

Soil Management Comments: Greater Vihiga

Introduction:

Most farmers, agronomists and extension workers are focussed on symptoms, problems and interventions that affect a plant's performance above the ground – where they can see it. Rarely do they stop to consider root growth and development. As a result, farmers and agricultural workers are typically unaware that maize root systems can develop to a depth of up to 1 metre and that young maize plants at the 3 leaf stage can develop a root of up to 30 cm long.

A good, deep root system allows the plant to more effectively absorb water and nutrition from the soil and applied manures and fertilizers, resulting in thicker stems, higher yields and reduced susceptibility to drought.

Many agricultural soils in marginal areas are either shallow, susceptible to erosion and prone to drought. Also, continued shallow digging with a Jembe or Oxplough can result in a hard pan 15 – 30 cm below the soil surface, through which rain water does not infiltrate and roots do not penetrate. Unless farmers practice improved tillage to manage these conditions in their soil, rooting systems do not develop effectively, water does not infiltrate deeply enough to last the season and yields are reduced.



Even at the 3-leaf stage the tap root should be reaching deep into the soil. This determines where the feeder roots develop. The tap root of maize is delicate and can not penetrate hard soil.

Options for soil management:

FIPS-Africa is developing soil management options for farmers to improve the water infiltration and rooting depth. These methods include *Deep Row Tillage* (an adaptation of reduced tillage) using the spring Jembe and *Tied ridges above Deep Row Tillage* (also known as *Deep Tied Ridges*, protocol attached). Farmers are being taught these methods through 3 or 4 plot demonstrations, allowing them to compare the benefits with their own local tillage methods. Importantly, farmers must also consider labour requirements, since moving soil around is difficult and timely. The *Deep Row Tillage* was designed to be an easier method than the labour intensive *Deep Tied Ridges*. Farmers must then consider any benefits in yield, drought tolerance against additional cost/efforts in labour. Factors affecting a farmers preferred methods may include rainfall patterns, soil type and depth, labour availability, cash availability, topography and plot size.

Soil Management Activities

In the RIU sponsored network of Greater Vihiga in Western Kenya, 15 Village Based Advisors (VBAs) were each given a target to establish 10 soil-water management demonstration plots within their target villages. Most farmers in Vihiga have very small plot sizes (ranging from 0.25 to 0.75 acres), but soil depth is not typically considered to be a major problem. This season has experienced higher than average rainfall so plants have not experienced drought conditions for which the methodologies were originally developed.



Deep roots give maize drought resistance, produce high yields and prevent lodging.

Shallow roots limited by a hard pan means poor yields and crop failure when rains fail



Farmer Tillage

No manure
No fertilizer



Farmer Tillage

+ manure
+ fertilizer



Deep Row Tillage

+ manure
+ fertilizer



Tied ridges on top of Deep Row Tillage

+ manure
+ fertilizer

Variety: ?

Fertilizer: Minjingo in all

Date planted: 8th Mar2011

Date visited: 7th May 2011

Farmer: Lois Aguya

VBA: Fred Ombera

Village: Igada

Location: North Maragoli

Division: Sabatia

District: Greater Vihiga

Observations

Deep Tied Ridges are substantially better for maize and beans than all other treatments. Followed by Deep Row Tillage, Farmer Tillage plus nutrition and Farmer Tillage without nutrition.

Farmer Opinion

Farmer has observed that Deep Tied Ridges are best and has a very small plot size so is prepared to put in labour to repeat on a larger area.



Farmer Tillage

No manure
No fertilizer



Farmer Tillage

+ manure
+ fertilizer



Deep Row Tillage

+ manure
+ fertilizer



Tied ridges on top of Deep Row Tillage

+ manure
+ fertilizer

Variety: PAN 7M-89

Fertilizer: Minjingo in all

Date planted: 8th Mar2011

Date visited: 7th May 2011

Farmer: Fred Ombera

VBA: Fred Ombera

Village: Igada

Location: North Maragoli

Division: Sabatia

District: Greater Vihiga

Observations

This farmer was unusually practicing 'double digging' on as his own 'Farmer Tillage' method. Deep Tied Ridges gave a substantial benefit compared to other treatments. The farmer felt that Deep Row Tillage did not give any substantial benefit compared to his own double digging method.

Farmer Opinion

Farmer has observed that Deep Tied Ridges are best and has a very small plot size so is prepared to put in labour to repeat on a larger area. He also commented that weeding is much easier with Deep Tied Ridges since he can just mound soil up to cover the weeds.



Farmer Tillage

No manure
No fertilizer



Farmer Tillage

+ manure
+ fertilizer



Deep Row Tillage

+ manure
+ fertilizer



***Tied ridges on top of
Deep Row Tillage***

+ manure
+ fertilizer

Variety: WH507

Fertilizer: Minjingo in all

Date planted: 8th Mar2011

Date visited: 7th May 2011

Farmer: George Adaruki

VBA: Fred Ombera

Village: Igada

Location: North Maragoli

Division: Sabatia

District: Greater Vihiga

Observations

Deep Tied Ridges plants were not taller than other plants, but the stems were thicker. Deep Row Tillage gave no observable benefit compared to Farmer Tillage.

Farmer Opinion

Farmer has observed that Deep Tied Ridges are best and has a very small plot size so is prepared to put in labour to repeat on a larger area.



Farmer Tillage

No manure
No fertilizer



Farmer Tillage

+ manure
+ fertilizer



Deep Row Tillage

+ manure
+ fertilizer



**Tied ridges on top of
Deep Row Tillage**

+ manure
+ fertilizer

Variety: ?

Fertilizer: DAP in all

Date planted: ?

Date visited: 7th May 2011

Farmer: Bewizah Malova

VBA: Moses Malobe

Village: Jephvovi (?)

Location: Easambai

Division: Hamisi

District: Greater Vihiga

Observations

In terms of height, Deep Row Tillage was best, followed by Farmer Tillage with DAP, followed by Deep Tied Ridges, with Farmer Tillage Manure performing very poorly. However, the VBA reported that the farmer thinks that Deep Tied Ridges is the best with a particularly strong difference at the beginning.

Farmer Opinion

Farmer likes Deep Tied Ridges the best.



Farmer Tillage

No manure
No fertilizer



Farmer Tillage

+ manure
+ fertilizer



Deep Row Tillage

+ manure
+ fertilizer



Tied ridges on top of Deep Row Tillage

+ manure
+ fertilizer

Variety: WH507

Fertilizer: Minjingo in all

Date planted: 22 Mar 2011

Date visited: 7th May 2011

Farmer: Salome Kilesi

VBA: Hesbon Samie

Village: Mwiligi

Location: Isava South

Division: Sabatia

District: Greater Vihiga

Observations

The Deep Tied Ridges performed the best. The Deep Row Tillage and Farmer Tillage were similar.

Farmer Opinion

VBA reported that farmer wants to adopt Deep Tied Ridges on his entire quarter acre because of benefits from the method and he wants to maximize production from his small area.

Conclusions

While these methods were originally developed for parts of Kenya that are semi-arid or have problems with shallow soils and erosion they also appear to give benefit to crop growth in areas with deep soil and sufficient rainfall. Where plot sizes are very small, such as in Vihiga district of Western Kenya farmers are highly encouraged by the methods since their options are limited to increase yields from limited areas.

In all of the 10 demonstration plots visited, either *Deep Row Tillage* or *Deep Tied Ridges* performed substantially better than farmer tillage methods, with *Deep Tied Ridges* being preferred by most farmers. All farmers asked stated that they would like to expand to a larger plot size next season to maximise production from their land.

Quality of demonstrations

The capacity of VBAs and district coordinators to establish and manage controlled multi-plot demonstrations has improved considerably compared to the first season of RIU. Almost all plots visited were treated equally and not planted near trees, paths, home-steads, manure piles or together with cassava, even though there was very little land available that on the farmers that is not near a tree or house because of the very small plot sizes. The VBAs seemed to understand the controlled nature of the trial. Importantly, the VBAs and farmers were all aware of the reason for the trial, explaining the improvements were because the plants have deeper tap roots and more water available to them.

Areas for improvement

- District coordinators must continue to emphasize the **controlled** nature of demonstrations, site choice and equal treatment of all plots.
- None of the plots of 'Tied ridges' actually had ties across the ridges. Ties (or small walls) should be placed between ridges to prevent water rushing along a furrow and allow more time for water infiltration. This should be emphasized in training by district coordinators before the start of next season.
- The demonstration plot could be simplified to either three sub-plots removing the farmer tillage without manure. In Vihiga, we could consider removing the *Deep Row Tillage* option since farmers almost universally prefer *Deep Tied Ridges*.