CAP – GART/CFU On-Farm Adaptive Trials Programme 2007/8 – 2010/11

Training Presentation for CFU Staff

Major Challenges Faced by Farmers and Researchers

Rapidly escalating fertiliser costs for Maize production and the absence of seasonal loan facilities. Today fertiliser costs $560/ton. In 2002 fertiliser cost US$285/ton.

Smallholders farming degraded soils cannot afford the fertilisers needed to obtain MAIZE yields required to achieve HFS and adequate returns to their labour and other resources invested to grow the crop.

Medium term solutions to restore soil fertility such as fallow cropping that reduce reliance on purchased Nitrogen exist but are ignored by farmers because the return on investment occurs in the following year.

Because Maize remains the predominant crop in Zambia, researchers must seek and demonstrate solutions that minimise reliance on purchased fertiliser and maximise natural capture of N.

Activities such as the manufacture of compost are inappropriate for the majority of farmers being too labour intensive.

Major Challenges Faced by Farmers and Researchers

The incorrect perception that CF is an improved Maize production system and therefore heavily dependent on the availability of synthetic fertilisers. Why invest in CF if fertilisers are beyond reach?

Dependency on late distribution of FSP Maize seeds and fertilisers and resultant late planting despite dry season land preparation.

Very late planting and total crop failure in drier due to widespread oxen hire.

General ignorance of the potential benefits of the biological crop synergies.

The failure of farmers to recognise the significant benefits of investing in their soils to improve underlying fertility in the medium term.

Labour constraints for weeding leading to excessive weed competition and low yields.

Scepticism of the benefits of the formal establishment of Faidherbia albida over CF farmed land, due to time required for benefits to emerge.

Criteria for Implementing Effective On-Farm Trials Programme

Trials should test technologies that CF/CA farmers can adopt to further increase efficiency, productivity, competitiveness and profits.

Trials managed by farmers have to be simple, practical and have immediate relevance.

On Station trials should be used to identify contributory factors that cannot be desegregated in on-farm trials.

The number of on–farm trials undertaken should be guided by GART/CFU's staff ability to ensure adequate supervision to enable the collection of reliable data.

Technologies tested should be within the financial grasp of farmers.

Criteria for Implementing Effective On-Farm Trials Programme

Technologies tested should demonstrate attractive value/cost ratios i.e. above 3:1 and where possible minimise reliance on costly or unavailable external inputs.

Biological synergies should be maximised.

Where feasible technologies should lend themselves to commercialisation. Often, farmers cannot find what they need to convert to CF/CA.

On-farm trials should provide venues for field days where technologies or systems being tested can be easily explained to and understood by farmers. Farmers should be able to relate what the see to what they are doing on a ‘field scale’.

The Challenge for Small-scale Maize Farmers

Nutrient Removal by Maize Our Primary Source of Carbohydrate

Maize Yield	N Kg	$P_2 0_5$ Kg	$K_2 0$ Kg	S Kg	Zn Kg	B Kg	Ca Kg	Mg Kg
2.0 tons	40.0	14.0	10.0	6.0	0.76	0.16	1.00	2.00
3.0 tons	60.0	21.0	15.0	9.0	1.14	0.24	1.50	3.00
3.5 tons	**70.0**	**24.5**	**17.5**	**10.5**	**1.33**	**0.28**	**1.75**	**3.50**
4.0 tons	**80.0**	**28.0**	**20.0**	**12.0**	**1.52**	**0.32**	**2.00**	**4.00**

Source Omnia Fertilisers Ltd

Before the impact of *Faidherbia* begins to take affect we need to test and demonstrate systems that would enable farmers to achieve a 3.5 to 4.0 ton/ha Maize crop with only 150kgs of compound purchased. This would in theory require 60-70kgs/ha N to be provided naturally.

Combinations to Maximise Capture of Atmospheric N

Maize Yield 3.5 tons	N Kg	$P_2 0_5$ Kg	$K_2 0$ Kg	S Kg	Zn Kg	B Kg	Ca Kg	Mg Kg
Extraction	**70.0**	**24.5**	**17.5**	**10.5**	**1.33**	**0.28**	**1.75**	**3.50**
140kg/Ha D Compound	**15.0**	**30.5**	**15.0**	**6.75**	**1.0**	**0.15**		
Early planting	**10.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		
Intercrops (Cowpea or Red Sunnhemp)	**20.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		
Fallow Crop (Velvet Bean Hoe Su- hemp Ox)	**40.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		

Trial Themes

Practical low input technologies with attractive VCR's that are within the grasp of resource poor CF farmers and which lend themselves to commercialisation through rural retail networks.

Trials

Trial 001 – Low Input: Combined Intercrop and Fallow Cropping Rotation for N Fixation, and Weed Suppression.

Trial 002 – Zero Input: Faidherbia albida, Comparative Observation of Crop Yields and Soil Effects

Trial 003 – Low Input: Faidherbia albida , Testing Low Cost Treatments to Enhance Growth & Survivability

Trial 004 – Low Input: Testing Yield Effects of Seed Priming, and Low Cost Seed Treatments on recycled Maize

In addition to the above trials CF Field staff will train selected Farmer Coordinators and Contact Farmers in the correct use Blazine herbicide for weed control in Maize crops combined with the Zamwipe for spot weeding resistant species such as Mulungwe, Couch Grass and Nut Grasses. The farmers involved will make their own conclusions regarding costs and benefits compared with hand or ox weeding.

On-Farm Trial Number 001 – Hoe CF Combined Low Input System

Rationale:

This 'low input farming system' observation trial would combine Cowpea/Maize Intercropping and Cotton planted in standard CF basin spacing rotated with Velvet Bean fallow. Fertiliser application rate on Maize is 140kg/ha (1 No. 8 cup of D per basin). Maize would be planted following CF recommendation. The aim of this observation would be (1) to determine if such as system can sustain Maize yields of 3.5 to 4 tons/ha over 4 seasons and (2) demonstrate to farmers that soil regeneration requires investment beyond 1 season. It would only suit farmers with idle land available. Velvet Bean fallow should also reduce weed population and weeding inputs in the following year.

Velvet Bean at GART Golden Valley

On-Farm Trial Number 001 – Hoe CF Combined Low Input System

Objective:

To observe the yield performance of a combined low input Maize/Cotton intercrop and fallow crop farming system. By suppressing weed growth and maximising contribution of atmospheric Nitrogen, can farmers reduce labour inputs, reduce N fertiliser application rates on Maize and at the same time achieve attractive crop yields and enhance net profits without depleting soil fertility;-

Longevity:

4 Seasons.

Number of On-Farm Trials and Location:

40 Trials. 10 Trials each in SR, WR, ER and CR.

Training and Supervision:

CFU Field Officers with visits by GART agronomists.

Appropriate Farmers:

Skilled Associated Farmers with idle crop land.

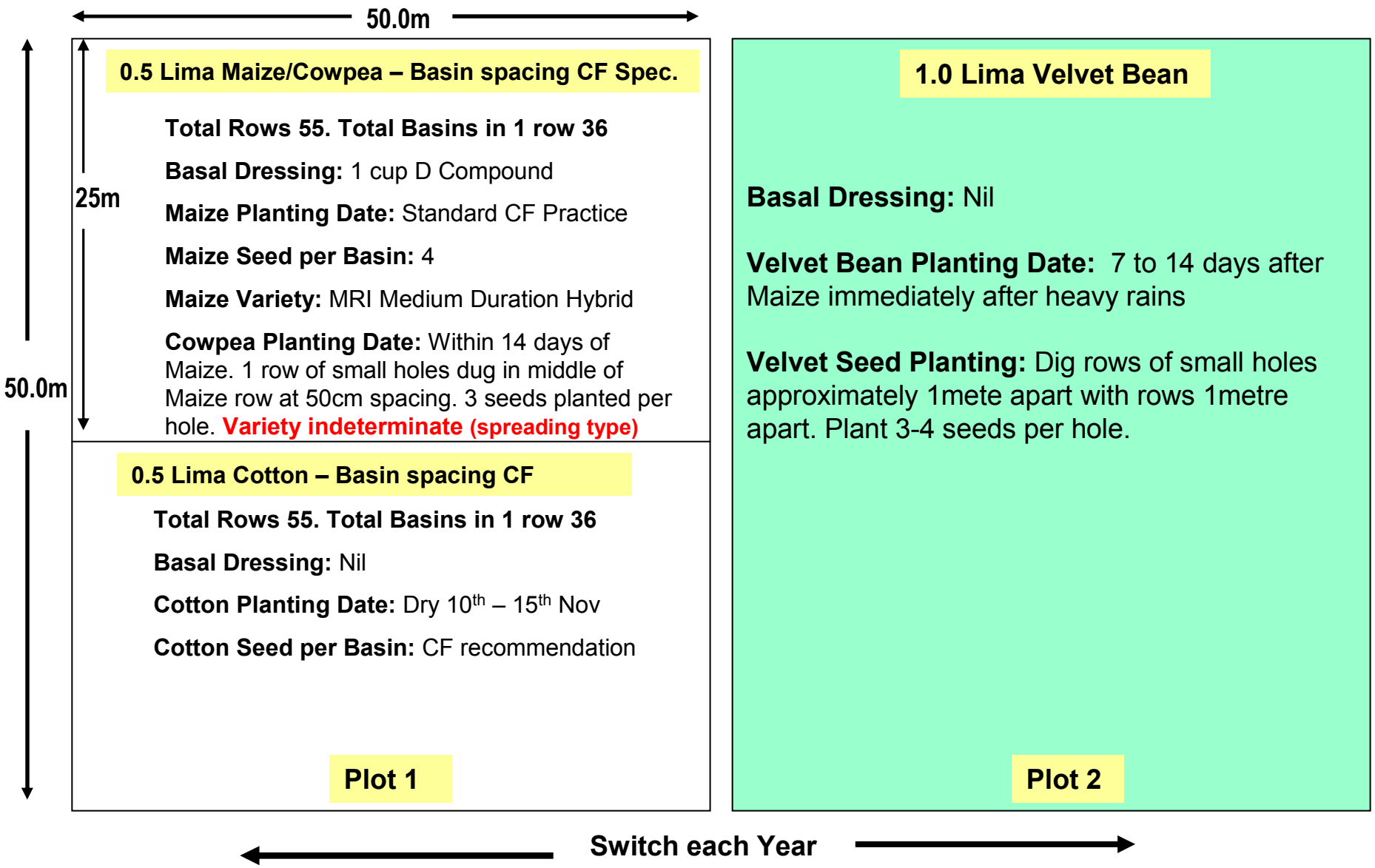
Data Collection: CFU Field Officers.

Soil and Data Analysis:

GART.

On-Farm Trial Number 001 – Hoe CF Combined Low Input System

Detailed Trial Design:



On-Farm Trial Number 001 – Hoe CF Combined Low Input System

Data Records:

Region:_____:	**Farmers Name:_____:**
Field Offices Name:_____ :	**Area: _____:**
PLOT 1	**PLOT 2**
Date of Basal Dressing Maize: _____:	
Date of Planting Maize: _____:	**Date of Planting Velvet Beans: _____:**
Date of Planting Cotton: _____:	
Date of Planting Cowpea: _____:	
Maize Yield:_____Kgs shelled dry grain **Cotton Yield:_____Kgs** **Cowpea Yield:_____Kgs shelled dry grain**	

Plot 1 Crop Score: Good **3,** Average **2,** Poor **1.** **Crop Stand:_____Colour of Crops:_____Weeds:_____Total_____**	**Plot 2 Score:** Good **3,** Average **2,** Poor **1.** **Crop Stand:_____Colour of Crop:_____Weeds:_____Total_____**

On-Farm Trial Number 001 – Hoe CF Combined Low Input System

Input Requirement for Trial and Total

Maize Seed:

MRI Medium Duration Hybrid **40 packs of 5kgs. Total 200kgs**

Basal Dressing:

D Compound **40 packs of 20kg. Total 800kgs**

Cotton Seed:

F135 (ER Chureza) **40 packs of 5kgs. Total 200kgs**

Cowpea Seed:

GART Indeterminate **40 packs of 7.5kgs. Total 300kgs**

Velvet Bean Seed:

Black or Green **40 packs of 20kgs. Total 800kgs**

Other Materials:

Chaka Hoes, Teren Ropes and Fertiliser cups already provided.

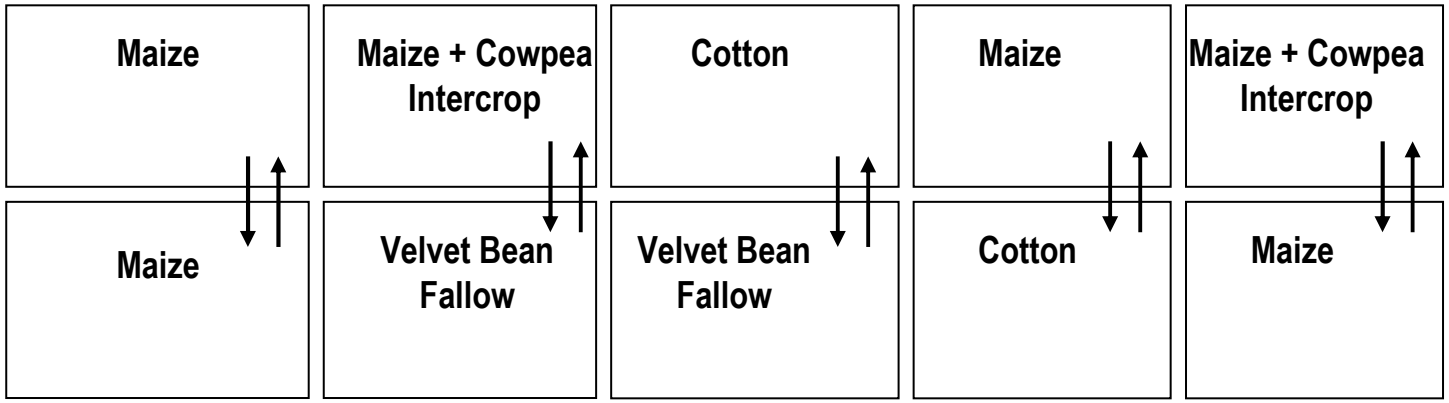
HQ Packing Instructions:

Inputs for each trial packed in 100kg sacks marked by Region

On Station Trial Number 001 – Hoe CF Combined Low Input System

Locations: Golden Valley and Magoye

Objective: Identify Source of Benefits



Planting Method: CF

Treatments: 4. 1 treatment is 5 rows x 10 basins

Inputs: Same as On Farm Trials

Replications: 4

Longevity: 4 Seasons

Data: Soil Analysis and Crop Yields

Note: Red Sunnhemp is an alternative to Cowpea inter-row planted at normal CF Maize spacing within 14 days

On-Farm Trial Number 002 – Faidherbia Albida Crop Yields

Rationale:

A major aim of the CAP Programme is to assist 120,000 CF farmers to formally establish 2 hectares of Faidherbia albida over their cropped land following the model established at GART. Total 240,000 hectares by 2011. The rationale is as follows:-

As fertiliser prices escalate increasing areas of Maize will be planted without fertilizer leading to accelerating food insecurity, poverty and dependency on food relief.

In the absence of seasonal loans for fertiliser, farmers are unable to finance purchases irrespective of Maize price increases and encroach forests to mine out natural fertility leading to accelerated de-forestation. Zambia already has the 2nd highest per capita deforestation in the world.

Faidherbia offers a long term solution through the restoration of soil fertility and will enable CF farmers to grow maize and other crops profitably without recourse to the purchase of excessive quantities of fertiliser.

That widespread planting of Faidherbia as an integral component of CF farming will convert small-scale agriculture to a force for the regeneration rather than the exploitation of rural environments.

That farmers who cultivate fertile soils under this tree will be more resilient to threats posed by climate change and will contribute to the capture of carbon emissions.

That Zambia should demonstrate that in the medium term this tree has the potential to revolutionise small-scale agriculture in the Region and well beyond.

On-Farm Trial Number 002 – Faidherbia Albida Crop Yields

Rationale continued:

Fertiliser Prices US$ Per Ton - Lusaka (ZMK Constant aprox. 4000:1

Year	2002	2003	2004	2005	2006	2007
Urea	285	315	385	455	520	560
D Compound	295	315	390	400	520	560

According to available scientific literature, mature trees supply per hectare the equivalent of 300kg of complete fertiliser and 250kg of lime worth ZMK 760,000 at current prices . This can sustain a maize yield of 4 tons/ha.

On-Farm Trial Number 002 – Faidherbia Albida Crop Yields

Objective:

To determine and demonstrate the contribution of mature Faidherbia albida to unfertilised Maize, Cotton, Groundnut and Soya Bean yields. To determine soil fertility accumulation under Faidherbia canopy.

Longevity:

4 Seasons

Number of On-Farm Trials and Location:

40 Trials. 10 trial each SR, WR, CR and ER

Training and Supervision:

CFU FO & Field Supervisors with visits by GART agronomists. (Where trees are).

Farmers:

Farmers who have large mature Faidherbia trees on their land. Livestock not using for shade!

Data Collection:

CFU Field Officers for Crop Yields GART for analysis of soils.

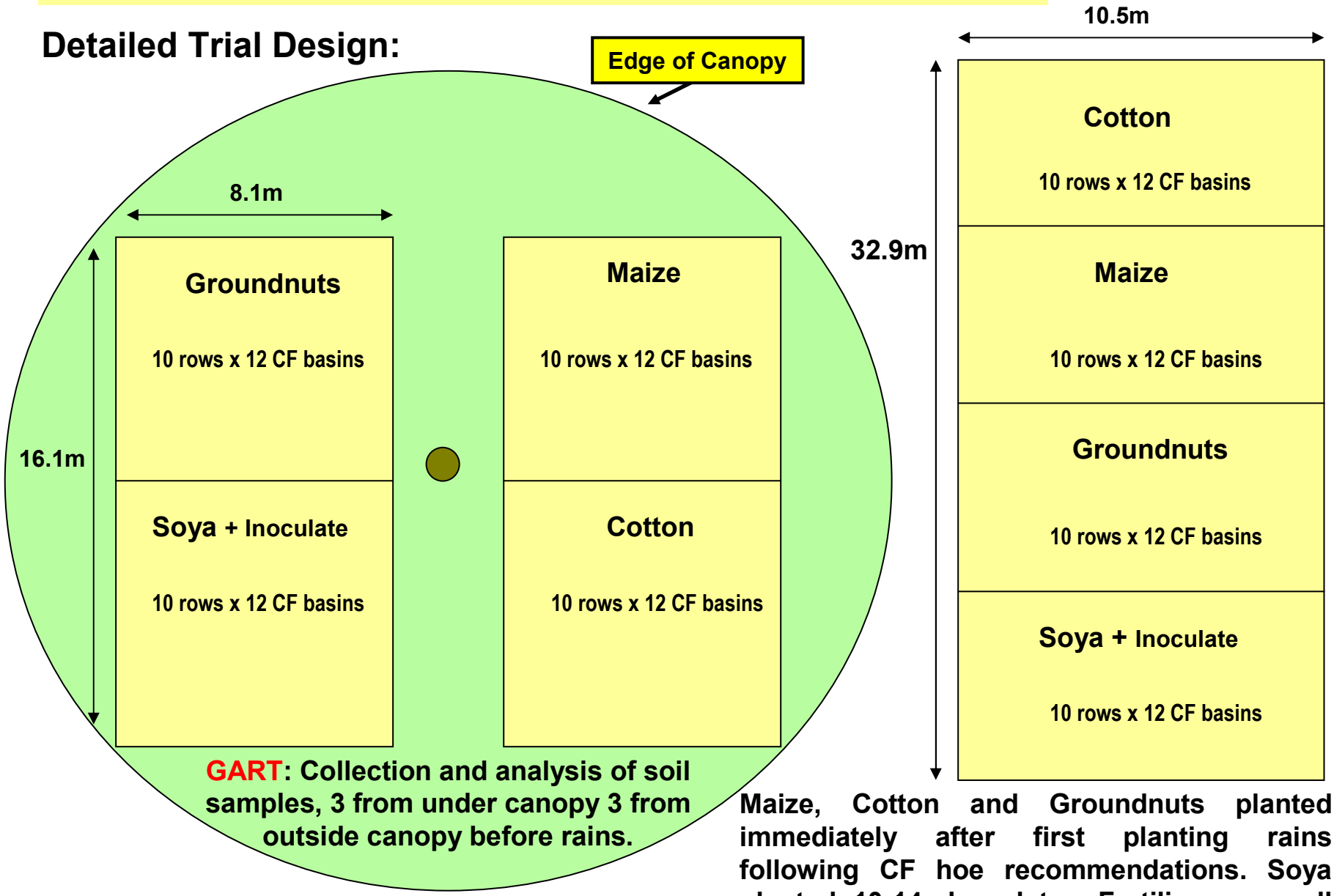
Data Analysis:

GART.

Very Important: As these will be repeated under the same trees for 4 years tree and farmer selection is crucial

On-Farm Trial Number 002 – Faidherbia Albida Crop Yields

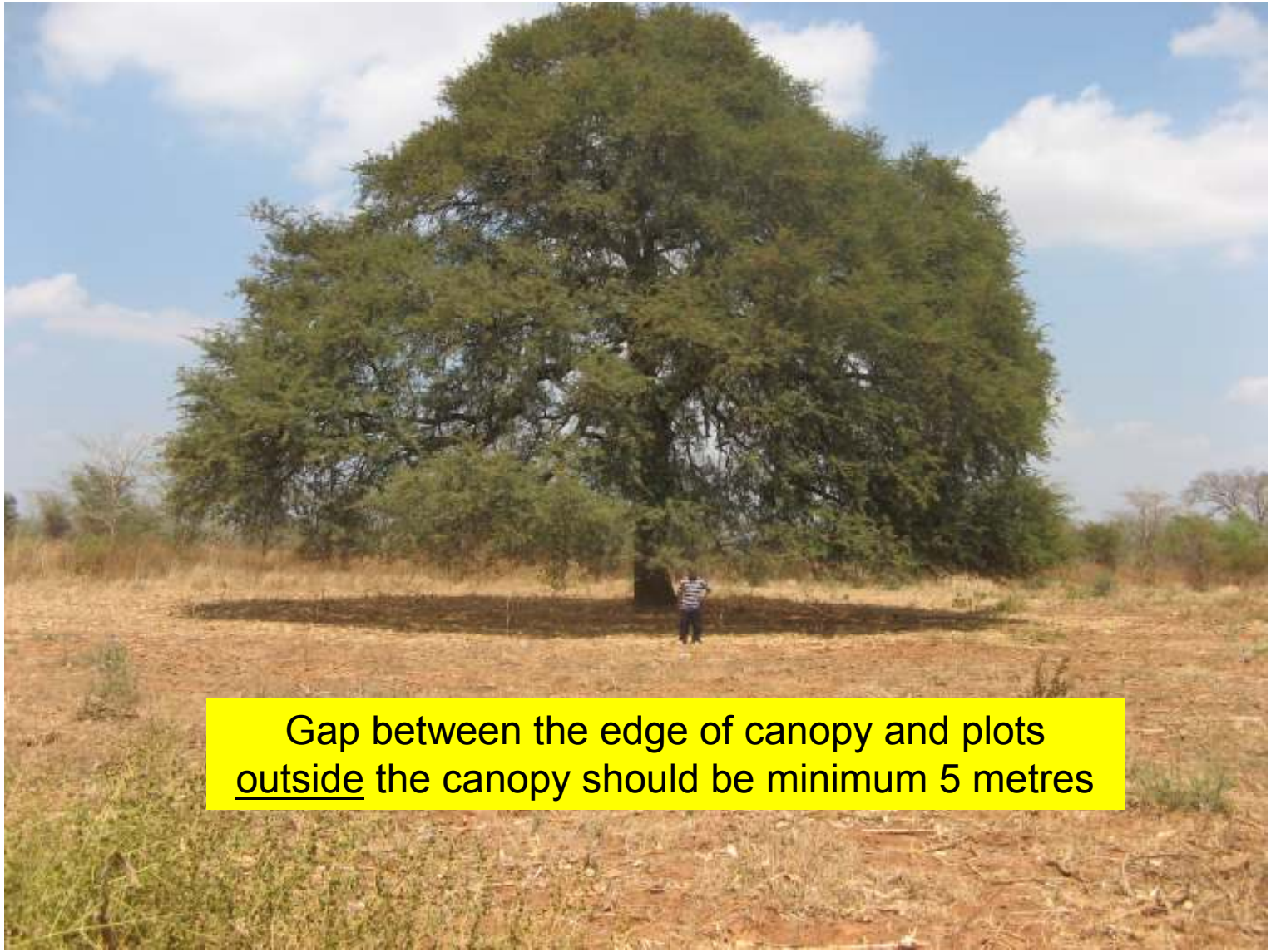
Detailed Trial Design:



GART: Collection and analysis of soil samples, 3 from under canopy 3 from outside canopy before rains.

Maize, Cotton and Groundnuts planted immediately after first planting rains following CF hoe recommendations. Soya planted 10-14 days later. Fertiliser zero all plots. Inoculate on Soya. Same day planting.

On-Farm Trial Number 002 – Faidherbia Albida Crop Yields



Idea Tree for Trial – Canopy Diameter 24 metres

On-Farm Trial Number 002 – Faidherbia Albida Crop Yields

Data Records:

Region:_____:	**Farmers Name:**_____:
Field Offices Name:_____ :	**Area:** _____:
Under Faidherbia	**Outside Faidherbia**
Date of Planting Maize, Cotton and Groundnuts: _____:	**Date of Planting Maize, Cotton and Groundnuts:** _____:
Date of Planting Soya: _____:	**Date of Planting Soya:** _____:
Maize Yield Dry Shelled Grain:_____**Kgs**	**Maize Yield Dry Shelled Grain:**_____**Kgs**
Cotton Yield:_____**Kgs**	**Cotton Yield:**_____**Kgs**
Groundnut Yield Dry Shelled Grain:_____ **Kgs** **Soya Yield Dry Shelled Grain:**_____**Kgs**	**Groundnut Yield Dry Shelled Grain:**_____ **Kgs** **Soya Yield Dry Shelled Grain:**_____**Kgs**
Plots Score: Good **3,** Average **2,** Poor **1.** **Crop Stand:**_____**Colour of Crops:**_____**Weeds:**_____**Total**_____	**Plots Score:** Good **3,** Average **2,** Poor **1.** **Crop Stand:**_____**Colour of Crops:**_____**Weeds:**_____**Total**_____

On-Farm Trial Number 002 – Faidherbia Albida Crop Yields

Input Requirement for Trial and Total

Maize Seed:

MRI Medium Duration Hybrid: **40 packs of 1.5kgs. Total 60kgs**

Groundnut Seed:

MGV4 **40 packs of 2.5kgs. Total 100kgs**

Cotton Seed:

F135 & Chureza (for ER x 10) **40 packs of 1.5kgs. Total 60kgs**

Soya Bean Seed:

Soprano/Solitaire **40 packs of 1.5kgs. Total 60kgs**

Soya Inoculate **40 packs**

Other Materials:

1 x 100kg weighing sack marked **Crops Under Tree**	Total 40
1 x 100kg weighing sack marked **Crops Outside Tree**	Total 40
Teren Ropes	Total 40
Chaka Hoes	Total 40

On Farm Trial 003 – Faidherbia albida , Low Cost Treatments to Enhance Growth & Survivability

Rational:

The survivability and growth rate of farmer transplanted Faidherbia through the first year is very variable, ranging from 15% to 60%. Numerous factors are involved including care when planting, rainfall, inherent soil fertility, etc. If CAP is to achieve its objective by 2011 the survival of seedlings in year 1 must average 50% minimum with replanting of gaps over the following 2 seasons to achieve full stands.

Objective:

To assess the impact of simple interventions to enhance survivability including the application of basal fertiliser and the product ZEBA a super absorbent technology based on corn starch. *Visit zeba.com/agriculture.* These trials would be undertaken by the best farmer groups who are receiving Faidherbia albida inputs and training.

2 cups of D Compound per planting hole is 1.8kg/ha – Cost $1.20/ha. 2 Grams of Zeba per planting hole is 0.2kg Cost $7.00/ha

On Farm Trial 003 – Faidherbia albida , Low Cost Treatments to Enhance Growth & Survivability

Longevity:
4 Seasons

Number of On-Farm Trials and Location:
40 Trials. 10 trial each SR, WR, CR and ER, under 1 good CF.

Training and Supervision:
CFU Field Supervisors

Farmers:
Choose 10 farmers form one FC Group under 1 CF. Do not scatter.

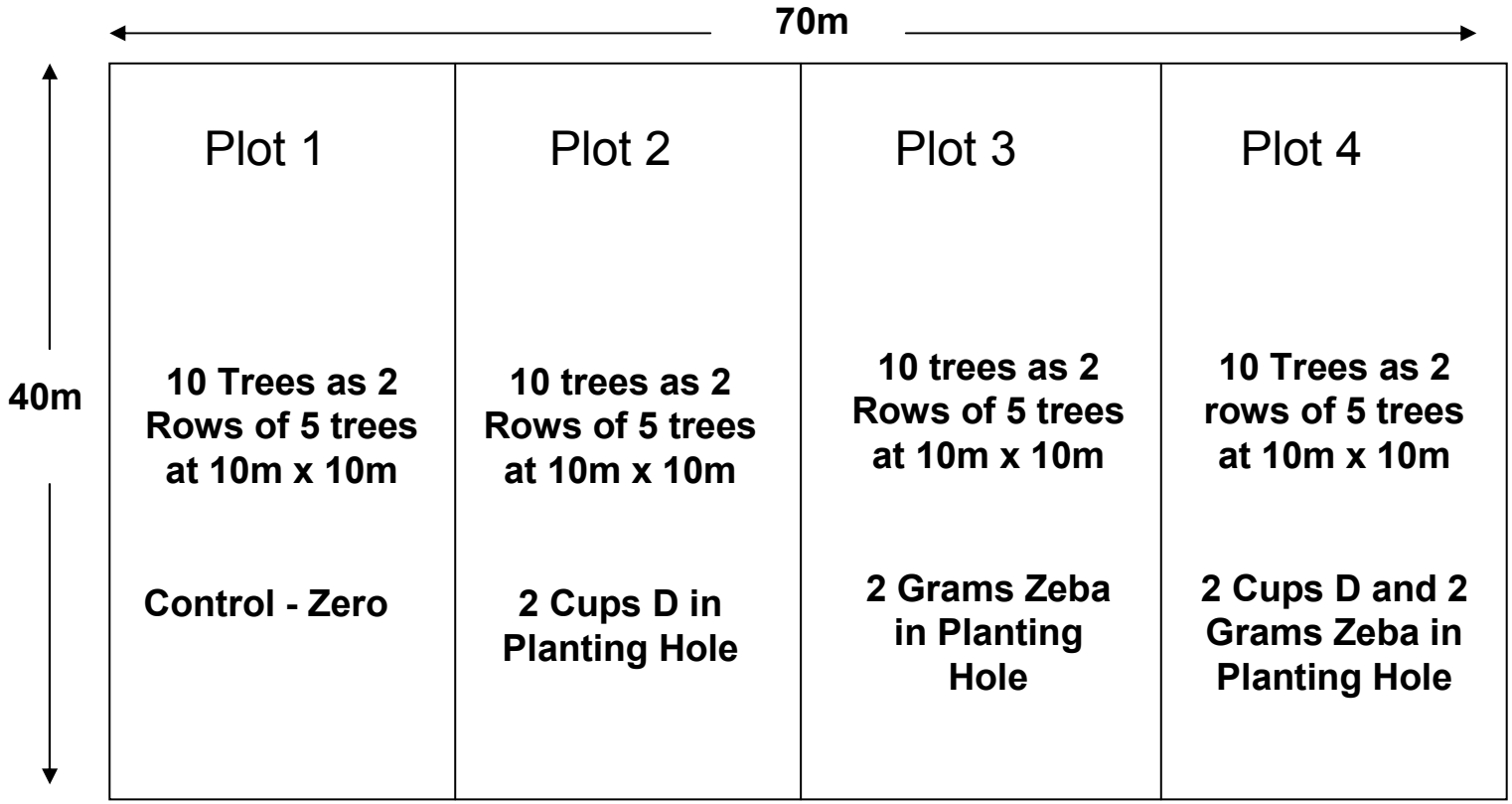
Data Collection:
CFU Field Supervisors survival rates and growth during following September

Data Analysis:
GART.

Each FO will be provided additional Zeba to make his/her own observations with other farmers.

On Farm Trial 003 – Faidherbia albida , Low Cost Treatments to Enhance Growth & Survivability

Detailed Trial Design:



On Farm Trial 003 – Faidherbia albida , Low Cost Treatments to Enhance Growth & Survivability

Data Records:

Plot 1: Date of Transplanting _____: Number of Surviving Plants counted following September _____: Ranking on seedling vigour compared to other Plots: ( ) Worst ( ) No Difference ( ) Good ( ) Best ( )	**Plot 3:** Date of Transplanting & Treatment _____: Number of Surviving Plants counted following September _____: Ranking on seedling vigour compared to other Plots: ( ) Worst ( ) No Difference ( ) Good ( ) Best ( )
Plot 2: Date of Transplanting & Treatment _____: Number of Surviving Plants counted following September _____: Ranking on seedling vigour compared to other Plots: ( ) Worst ( ) No Difference ( ) Good ( ) Best ( )	**Plot 4:** Date of Transplanting & Treatment _____: Number of Surviving Plants counted following September Ranking on seedling vigour compared to other Plots: ( ) Worst ( ) No Difference ( ) Good ( ) Best ( )

Note for Vigour Scoring: Worst = 1, No Difference = 2, Good = 3, Best = 4.

On Farm Trial 003 – Faidherbia albida , Low Cost Treatments to Enhance Growth & Survivability

Input Requirement for Trial and Total

Faidherbia Inputs:

Already supplied

Fertiliser:

D Compound	**40 packs x 1.0kgs Total 40kgs**

Zeba Product:

Water absorbent	**40 packs x 60grams Total 2.4kgs**
400 spare packs	**400 packs x 60grams Total 24.0kgs**
Stake	**Marker for each plot (Farmer)**

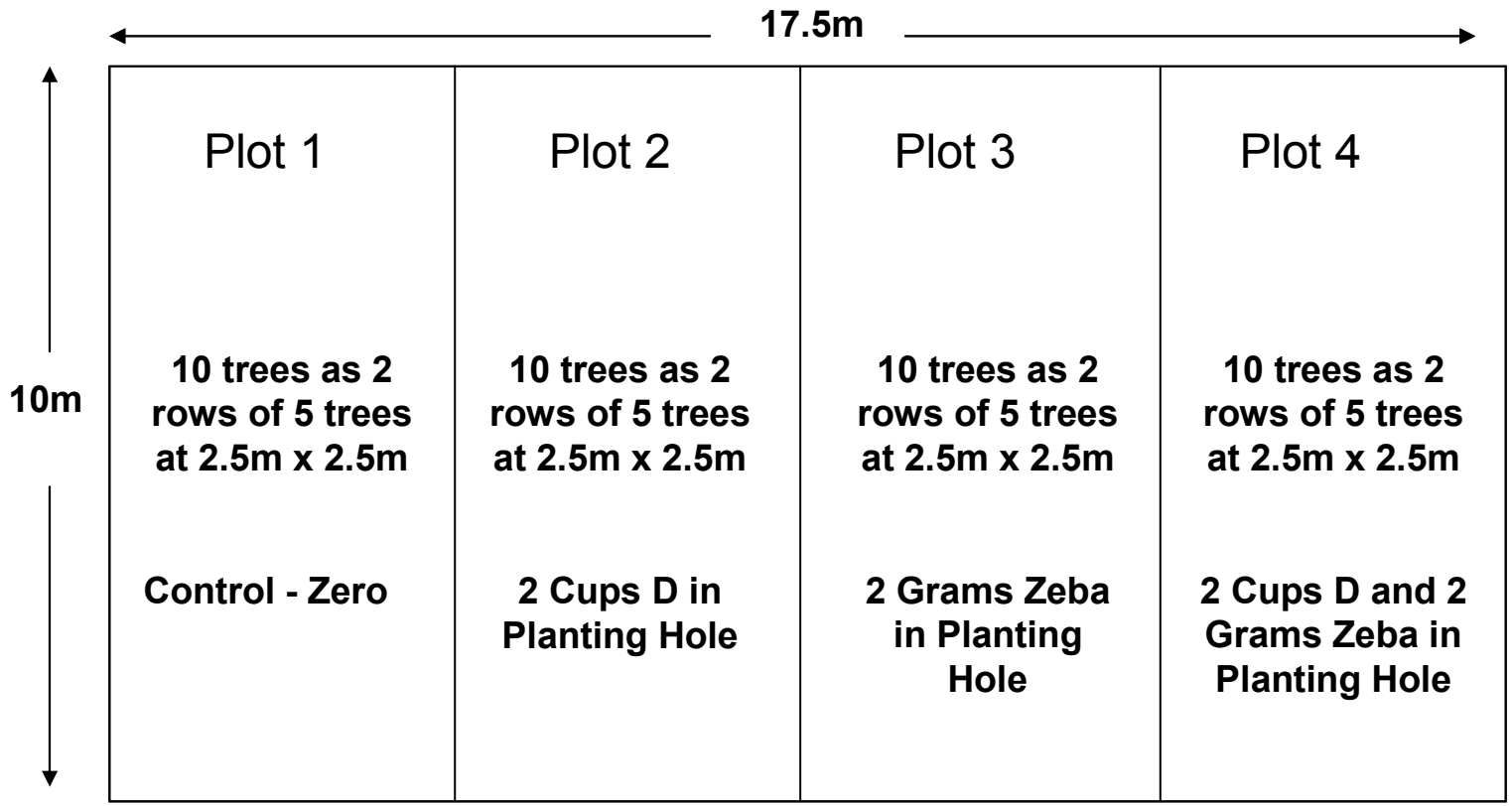
On Station Trial 003 – Faidherbia albida , Low Cost Treatments to Enhance Growth & Survivability

Locations: Golden Valley and Magoye

Objective: More controlled assessment with measurements of seedling growth

Replicates: 3

Treatment: Same as On Farm Trial – Reduced Spacing to reduce land requirement. Plot 5 Lime?



On Farm Trial 004 – Low Input: Testing Yield Effects of Seed Priming, and other Seed Treatments on recycled Maize

Rationale:

Many farmers who grow Maize including CF adopters plant recycled Maize and cannot afford to purchase adequate amounts of fertiliser if any at all. In these conditions low cost interventions must be tested that can increase yields and which in future, be incorporated with low input CF farming practices such as those being tested in Trial 001.

Cheap interventions such as seed priming, the use of new more effective seed dressings and root enhancing inoculates individually or in combination can increase yields and offer very attractive VCR's by:- reducing seed losses to pests, enhancing rapid and even crop emergence and increasing crop root volumes and efficiency of nutrient uptake.

Objective:

To test the additive benefits of seed priming (15 hour soaking before planting), seed dressing, and root inoculates individually and in combination with low fertiliser rates.

On Farm Trial 004 – Low Input: Testing Yield Effects of Seed Priming, and other Seed Treatments on recycled Maize - GART

Longevity:
4 Seasons

Number of On-Farm Trials and Location:
20 On-Farm Trials. 10 each trial in SR and CR. 1 Replicated trail at Golden Valley and at Magoye

Training and Supervision:
GART agronomists.

Farmers:
Farmers who apply hoe CF

Data Collection:
GART agronomists

Data Analysis:
GART.

On Farm Trial 004 – Low Input: Testing Yield Effects of Seed Priming, and other Seed Treatments on Recycled Maize

Detailed Trial Design:

Maize Variety: Recycled Hybrid

35.1m

10 rows of CF 15 basins 1cup D per Basin + zero	10 rows of CF 15 basins 1cup D per Basin + Seed priming	10 rows of CF 15 basins 1cup D per Basin + Seed priming + Seed Plus	10 rows of CF 15 basins 1cup D per Basin + Seed priming + Seed Plus + Inoculate

Planting Date: Day following first Heavy rains after Nov 15th

Seed Priming: Soak Maize seed for 15 hours day before

Seed Dressing: Add Seed Plus with Priming

Inoculate: Add Add Seed Plus and Soygro Maize Inoculate with Priming

Total Number of Trials Managed by CFU Staff

Trial	SR	WR	CR	ER
001 - Combined Intercrop Fallow	10	10	10	10
002 - Faidherbia Crop Yields	10	10	10	10
003 – Faidherbia Growth & Survival	10	10	10	10

Additional Velvet Bean and Sunnemp seed will be provided to FO's by CFU so they can demonstrate Maize/ Sunnhemp intercropping and Velvet bean Fallow cropping or combinations of both, with CF hoe and ox farmers.

These simple observation plots would have to be continued with the same farmers for 2 seasons at least to be useful.

Staff and farmers should always be encouraged to do some experiments themselves with guidance from more experienced staff

All CFU staff will also receive training on use of Maize herbicides and chemical packs so they can demonstrate to selected FC's CF's and farmers can observe results. This would compliment PROFIT's service provider schemes

Getting the best results from herbicides demands accuracy. Many attempts to promote the use of herbicides by SSF's have failed because:-

- Herbicide is used at the wrong time
- Incorrect application rate is used - either too much or too little.
- Dirty water is used
- Faulty sprayer with inadequate pressure is used
- Filters and nozzles are blocked or damaged
- Farmer expects herbicides to kill all weeds. Herbicides cannot do this.

When these things happen the farmer says the manquala was no good!

To succeed in any endeavour our focus must be unshakable and our determination absolute!