, that field should be left out. Each field will have six experimental plots measuring 10 m x 10 m. Paths will be maintained on all sides of the plots to allow for easy monitoring and farmer evaluation during field days.

Soil sampling

After fields have been selected at the plots demarcated, soil samples will be collected from all the plots. The soil samples shall be placed in bags clearly labeled with site name, cluster, field and plot number and the date.

Treatments

The table below shows the treatments which will be tested within intercropping systems.

Table 1

Plot	crops	P source	N source
1	Maize	-	-
2	Maize + legume	-	-
3	Maize + legume	Minjingu Mazao	Urea*
4	Maize + legume	DAP	Urea*
5	Maize + legume	Urea	-
6	Maize + legume	Manure	-

1. Urea* applied here is calculated bearing in mind that some N is provided through the applied P source. i.e., the Urea is for providing what has not been provided by the P source and targeting 60 kg N ha^{-1}. Top dressing will be done at four (4) weeks after planting and after the first weeding has been conducted. Some of the Urea (1/3) will be applied at basal application.
2. P fertilizer will be applied to provide 20 kg P ha^{-1}.

3. Manure will be applied at an N rate of 60 kg N/ha and the calculation is based on an average rate of 1%N in on-farm manure.
4. The legume grown will be either lab lab or pigeon pea. Each farmer will select the legume they are interested in and use it for their experimentation. Legumes should not be mixed within one field.
5. Fertilizer will only be applied to the maize plants. No fertilizer will be applied to the legumes.

Plant spacing

Maize will be planted at a spacing of 90 cm by 50 cm. Three seeds shall be planted. These shall later be thinned to 2 plants, 2 weeks after planting. Where no plants have germinated, replacement planting (gapping) shall be conducted. Seeds used for gapping should be soaked overnight to hasten germination and ensure the gapped plants catch up with those planted initially. The legume will be planted between the rows of maize, lab lab will be spaced at 40 cm (3 to 4 seeds per hole) while pigeon pea will be spaced at 90 cm by 50 cm (2 seeds per hole). Gapping will be done 10 days after planting while thinning will be done 3 weeks after planting (2 weeks after gapping).

Manure use

Manure at the rate of 6 t/ha is affordable to farmers in Kiberashi. There is currently a lot of manure that is hardy used except on tobacco (not very common crop in the site). It is important to start introducing and training farmers on use of inputs in the context of ISFM. This is because although currently a fertile site, there is evidence of nutrient depletion yet sustainable production is necessary.

Herbicide application

Care should be taken to avoid problems with stalk borers. All fields should be sprayed at the knee height stage of maize growth or immediately following inspection and identification of pest attack in any of the fields.

Weeding

All the plots will be kept weed free through 2 or 3 weeding operations by the farmers.

Maize variety

The hybrid variety Pannar 67 which is a medium term variety will be used.

Data collection

For all the fields, data will be collected on the following attributes and events.

1. Full history of land management.
2. 50% emergence date.
3. Plant height, diameter and no. of leaves at 50% flowering.
4. Dates of agronomic management activities.
5. Harvest data.

Trial Layout

Each of the on-farm field trials will be laid out as shown below (figure 1). A sketch of the field should be drawn indicating direction of important features such as village, hill, big tree, e.t.c. All data recording should indicate the plot number within which data is collected.

Note: A space of at least 0.5 m should be left between the plots (see colored part of the Figure).

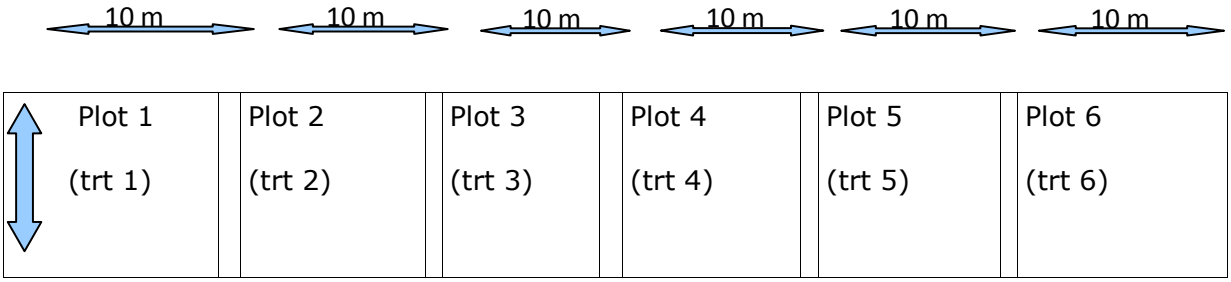

Figure 1. Field layout

Planting

Each plot should be planted as show in the Figure below. The hills of the legume should not start at the same point as those of maize. While maize hills will start at 25 cm from the end of the plot, legume hills will start at 50 cm from the end of the plot. This will ensure crops maximize on the available space through good distribution.

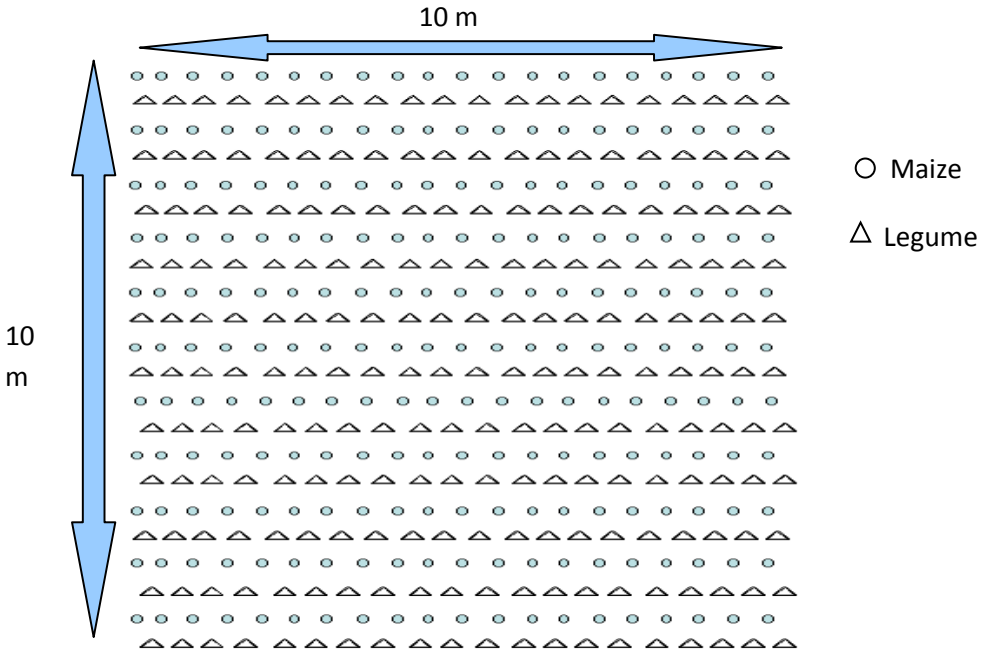

Figure 2. Planting of maize and legumes within a field plot

Table 2. Amount of fertilizers to apply per plot in the intercrop trials

Plot	Urea at planting (g/plot)	Majingu mazao (g/plot)	DAP (g/plot)	Urea topdress (g/plot)	Manure (kg/plot)
1	-	-	-	-	-
2	-	-	-	-	-
3	-	2272	-	847	-
4	-	-	1000	933	-
5	400	-	-	933	-
6	-	-	-	-	60

Table 3. Amount of fertilizers to apply per maize hole in the intercrop trials

Plot	Urea at planting (g/plot)	Majingu mazao (g/plot)	DAP (g/plot)	Urea topdress (g/plot)	Manure (kg/plot)
1	-	-	-	-	-
2	-	-	-	-	-
3	-	10.2	-	3.85	-
4	-	-	4.55	4.24	-
5	1.82	-	-	4.24	-
6	-	-	-	-	Broadcast

Detailed trials within schools

Detailed trials will be conducted to assess the optimal application rate of N and P in Kiberashi. The trials will be set-up with four levels of N and 3 levels of P resulting in twelve treatments as shown in below (Table 4). The trials will be located in schools found within the sentinel site and will be fully managed by researchers.

Experimental trials will be located in the following schools to allow for early introduction of pupils to research.

- Mgera primary school (gideon)
- Elelai primary school (Kombe)
- Kwediswati Primary school (Gideon/Mulai)
- Nkoa primary school (Muruma/Aaron)

- Kwamaligwa primary (Muruma)
- Kiberashi primary school (Aaron)
- Kiberashi secondary school (Murai)

Table 4. Treatments for the detailed trials

Treatment	N kg/ha	P kg/ha
1	0	0
2	40	0
3	80	0
4	120	0
5	0	20
6	40	20
7	80	20
8	120	20
9	0	40
10	40	40
11	80	40
12	120	40

NOTE: Application rates refer to the element itself, not the fertilizer.

Plot sizes

Plot size will be 5 m by 5 m. There will be a 0.5 m space left between plots while replicates will be separated by a space of 1 m. Plot numbers will run from 1 to 12 for ease of follow-up by extension staff and farmers.

Table 5. Amount of fertilizers to apply per plot in the detailed trials

N rate (kg/ha)	Fertilizer required at planting		Fertilizer required at topdressing	
	g/plot	g/hill	g/plot	g/hill
0	0	0	0	0
40	296.3	2.22	592.5	4.45
80	592.6	4.45	1185.2	8.91
120	888.8	6.68	1777.7	13.37
P rate (kg/ha)				
0	0	0	-	-
20	1000	7.52	-	-
40	2000	15	-	-

Action plan

Activity	**Date**	**Responsible**
Sensitization	28-29th December 2010	SARI/Extension
Farmer training	4th week December 2010	SARI/Extension
Site selection	1st week of January 2011	SARI/Extension
Field/ plot layout	2nd week of January 2011	SARI/Extension
Land preparation	1st week of January 2011	Extension
Input acquisition and delivery	3rd week of December 2010	SARI
Planting	3rd week February 2011	SARI/Extension
Weeding	3rd week of february 2011	Extension
Gapping	Last week of January to 1st week of february 2011	Extension
Thinning	3rd week of February 2011	Extension
Pesticide application	3rd week of February 2011 or as need arises	Extension
Top dressing	3rd week of February 2011	SARI/Extension
Harvesting	July 2010	SARI/TSBF/Extension
Field days		

Sensitization will be for village leaders in the site (village chairmen and secretaries). I.e, the chairmen and secretaries will be visited in their office and updated prior to the training of farmers. Farmer training to include feedback on previous studies conducted. Extension staff in-charge of some fields should coordinate among themselves in case one is not available to attend to a scheduled activity.

Field days will be held twice targeting key crop growth stages, at 5 weeks after planting and at physiological maturity. Stakeholders will include farmers, decision makers, village government, Kilindi-based DALDO. Invitation should be extended to all farmers in the village and not just participating farmers.