Progress report on the Agronomy Component
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April 30, 2015

1. Soil sampling and analysis

Soil samples were collected at 0-20cm soil depth from 411 farmers' plots and 19 demonstration plots sites in November – December 2014 in the two intervention EPAs, Mtunthama in Kasungu district, and Chibvala in Dowa district. The plots are located at an elevation of 1138-1402m (in Dowa), and 942-1690m in Kasungu. The soils were analyzed for pH, nitrate nitrogen (NO_3^-), active organic carbon, inorganic phosphorus (P), sulfur (S), exchangeable potassium (K) and electrical conductivity (EC) at Bunda College Soil and Plant Analysis Laboratory using the Soil Doc. The following plot data were collected along with soil sampling: GPS coordinates, cropping history and soil fertility management for the previous three agricultural seasons.

Table 1 shows preliminary results on soil chemical characteristics in the two EPAs. Soil pH (in water) ranged from slightly acidic (4.8) to slightly alkaline (7.9) and a mean of 6.1 and 6.3 for Chibvala and Mtunthama, respectively. The average soil pH in both districts is within the recommended range (5.5-6.5) for most production of most arable crops including soybean, groundnut, maize and beans. Nitrogen is one of the major essential nutrients elements for plant growth and development. In Chibvala EPA, soil NO_3^- was highly variable between farms (0-102 mg/kg) and this may be attributed to cropping story and soil fertility management. Exchangeable potassium (K) range from low to high with a mean =0.969 cmol/kg and 1.05 cmol/kg in the two EPAs. The soils are non-saline with mean EC values of 0.51dS/cm and 0.39dS/cm for Chibvala and Mtunthama, respectively.

Table 1: Soil chemical characteristics in Chibvala and Mtunthama EPAs, 0-20cm soil depth

EPA	Variable	N	Mean	SE	Min	Max
Chibvala	pH (H_20)	206	6.1	0.26	4.8	7.9
	pH (CaCl)	206	5.5	0.22	3.4	6.7
	Active carbon (mg/kg)	204	507	7.84	74.88	969.84
	NO_3^- (mg/kg)	206	5.22	0.38	0.00	102.27
	K (cmol/kg)	202	0.97	0.028	0.05	3.18
	S (mg/kg)	205	7.96	0.119	0.43	19.63
	EC (dS/cm)	206	0.51	0.019	0.7	3.73
Mtunthama	pH (H_20)	210	6.3	0.12	5.0	7.6
	pH (CaCl)	210	5.6	0.02	4.72	6.93
	Active carbon (mg/kg)	207	397	8.01	3.60	1049.04
	NO_3^- (mg kg^{-1})	213	6.32	0.31	0.00	48.18
	K (cmol/kg)	213	1.06	0.02	0.05	3.08
	S (mg/kg)	212	7.39	0.098	2.46	15.90
	EC (dS/cm)	212	0.39	0.009	0.03	1.59

2. Field observations

On-farm demonstrations were established by the CDI in the 2014/2015 growing season in Chibvala and Mtunthama EPAs. There are three types of demonstration plots: soybeans-maize, groundnut and maize and common bean and maize (see Table 2). In the soybean trial, all treatments were replicated twice on each plot. A total of 11 demonstrations plots in 9 locations were established in Mtunthama EPA; and 8 demonstration plots in 8 locations in in Chibvala EPA.

The varieties grown were Squire (soybean), Kholophete (common bean), CG7 (groundnut) and SC 719 (maize). Planting was done in the last week of December 2014 to first week of January 2015. Germination was assessed at two weeks after planting using a checklist (see Appendix 1). Follow up data on agronomic practices and crop performance were collected through phone calls on a weekly basis from that point onwards following a checklist (see Appendix 2).

Table 2: Treatments for the soybean, groundnut and common bean demonstration plots, 2014/2015 cropping season

Treatment	Demonstration plots		
	Soybean and maize	Groundnut and maize	Bean and maize
1	Soybean BPA	Groundnut BPA	Beans BPA
2	Soybean control	Groundnut FP	Beans FP
3	Maize rotation	Groundnut control	Beans control
4	Maize BPA	Maize FP	Maize BPA
5	Maize control	Maize control	Maize control
6		Maize FP	Maize FP

Key: FP=farmer practice; BPA=Best Practice Agronomy.
Information on BPA for each crop as provided by CDI

Germination of soybean and groundnut was variable between plots and treatments. Figure 1 shows plant population of soybean after germination and it ranged from 16700-303100 plants ha^{-1} in Mtunthama EPA; and 65100-206400 plants ha^{-1} in Chibvala EPA. In Mtunthama EPA, higher plant population was observed in the soybean with BPA than the control, p=0.0002 (see Figure 1). However, no differences observed between soybean treatments in Chibvala EPA. In groundnut, plant population after emergence ranged from 65100-118500, 45200-115300 and 30700-54400 plants ha^{-1} for best practice agronomy, control and farmer practice, respectively. Higher germination rate was observed in groundnut treatments with best agronomy practice (100033 plants ha^{-1}) and control (81916 plants ha^{-1}) than farmer practice (41967 plants ha^{-1}).

Figure 2 shows the maize density after germination across the two EPAs. The average plant population per hectare ranged from 38,900 plants (maize rotation) to 46,863 plants in control plots. This is slightly lower than the 53,000 plants ha^{-1} expected plant population and this was partly attributed to mice (maize seed eaten by mice after planting) in plots under conservation agriculture (CA).

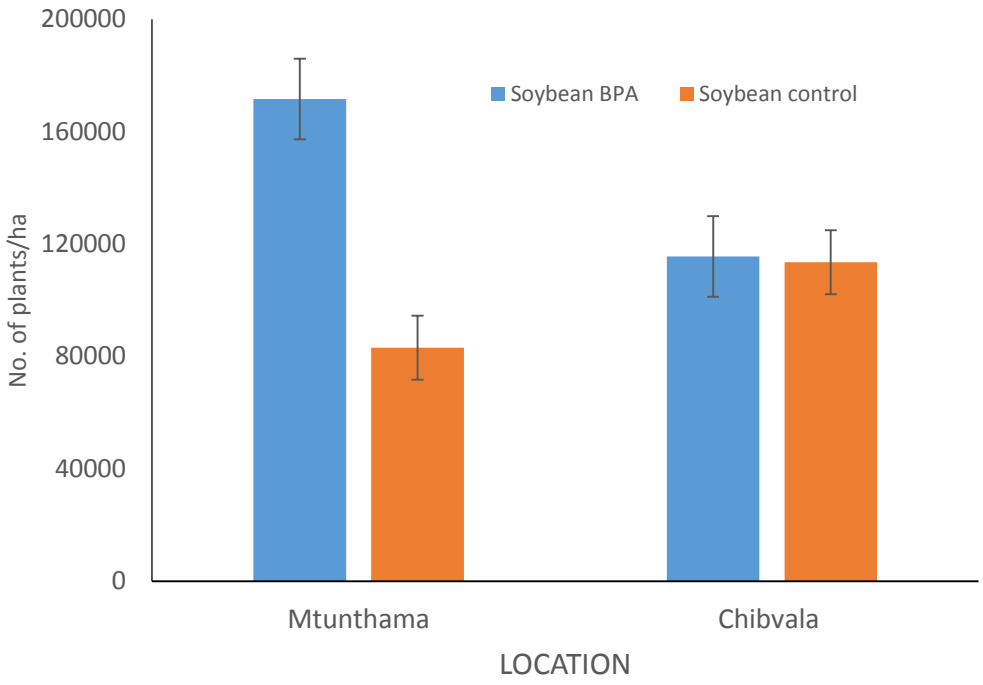

Figure 1: Plant population of soybean after germination
BPA=Best Practice Agronomy

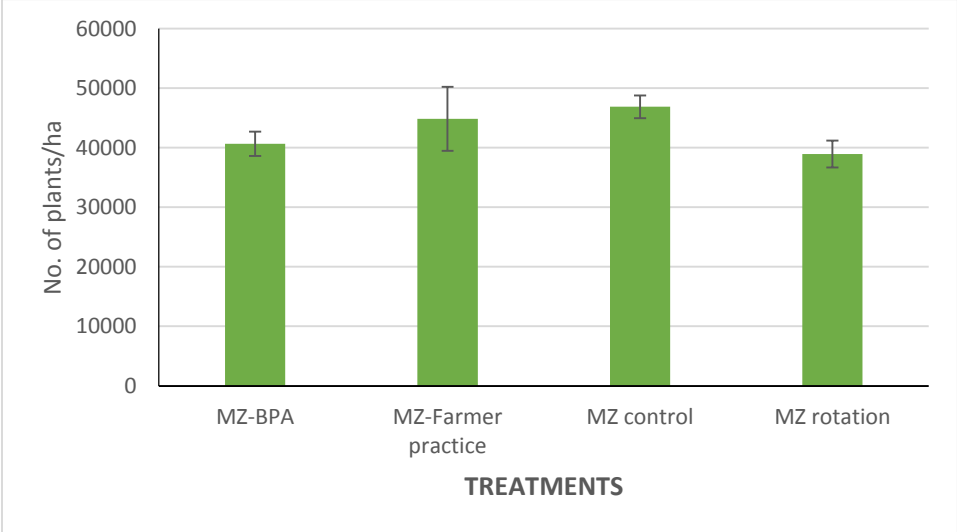

Figure 2: Plant population of maize after germination in Chibvala and Mtunthama EPAs
MZ=maize; BPA=Best Practice Agronomy

3. Rainfall

Rain gauges were installed at the demonstration plots and farmers were trained on recording of rainfall data. Figures 3 and 4 show the monthly rainfall in the locations in Mtunthama and Chibvala EPAs during the 2014/2015 cropping season. The late onset of planting rains (second half of December) delayed planting compared to a normal year whereby planting is completed within the first half of December. In terms of distribution, the areas received heavy rains in January to mid-February when the crops were at germination phase or early vegetative stage. During the season, a dry spell was experienced from mid-February to mid-March when crops were at late vegetative stage or reproductive stage. Late onset of planting rains and rainfall distribution might have negatively affected crop establishment, nutrient leaching, grain formation and overall crop yields.

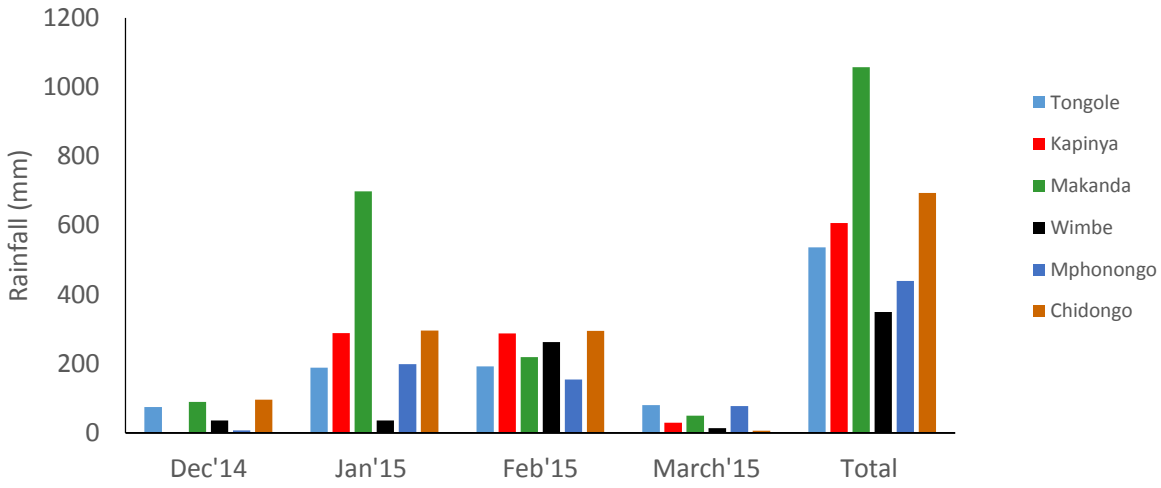

Figure 3: Monthly rainfall in Mtunthama EPA, 2014/2015 cropping season, by location

Note: We are still in the process of processing the information of the three remaining locations

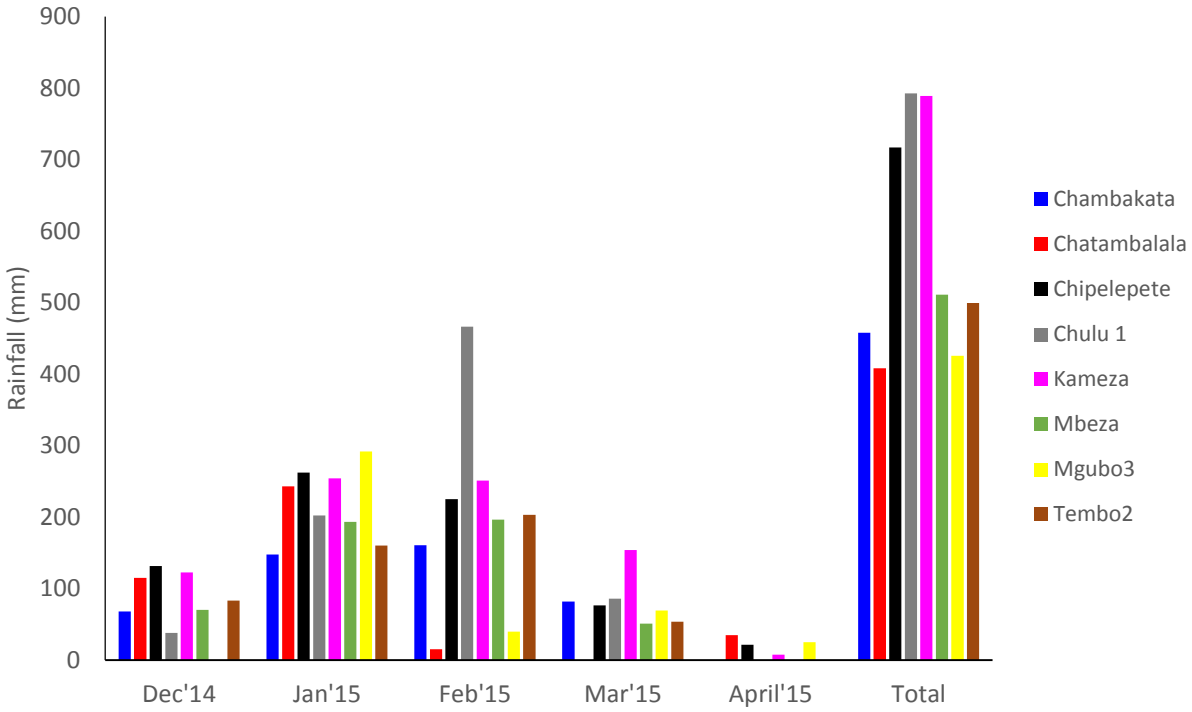

Figure 4: Monthly rainfall in Chibvala EPA, 2014/2015 cropping season, by location

4. Harvesting data collection

Beans were harvested in April 2015. Soybean will be harvested in May 2015, and groundnut and maize will be harvested in May-June 2015. The protocols for harvesting are included in Appendix 3. A questionnaire will be administered to farmers at harvest time to learn farmers' perception on factors that affect grain yield.

Appendix 1: Data collection two weeks after planting (estimated first week of January) To be collected in person for each subplot

District		Village name	
EPA		Club	
TA		Lead farmer	
Section		Today's date in DD/MM/YY	
GVH		Is this a soy/maize or Groundnut/maize or beans/maize demonstration plot (circle correct answer)	Soy Groundnut Beans

Details of activity:

How many club members were present for this planting?	
How many other individuals from inside the village were present?	
How many individuals from outside of the village were present?	
How long did these club members engage in this activity? (hours)	
Was the CDI officer present at planting?	

IDENTIFICATION

Which subplot is this? ----------

Planting date in DD/MM/YY	
Seed used 1 = hybrid 2 = local variety	
Seed variety name	
Did you use inoculants? (for Soybean only) 1 = yes 2 = no	
Plant spacing	

Details of planting:

Unit Plant spacing	
Plant count after germination	
Unit plant count:	
Anything else noteworthy?	

Appendix 2: One for each subplot -To be done every Monday

District		Village name	
EPA		Club	
TA		Lead farmer	
Section		Today's date in DD/MM/YY	
GVH		Is this a soy/maize or Groundnut/maize or beans/maize demonstration plot (circle correct answer)	Soy Groundnut Beans

IDENTIFICATION

Which subplot is this?

Which activity did the club undertake this week?

Weeding ☐ Applying fertilizer ☐ Other ☐

Specify the other activity below

_____

Details of the activity:

How many club members were present for this activity?	
Was the CDI agent present for this activity?	
How long did these club members engage in this activity? (hours)	
How many people from within the village but who are not club members were present?	
How many people from outside of the village were present?	
What is the type of fertilizer/pesticide/herbicide applied?	
How much was applied on each plot?	
Specify unit:	

Did anything out of the ordinary happen this week? Such as a plant disease, pest or extraordinary weather event? If so, describe the event, and the response.

Did any rain fall this week? If yes, how much, in mm, PER DAY.

Appendix 3: Harvest protocols (Data to be collected from each subplot at harvest)

District:
EPA:
Name of Village
Village ID:
Name of Club:
Name of lead farmer:
Lead farmer ID:
Date of harvesting:
Type of demonstration plot: groundnut OR soya OR common beans:
Treatment name:
Replicate/Block No.:

Take note of the following:
How many of the club farmers participated in harvesting today:
Were any non-club farmers of this village present, and if so, how many?
Were any farmers from other villages present, and if so, how many?
Was the CDI extension agent present?

A. HARVESTING COMMON BEANS AND SOYABEANS

1. Record the plot area to be harvested (ridge length, number of ridges and ridge spacing)
2. Record stand count at harvest
3. Uproot all plants and record the total biomass fresh weight at harvest
4. Record the fresh weight of leafy biomass (crop residues of soya or beans) at harvest
5. Take a sub sample of the leafy biomass (crop residues) to determine moisture (as part of ISFM—assuming these crop residues will be incorporated in the soil on this subplot)
6. Strip off the pods from the plant and record the fresh weight of unshelled pods
7. After shelling the pods, record the weight of grain
8. After weighing the grain yield, randomly select 100 seeds and put in a well labelled envelope. Record the weight of the 100 seeds
9. Put the weighed 100 seeds (from step 8 above) in an oven at 70^0C for 48 hours. Record the dry weight after drying.

B. HARVESTING GROUNDNUT

1. Record the plot area to be harvested (ridge length, number of ridges and ridge spacing)
2. Record stand count at harvest
3. Record the total biomass weight
4. Strip off the fresh pods
5. Record the fresh weight of unshelled pods
6. Record the weight of fresh haulms (groundnut crop residues) (i.e. step 3-step 5)
7. Take a sub sample of fresh haulms to determine moisture content of fresh haulms (as part of ISFM—*assuming these crop residues will be incorporated in the soil on this subplot)*

8. Put the fresh pods for each subplot separately in a well labeled sac bag. Dry the pods separately for each sub plot.
9. After the pods have dried, record the weight of dry unshelled pods

HARVESTING MAIZE

1. Record the plot area to be harvested (ridge length, number of ridges and ridge spacing
2. Record stand count at harvest
3. Record the total biomass fresh weight at harvest
4. Remove the ears from the maize stalks
5. Record weight of maize ears at harvest
6. Record the weight of stover (maize crop residues) at harvest (i.*e. step 3 - step 5)*
7. Take a sub sample of the maize stover to determine moisture content (as part of ISFM—assuming these crop residues will be incorporated in the soil on this subplot)
8. Measure and record the fresh grain weight at harvest
9. Measure and record moisture content of grain. To get readings for moisture content using a grain moisture meter, mix the grain thoroughly and take 3 readings, and then record the average moisture content.