Enabling poor rural people to overcome poverty

International Maize and Wheat Improvement Center

2011 EC/IFAD CGIAR Programme: Conservation Agriculture and Smallholder Farmers in Eastern and Southern Africa-Leveraging Institutional Innovations and Policies for Sustainable Intensification and Food Security

(CASFESA, 2011/260-204)

Bi-annual Progress Report
1 February 2013 to 31 July 2013

Submitted to:

The International Fund for Agricultural Development
(IFAD)

26 September 2013

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CIMMYT

Highlights of Project Implementation

Conservation Agriculture and Smallholder Farmers in Eastern and Southern Africa-Leveraging Institutional Innovations and Policies for Sustainable Intensification and Food Security (CASFESA) project is funded by EC-IFAD and implemented by CIMMYT in Ethiopia and Kenya (Eastern Africa), and Malawi (Southern Africa) in collaboration with national partners (Ethiopian Institute of Agricultural Research, EIAR, Kenyan Agricultural Research Institute, KARI, and Department of Agricultural Research and Technical Services, DARTS in Malawi). The overall goal of the project is increasing food security and incomes of resource poor smallholder farmers in Eastern and Southern Africa through pro-poor technological and institiutional innovations that improve productivity and enhance the resilience and sustainability of farming system.

To systematically assess the role of institutional innovations and technological interventions in enhancing crop productivity and income of resource poor smallholder farmers, we followed a Randomized Control Trial (RCT) where Conservation Agriculture (CA) technologies are demonstrated in randomly selected treatment villages. Farmers in the treatment villages are invited to visit the demonstration plots in their villages and participate in the CA-based technology evaluations compared to their traditional (conventional) practices. With the aim of better adoption of CA-based practices in the treatment villages, in addition to CA-based technology demonstrations, the project facilitates/strengthens institutional and market arrangements that could enhance resource-poor smallholder farmers' access to CA related inputs like herbicides and farm equipments. In the final CA adoption assessment, farmers in the treatment villages are compared with farmers from counterfactual control villages. Control villages are randomly selected along with the treatment villages when the project implementation starts and left aside with no intervention.

This report covers activities conducted during the period of **1st February 2013 to 31st July 2013**. During this period project activities were conducted in the three countries (Ethiopia, Kenya and Malawi), second season in Ethiopia, first season in Kenya and field assessment in Malawi.

Acronyms

ARARI	Amhara Regional Agricultural Research Institute
CA	Conservation Agriculture
CASFESA	Conservation Agriculture and Smallholder Farmers in Eastern and Southern Africa
CIMMYT	International Maize and Wheat Improvement Centre
CT	Conventional tillage
DA	Development Agent
EC	European Commision
IFAD	International Fund for Agricultural Development
ISFM	Integrated Soil Fertility Management
KARI	Kenyan Agricultural Research Institute
PA	Peasant Association
RCT	Randomized Control Trial
TLU	Tropical Livestock Unit

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1. Research Methodology

1.1. Baseline Study and Site Selection

a. Summary of the baseline study. To the extent possible provide data disaggregated by gender

Primary data collection for baseline study in Ethiopia and Kenya were finalized in March 2013 and June 2013, respectively. Data entry and cleaning was done for Ethiopia whereas only data entry is finalized in Kenya during this reporting period. Summary of the baseline data is presented for Ethiopia below on sample distribution by gender, farmland and livestock holding, cropping system, maize residue use, and experience in use of zero tillage on their farm. Details of the Kenya Data will be included in the next bi-annual report.

1.1.1. Baseline survey results (Ethiopia)

Sample distribution:

From the 15 treatment and 15 control sub-PAs in each of the two CASFESA Districts in Ethiopia, we randomly selected 7 treatments and 7 control Sub-PAs to be surveyed. From each of these randomly selected Sub-PAs, we selected a total of 292 and 278 sample households (from South Achefer and Jabitehnan districts, respectively) using a proportionate random sampling technique based on the list of sample households provided by the PA administrators. From the total sample households, 8.2% and 15.1% were female headed households in South Achefer and Jabitehnan districts, respectively (Table 1 and 2).

Table 1. Sample distribution at South Achefer District

	Sex of respondents				Sex of respondents		
Treatment Sub-PA	Female	Male	Total	Control Sub-PA	Female	Male	Total
Afrifidda	1	27	28	Adbi	3	29	32
Atiti Michael	2	31	33	Giltata	0	19	19
Debire Tsion	0	18	18	Ker gurach	0	24	24
Dikuli	2	8	10	Kurbeha 02	0	11	11
Gurach Jarso	4	28	32	Mar Medhanealem	2	9	11
Kurbeha 03	0	10	10	Gureza Dur	2	22	24
Lihudi 01	6	14	20	Yebodan Hanna	2	18	20
Total	**15**	**136**	**151**	**Total**	**9**	**132**	**141**

Table 2. Sample distribution at Jabitehnan District

	Sex of respondents				Sex of respondents		
Treatment Sub-PA	Female	Male	Total	Control Sub-PA	Female	Male	Total
Atahign and Chifrat	3	24	27	Akilat	4	12	16
Abaj	2	12	14	Girgira	2	17	19
Gumbi	0	10	10	Guansa	4	21	25
Inqoqima	2	8	10	Abdogoma	2	12	14
Kiros	2	23	25	Tach Werkima	2	18	20
Quarti and Sekela	8	20	28	Yewubshet	7	24	31
Botmalan	2	22	24	Zamrit	2	13	15
Total	**19**	**119**	**138**		**23**	**117**	**140**

Farmland and Livestock Holding

The average farmland holding in South Achefer and Jabitehnan districts is 1.2 and 1.1 ha, respectively. There is no significance deference between the treatment and control groups in farmland holding in both districts. There is a kind of land renting-in or out and share cropping in or out arrangements among farm households in both districts. This depends on the difference in resource endowments among farm households. Household with scarce land but abundant labour and other farm capital are renting-in or sharing –in farmlands and vice versa.

In terms of livestock holding (measured in Tropical Livestock Unit, TLU), there is no significant difference between the treatment and control groups. On average a household in South Achefer and Jabitehnan owns 5.7 and 3.4 TLU, respectively (Table 3).

Table 3. Farmland holding between the treatment and control groups

	South Achefer						Jabitehnan					
	Treatment *(N=151)*		Control *(N=141)*		Combined *(N=292)*		Treatment *(N=138)*		Control *(N=140)*		Combined *(N=278)*	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Farm size (*ha)*	1.2	0.7	1.2	0.8	1.2	0.8	1.2	0.7	1.1	0.6	1.1	0.7
Shred/rented-in land *(ha)*	0.5	0.6	0.5	0.6	0.5	0.6	0.4	0.6	0.5	0.7	0.5	0.6
Shred/rented-out land *(ha)*	0.1	0.2	0.1	0.3	0.1	0.2	0.2	0.4	0.1	0.4	0.1	0.4
Livestock Owned *(TLU)*	5.8	**3.1**	5.7	2.8	5.7	3.0	3.7	2.5	3.1	2.2	3.4	2.3

Cropping System:

Maize, Finger millet and white *tef* are the major cereal crops grown in south Achefer district in terms of farmland area allocation. The three crops constitute 35%, 19% and 12.3% of farmland area, respectively. Maize, white *tef*, pepper, barley, and faba bean are the five major crops widely grown in Jabitehnan district in terms of area. Pepper is the major cash crop to farmers in the district. Details are in Table 4 below.

Table 4. Cropping system (control and treatment, by district and gender, if possible)

	South Achefer						Jabitehnan					
	Treatment (N=151)		Control (N=141)		Combined (N=292)		Treatment (138)		Control (140)		Combined (N=278)	
Crop Type	Total area	Prop.	Total area	Prop.	Total area	Prop.	Total area	Prop.	Total area	Prop.	Total area	Prop.
Maize	280.1	0.370	237.4	0.343	517.4	0.350	227.0	0.345	186.4	0.312	413.4	0.330
Millet	163.4	0.213	110.3	0.159	273.6	0.190	16.5	0.025	10.8	0.018	27.3	0.022
White Teff	84.8	0.111	94.3	0.136	179.0	0.123	104.3	0.158	115.3	0.193	219.5	0.175
Red Teff	6.0	0.008	7.3	0.010	13.3	0.009	19.1	0.029	8.3	0.014	27.4	0.022
Mixed Teff	5.8	0.008	2.5	0.004	8.3	0.006	15.5	0.024	1.0	0.002	16.5	0.013
Lupin	9.0	0.012	9.9	0.014	18.9	0.013	0.0	0.000	0.5	0.001	0.5	0.000
Faba Bean	28.8	0.038	10.5	0.015	39.3	0.027	31.3	0.047	36.1	0.060	67.4	0.054
Barley	16.8	0.022	54.3	0.078	71.0	0.049	62.0	0.094	29.0	0.049	91.0	0.072
Pepper	5.8	0.008	4.3	0.006	10.1	0.007	40.1	0.061	79.8	0.134	119.9	0.095

Crop residue utilization

Crop residue retention is one of the conservation Agriculture principles where it is required for soil organic matter replenishment, maintaining soil moisture and soil structure, etc. However, farm households face tradeoffs in residue use particularly when they own large ruminants and face feed shortages. As indicated above, maize is important crop in both districts in terms of area coverage and here residue use of maize crop is discussed. There are two parts of maize residue we consider: the top part that farmers cut with the cob while harvesting and the below part that is left on the farm till eaten by animals or collected by farmers for fuel wood or construction purposes.

In South Achefer, our data show that about 36% of maize biomass is left in the field while the other 64% is harvested with cob for shelling and use the residue as livestock feed and other purposes. In Jabitehnan, on average, more proportion of maize biomass is left in the field (42%). In all cases, major proportion of maize biomass left on the farm after harvesting is collected for fuel wood use. However, maize biomass available after shelling is used mainly for livestock feed and fuel (in their order of importance). The proportion of maize residue mixed with soil as organic matter is very minimal (5-6% of the biomass left on farm as stubble). Details are in Tables 5 and 6 below.

Table 5. Maize residue left on farm plots as stubble (biomass proportion and utilization)

Purpose	South Achefer						Jabitehnan					
	Treatment *(N=151)*		Control *(N=141)*		Combined *(N=292)*		Treatment *(N=138)*		Control *(N=140)*		Combined *(N=278)*	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
% total biomass	36.2	14.3	35.2	11.9	35.7	13.2	41.1	11.9	42.8	11.7	42.0	11.8
Burnt in the field before ploughing(%)	3.1	6.8	1.1	3.3	2.1	5.4	1.1	3.4	1.1	3.1	1.1	3.2
Burnt in the field after ploughing(%)	1.8	5.0	3.2	9.8	2.5	7.8	1.5	4.4	2.2	4.7	1.9	4.5
Used as firewood (%)	76.8	26.2	83.2	22.0	79.9	24.4	88.1	11.7	87.1	17.5	87.6	15.0
Left on land and mixed with soil while ploughing (%)	6.0	10.6	4.7	6.8	5.4	8.9	5.1	6.9	5.7	13.8	5.4	11.0
Fed to livestock (%)	9.8	16.9	5.6	13.0	7.7	15.2	3.9	9.6	3.9	9.3	3.9	9.5
Used for construction (%)	0.8	3.4	0.9	3.9	0.8	3.6	0.2	1.9	0.1	0.8	0.1	1.5
Sold (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Used for composite making (%)	1.2	5.5	0.5	2.7	0.8	4.4	0.0	0.0	0.0	0.0	0.0	0.0

Table 6. Percentage biomass of maize residue harvested and used in different competing purposes

Purpose	South Achefer						Jabitehnan					
	Treatment *(N=151)*		Control *(N=141)*		Combined *(N=292)*		Treatment *(N=138)*		Control *(N=140)*		Combined *(N=278)*	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
% total biomass	63.0	14.6	65.2	12.1	64.1	13.5	58.9	11.9	57.3	11.7	58.9	11.9
Burnet in the field before ploughing (%)	1.7	4.1	0.9	2.7	1.3	3.5	0.4	2.3	0.7	3.9	0.5	3.2
Burnet in the field after ploughing (%)	0.7	2.9	0.3	2.0	0.5	2.5	0.1	1.4	0.1	1.2	0.1	1.3
Used as firewood (%)	23.8	18.9	20.6	18.1	22.3	18.6	21.7	22.4	20.0	21.1	20.8	21.7
Left on land and mixed with soil while ploughing (%)	1.3	3.7	1.7	7.8	1.5	6.1	0.7	3.0	1.2	7.1	1.0	5.5
Fed to livestock (%)	67.1	22.2	73.1	20.3	69.9	21.5	73.6	22.5	73.4	24.5	73.5	23.5
Used for construction (%)	1.5	4.0	0.3	1.4	0.8	3.1	0.1	0.9	0.9	7.0	0.5	5.0
Sold (%)	0.2	2.2	0.0	0.4	0.1	1.6	0.0	0.0	0.0	0.0	0.0	0.0
Used for composite making (%)	4.4	7.3	3.0	6.8	3.7	7.1	2.8	5.8	2.4	4.9	2.6	5.3
Other uses	0.1	0.7	0.0	0.0	0.0	0.5	0.6	6.4	0.0	0.0	0.3	4.8

Experience in zero tillage:

Zero/minimum tillage is not a new technology in South Achefer district. About 95% of the sample farmers in South Achefer have heard about zero tillage, 42% used it in 2012/13 production year, and about 87% of the sample farmers were willing to use the specific technology. However, farmers in Jabitehnan are less experienced on the knowledge and practices of zero tillage. Only about 27% of sample households from Jabitehnan have heard about zero/minimum tillage. None of the sample farmers have used zero/minimum tillage practices yet (see Table 7 and Figure 1 for detailed comparisons).

Table 7. Experience in zero tillage (by district and village)

Status	South Achefer						Jabitehnan					
	Treatment Group *(N=151)*			Control Group *(N=141)*			Treatment Group *(N=138)*			Control Group *(N=140)*		
	Yes	No	*% Yes*	Yes	No	*% Yes*	Yes	No	*% Yes*	Yes	No	*% Yes*
Heard about zero tillage?	144	7	95.4	138	3	97.9	48	90	34.8	26	114	18.6
Ever used zero tillage?	67	84	44.4	47	94	33.3	1	137	0.7	0	140	0.0
Used zero tillage in 2012/13?	64	87	42.4	44	97	31.2	1	137	0.7	0	140	0.0
Will use it in future?	131	20	86.8	116	25	82.3	41	97	29.7	24	116	17.1

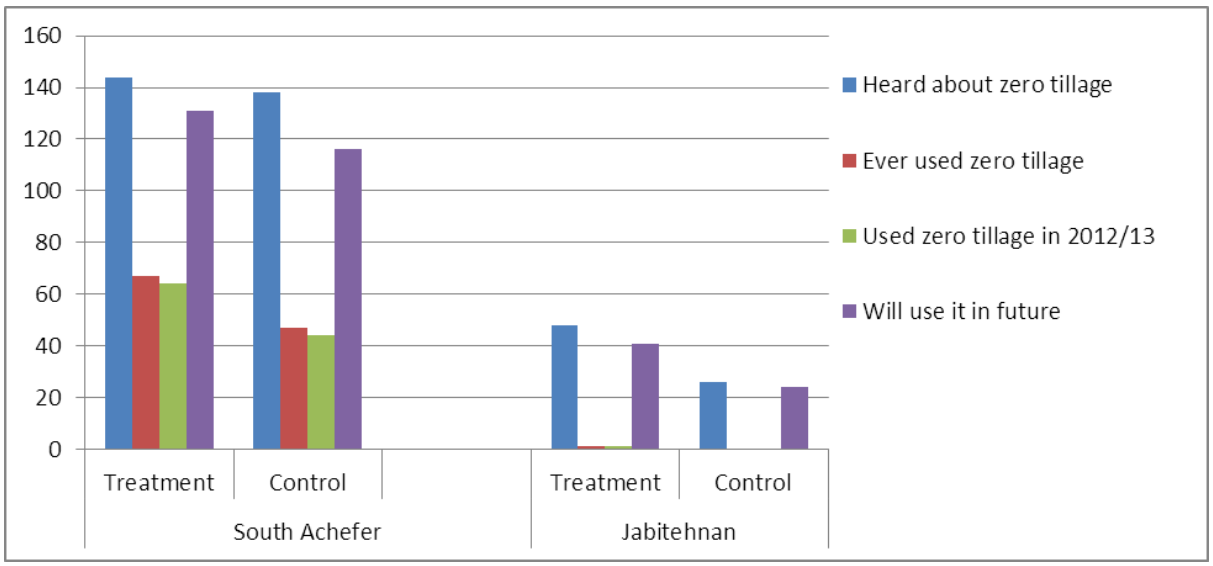

Figure 1. Distribution of sample households in terms of their experience in zero/minimum tillage

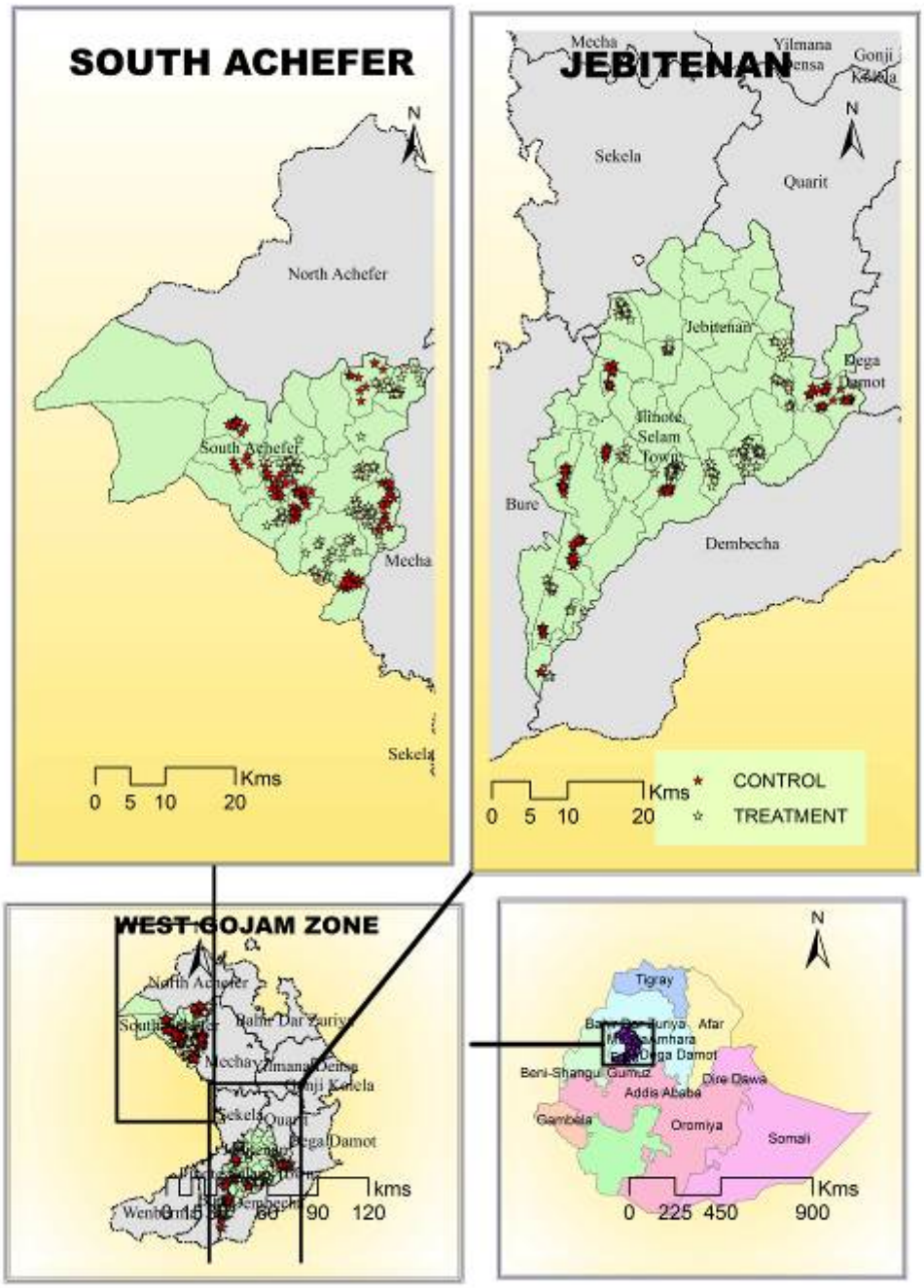

Figure 2. Locations of sample households in treatment and control villages (Ethiopia)

1.1.2. Baseline survey results (Kenya)

As indicated earlier, baseline household survey was conducted in Kenya during May-June 2013.From the total 15 treatment and 15 control villages we have under the project, 8 villages from each group were randomly selected to include in the survey. Then, using a proportionate random sampling method, a total of 158 and 142 sample households were interviewed from the treatment and control villages, respectively. Till the end of July 2013, data entry was finalized and ready for cleaning and analysis. Gender disaggregated distribution of the sample households categorized by treatment and control villages are presented in Table 8 Below.

Table 8. Distribution of sample households surveyed (Kenya)

		Treatment village				Control village		
No.	Village name	Male	Female	Total	Village name	Male	Female	Total
1	Mbogori -A	19	5	24	Mukuria	19	3	22
2	Kigangari	12	3	15	Gaciari	12	3	15
3	Rwarari	17	8	25	Kwamutheri	32	7	39
4	Kirigi	20	6	26	Kangare	12	2	14
5	Mageca	16	2	18	Gitakari B	13	5	18
6	Kamutungi	15	2	17	Kathigiri	4	2	6
7	Iriari	17	8	25	Rung'ang'a	14	7	21
8	Kathageri	7	1	8	Gicegeri	7	0	7
Total		123	35	158		113	29	142

1.2. Description of characteristics of the project sites

1.2.1. Site characteristics (Ethiopia)

Detailed characterization of the research sites in Ethiopia was included in the previous report (June 2012-january 2013).

1.2.2. Site Characteristics (Kenya)

Background on Embu District

Embu District is located at south of Eastern Province with high agricultural potential where over half the population is nevertheless classified as poor, and poverty is reported to be on the increase. Eastern Province itself has considerable variation in terms of environment and socioeconomic conditions. It is the second most populous province after Rift Valley While land registration is not complete in the province as a whole, the district of Embu was one of the first to undergo land titling in the early 1960s, and all land in the district is registered. Official records have, however, not kept up with informal processes of transfer and subdivision of land parcels on the ground.

Geographic features

Embu is one of the thirteen districts in Eastern Province covering an area of 708 km² (with Mt. Kenya Forest Reserve and Mt. Kenya National Park occupying 210.2 km² which is about 30% and uninhabited). It borders Mbeere District to the east and south east, Kirinyaga

District to the West and Meru South District to the North. The District lies approximately between latitudes 0°8' and 0° 35' south and longitudes 37°19' and 37°42' east.

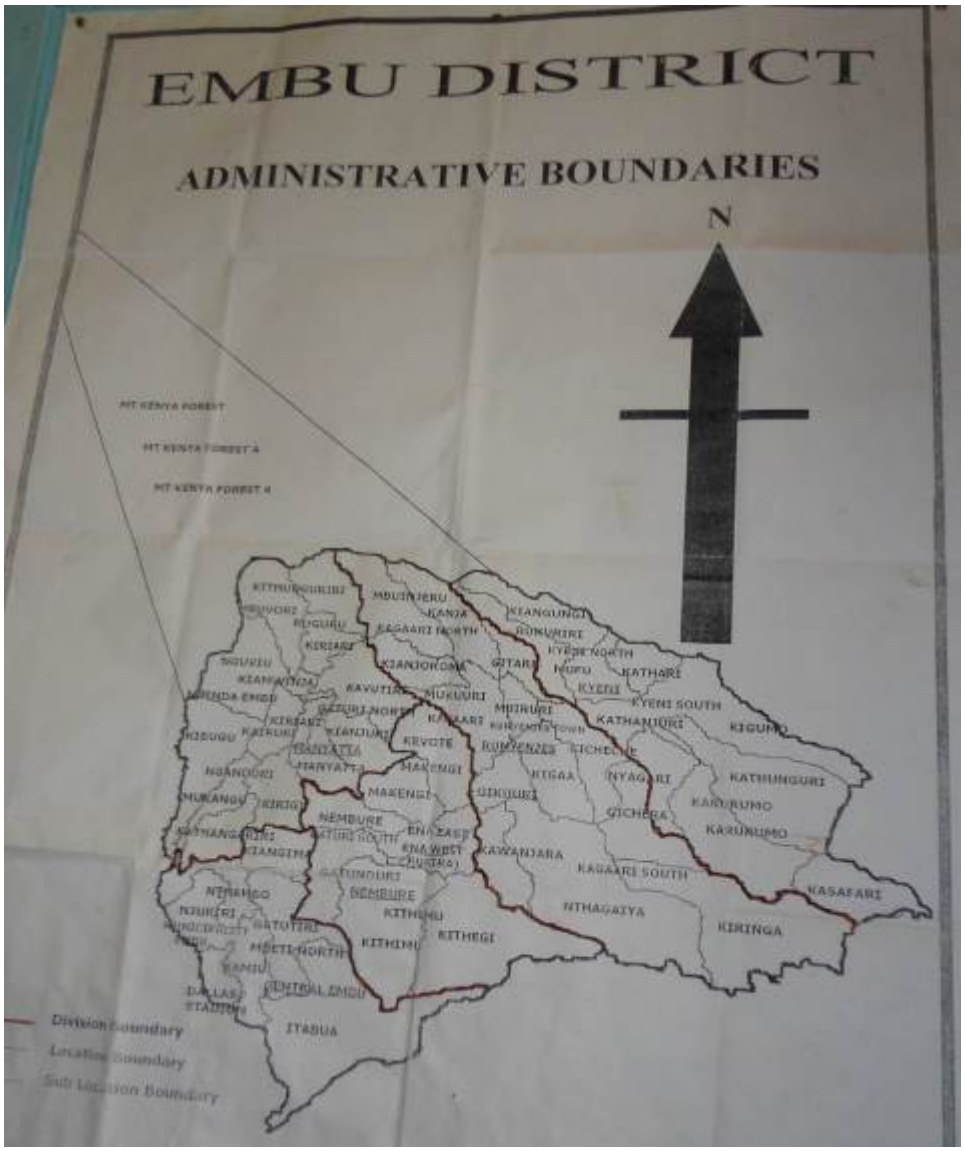

Figure 3. Map of Embu county with is 5 Divisions
Source: Embu District Agricultural Extension Office

Embu district is divided into five administrative divisions, namely; Central, Manyatta, Nembure, Runyenjes, and Kyeni. There are 15 locations and 52 sub-locations. Manyatta Division is the largest occupying 208 km², followed by Runyenjes occupying 186 km², Kyeni occupying 139 km² and Nembure occupying 111 km^2. Central Division is the smallest of all, occupying 64 km^2. The District Headquarters is located in Embu town, which is in Central Division. The project is currently operating in four divisions – Nembure, Central, Runyenjes and Kyeni. The treatment villages are shown in the map below.

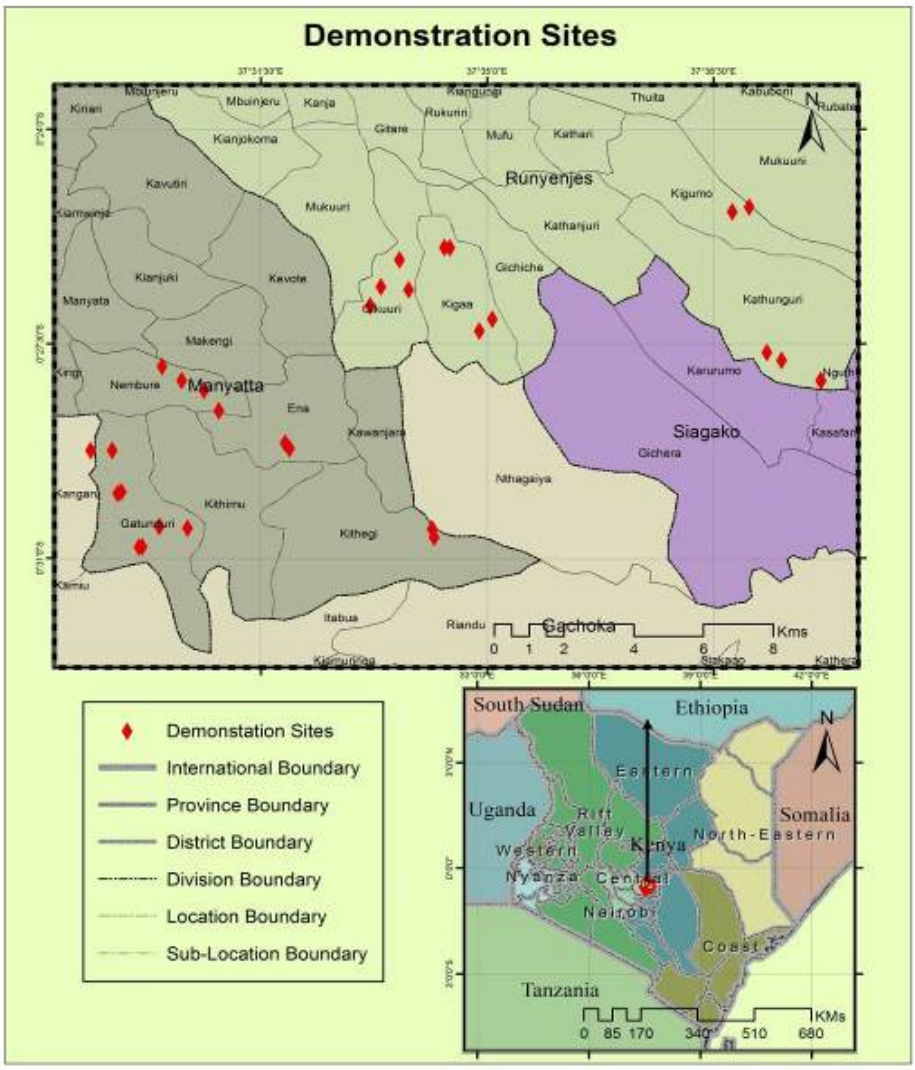

Figure 4. Distribution of the CA demo-plots in the three Divisions in Embu County

Climate and Physical Features

Highlands, midlands and other topographical features like hills and valleys, typical of Kenya's Eastern Highlands, characterize the landscape of the District. Altitude varies between 910 and 4500 metres above sea level. The upper parts of the district (parts of Kyeni, Manyatta and Runyenjes Divisions) fall between 1500 to 4500 metres. The middle parts covering Nembure and Central Divisions fall between 1200 to 1500 metres. The district is drained by four major rivers, namely Thuchi, Kii, Rupingazi (with Kapingazi as a tributary) and Ena, all of which flow in a South East direction. The Kapingazi and Rupingazi are intensely used for domestic water and for irrigation. The highlands are found in areas whose altitude range from about 1500 to 4500 meters. The only hills in the district are Karwe and Maranga.

Rainfall

The annual rainfall ranges from 2200-2500 mm to less than 800 mm in the lower zones down at the eastern end of Kyeni and Runyenje's Divisions. Rainfall and altitudes largely determine land use. The wide range of altitude gives the District distinct agro-ecological zones. The South Eastern part receives 1,250 to 2,500 mm of rainfall while the lowlands on the leeward side to the north and to the East receive unreliable rains of between 400- 1,000 mm. Annual average rainfall is 700 mm. The rainfall in the District is bimodal, with long rains occurring from mid-March to May, and short rains from October to December.

Temperatures and Agro-Ecological Zones

Temperatures in the district range from $12C^0$ in July to a maximum of $27C^0$ in March. The District displays a characteristic sequence of belts of vegetation associated with altitude generally found on tropical high mountains. Extending from the high to low altitudes, the belts are:

1. The Nival zone, topped by the mountain peak above 4500 m above sea level
2. The Afro-alpine zone, between 4000 m and 4500 m above sea level
3. The moorland zone, between 3300 m and 4000 m above sea level
4. The forest zone, between approximately 2000 m and 3300 m above sea level and containing areas of indigenous forest and areas of forest plantations merging into bamboo zones with increasing altitude; and
5. The agricultural zone below the forest zone (below 2000 m above sea level) but in some places extending up to 2800 m above sea level)

Socio-economic Features in Embu

Social-economic vulnerability in the district increases from the upper tea zone (with an average monthly income of ksh 6000) to the lower cotton and tobacco zones (with an average monthly income of ksh 1000). These incomes influence a household's ability to provide food, education and health care. Overall, the district population is vulnerable since it is subject to decreasing farm size and declining land productivity.

The collapse of the coffee sector stemming not only from the depressed world coffee prices, but also from local and national problems in the industry, has made small-scale coffee production uneconomical and has significantly contributed to accelerating poverty in the district. Embu district economic mainstay is coffee and tea production. The production levels of the two crops have been declining over the last few years thus perpetuating poverty situation in the district. This has had trigger effects to the other sectors of the economy, affecting the social-economic wellbeing of the people.

Agriculture and Livestock in Embu District

Agriculture in the form of small-scale food and cash-crop production is the major economic activity in the district, accounting for 70% of income. According to the District Development Plan, there are some 60,000 small holders in the district, who account for 90% of total agricultural output. Women provide 80% of family labour and produce 60% of farm-derived incomes in the district, but most do not own land in their own name. About 15% of

smallholder farms in the district are female-headed and these households are generally regarded as among the poorest.

Livestock production mainly consists of both local and exotic cattle, sheep, goats local and exotic poultry, pigs, and rabbits. There is emerging livestock in the district that mainly include Bee keeping, Silkworm farming and Quails. The main products of livestock in the district include: milk, beef, eggs, poultry meat and pork. The livestock population has been on the increase over time. The increase in dairy cattle and goats could be attributed to the Integrated Small Livestock and National Dairy Development Programmes in the district. Most areas of the District produce enough food to feed its population apart from the dry area which covers less than 5% of the district, in the lower areas of Runyenjes, Kyeni, Nembure and Central Divisions.

1.2.3. Site characteristics (Malawi)

Since there are on-going CA on-farm trials in Malawi under CIMMYT and collaborating local institutes, demonstration plots are not implemented. As indicated in Annex, CASFESA research team visited three districts where the CIMMYT on-farm trials are taking place.

Farming system

The three districts visited by the team have a mixed crop-livestock farming system with limited cattle holdings. Maize, pigeon pea and groundnut are the major crops i Balaka district, In Nkotakota, maize, groundnuts, cassava and rice are the main crops grown. In addition to crop production, fishing is the dominant livelihood strategies. In Salima, Cotton, groundnut, maize, sorghum and soybean are widely grown.

Crop production and Productivity

As indicated earlier, the level of CA adoption is relatively higher in Malawi. In the three districts, about half of maize area is under conservation tillage. There are also households growing cotton under CA (Figure 3).

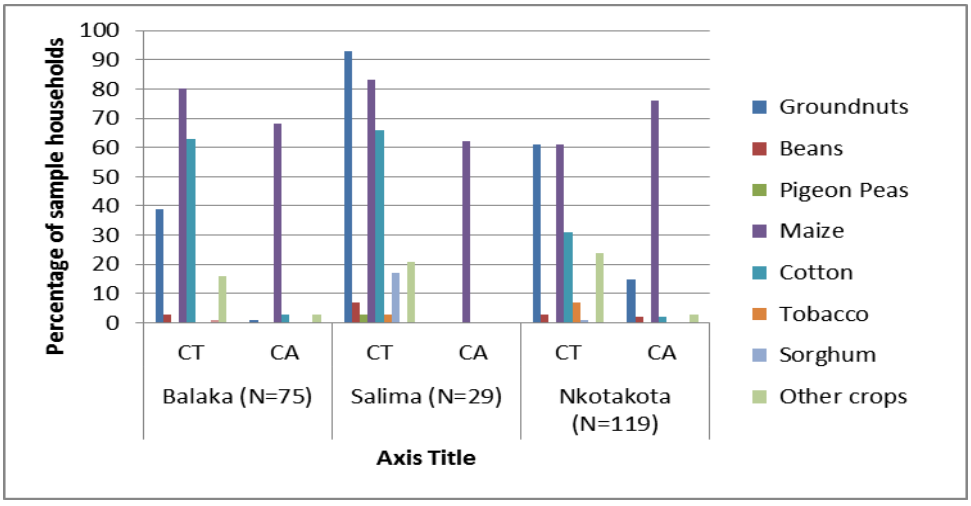

Figure 3. Percentage of households growing different crops under CT and CA

Note: CT=Conventional tillage; CA=conservation agriculture
Source: Survey 2011 (under another project)

Figure 4 shows average crop land allocated to different crops per household. In Balaka, maize and cotton are the dominant crops on conventional and conservation tillage plots, respectively. Though cotton is the dominant crop in terms of area in Salama, maize is the only crop grown under conservation tillage. In terms of crop diversity under conservation agriculture, Nkotakota stands first. Ground nuts, beans, maize and cotton are grown under conservation tillage practices.

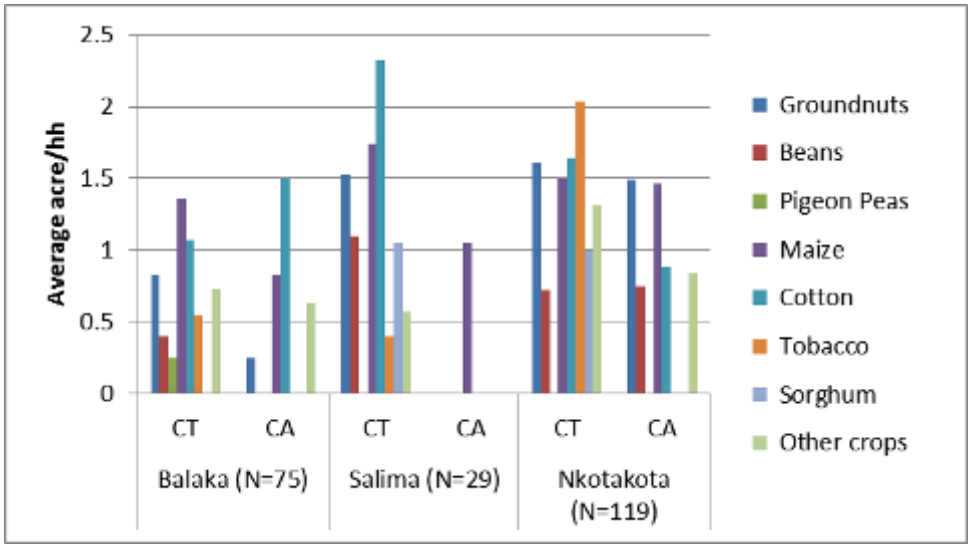

Figure 4. Average crop land per household under conventional and conservation tillage

Source: Survey 2011 (under another project)

Figure 5 shows crop productivity in the three districts. Nkotakota stands first in terms of groundnut, maize and cassava productivity. Average cotton productivity is higher at Balaka. However, Balaka is the least in terms of average maize productivity per household.

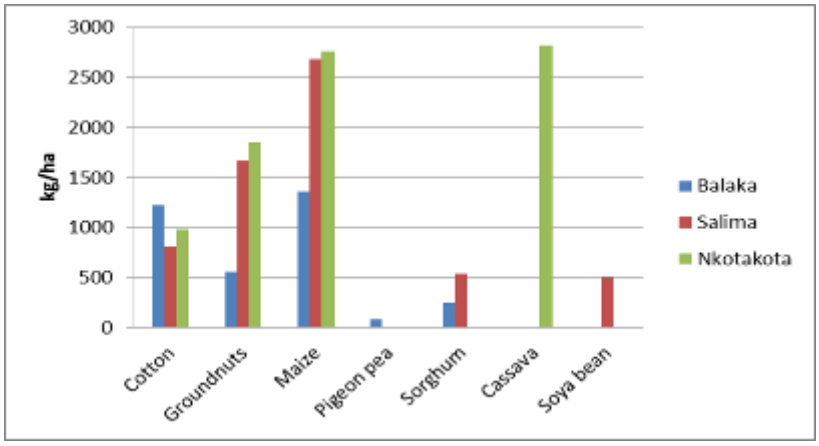

Figure 5. Crop productivity in selected districts in Malawi

Source: Survey 2011 (under another project)

Livestock holding

Generally, livestock holding in Malawi is very low. Relatively, the number of goats, chicken and pigs are better than the limited cattle holding. This makes crop residue retention on farm plots easier in Malawi. Based on survey results under another project, the following table shows average livestock holding in Balaka, Salima and Nkotakota.

Table 9. Average livestock holding in selected districts (Malawi)

Type of animal	Balaka (N=75)		Salima (N=29)		Nkotakota (N=119)	
	Proportion of HHs own (%)	Average number owned	Proportion of HHs own (%)	Average number owned	Proportion of HHs own (%)	Average number owned
Cow	3	6.0	0		7	4.5
Oxen	0		0		1	2
Bulls	0		0		0	
Young cattle	0		0		3	3.0
Goat	45	4.0	59	4.4	62	5.1
Sheep	0		0		5	4.5
Donkeys	0		3	4	0	
Yard chickens	85	6.9	79	9.5	87	9.8
Layers and broilers	4	16.3	3	10	0	
Pigs	17	2.9	21	3.7	29	6.7

Source: Survey 2011/12 (under another project).

b. Innovative approaches, use of ICT or market-led technology development?

There is an attempt to link farmers in the treatment villages with primary cooperatives in their locality to make them have access to herbicides. But this activity will be enhanced starting form the second and third seasons to make sure that farmers who were convinced in the CA technology during the first season get access to the necessary technologies.

2. Innovations and Technologies

2.1 Participatory development and evaluation of best-bet technology options

During the farmers' field days both in Kenya and Ethiopia, field day participants were asked to evaluate the performance of crop stands on zero-tillage and conventional tillage. In addition, they were asked to evaluate the benefits of intercropping over sole maize both under zero tillage and conventional one. In addition, during the review and planning meeting at the two districts in Ethiopia (see annex), farmers and extension agents in the treatment villages witnessed the crop stand and level of soil moisture differences they observed on CA plots with crop residue and conventional plots.

Development of Improved Crop Varieties/up scaling of tested technologies.

CASFESA is not dealing with varieties but on conservation agricultural practices, zero tillage and intercropping of maize with legumes. Demonstration plots from the first season production in Ethiopia and Kenya were visited by neighbouring farmers in the treatment villages for a potential uptake of CA technologies by visiting farmers. The overall level of technology uptake/ up scaling is something that needs to be planned at the final stage of the project life to capture the level of adoption.

a. Varietal evaluations at farm level to increase farm productivity.

CASFESA project is not dealing with varieties. However, in Ethiopia, the beans variety (Awash-1) used for intercropping with maize were not successful during the first cropping season. During the second cropping season, cowpea was used instead of haricot bean. The emergence was good but to be evaluated at harvest.

b. Increased Productivity of Farming Systems

The project is at its initial stage and this is not yet ready. As the effect of CA on soil fertility takes some years, from the first cropping season, not much difference in crop productivity is expected. This is reflected in the beans harvest data in Kenya. During the first production season in the on-farm demonstrations of farmers' plot, there is no statistically significantly different beans productivity on conventional and zero tillage plots (Table 10). This is expected mainly due to the fact that the intended soil fertility gain through conservation agriculture could not be attained only in the first year.

Table 10. Productivity of beans intercropped with maize under different tillage (kg/100m^2).

Tillage type	Observations	Mean	Std. Dev.	Minimum	Maximum
Zero tillage	26	2.2	1.0	0.34	4.04
Conventional tillage	26	2.1	1.0	0.45	3.58

c. Develop processing technologies for crops at household level

This is out of the project mandate.

2.2 Trade-off Analysis and Research Feedback

a. System resilience and livelihood status.

The project deals with system resilience through reducing yield variability through moisture stress and lack of soil fertility through best-bet CA practices (zero tillage, intercropping, and crop residue retention). Zero tillage is advantageous to women headed households where they are not culturally allowed to do ploughing activities. Thus, direct seeding with herbicide use for weed control could help them to avoid renting out land to other male that could plough and plant maize. Increase in production could help improving the livelihood of the poor and women-headed households that would have rented out land and earned less crop income from share cropping or generated income form rented out land.

b. Farmer decision making processes.

The challenge that farmers face in adopting CA is keeping crop residue in the field as soil mulch while they need the same for livestock feed. Understanding the benefit of residue retention on crop productivity comes through observations and this is going on using the demonstration plots and influencing farmers' decision making process to adopt these technologies on their farm once they are convinced on the actual benefit.

c. Contribution of germplasm to systems' resilience and performance.

Germplasm identification is beyond the project's mandate.

d. Contribution of ISFM options and crop technologies on food security, income, soil fertility status, and systems resilience and soil health across the impact zones.

Zero tillage and intercropping were the two Conservation agricultural practices CASFESA demonstration works started in Ethiopia in the second season, however, crop residue retention for mulching will be included. It is too early to report on the soil fertility gain from the demonstration plots.

2.3 Scaling up and delivery of crop and ISFM technologies and practices to farmers

a. Farmers' organizations and entrepreneurs support for scaling up and replication of the established ISFM options beyond the Action Sites (*farmers involved, hectares etc and crop yields*).

The project is still in its initial stage and much is not expected on scaling up and replication of the established CA practices that could help in reducing soil fertility management. In the second cropping season in Kenya, there is a plan to provide technical support and input supply arrangements to randomly selected farmers in the treatment villages to encourage them trying CA practices on their farm. The achievement in this regard will be included in the next term report.

b. Development of extension material

Not done yet.

c. Seed production initiatives

Not in the project plan.

2.4 Support for Smallholder Processing and Marketing Opportunities

a. Support for local processing and utilization of target crops under the project

Not applicable.

b. Post-harvest handling, storage and packaging*(highlights only)*

Not applicable.

c. Identification of market opportunities for farm produce/processed products.

Not applicable.

2.5 Capacity Building for all project stakeholders

a. Training needs assessment for scientific and development partners, development of training programmes.

Farmers and extension agents in Jabitehnan district (Ethiopia) have never come across the concept and practice of Conservation Agriculture. Farmers in South Achefer (Ethiopia) do know about zero tillage in Conservation Agriculture but not much on the role of crop residue retention and intercropping of legumes in retaining moisture and increasing soil fertility, respectively. Thus, a half day training on CA, CA principles and benefits were organized at

Jabitehnan and South Achefer districts where demonstration plots hosting farmers, extension agents in the treatment villages, experts from district Office agro-dealers and delegates from cooperative unions were given. This was strengthened again during this reporting period while having the annual review and planning meeting held at both locations (see annex).

2.6 Gender mainstreaming

At the CASFESA project sites in Ethiopia, women are not doing ploughing activities due to cultural pressure where ploughing is seen as men's job. The introduction of zero tillage, direct seeding of maize by controlling weed through herbicide use is a great advantage for those women farmers who have the resources to buy herbicides and other inputs (seed and fertilizer) in maize production. This helps to increase grain production at a household level for women headed households.

In Kenya, there were efforts to encourage female farmers to take part in the field visits and attend farmers' field days. This was successful and large number of female farmers visited the demonstration plots and evaluated the crop stands on the demo-plots (see Table 10 and/or Figure 3).

3. Nutrition at household level

Not applicable.

4. Generation of International Public Goods

Not yet done, but there is one draft paper developed during this reporting period on targeting CA in Ethiopia, Kenya and Malawi (see annex).

5. Partnerships.

In CASFESA project, partnership has been developed between CIMMYT and the Amhara Regional Agricultural Research Institute (ARARI), in Ethiopia. The two districts where CASFESA project operates in Ethiopia are under the mandates of ARARI. Thus, ARARI shared the responsibilities of establishing and managing the demonstration plots in 30 treatment villages in the two districts. ARARI also organizes farmers' field days where the neighbouring farmers in the treatment villages visit the demonstration plots for a faster adoption of CA practices. In addition to ARARI, district Offices of Agriculture at Jabitehnan and South Achefer are also partners in project implementation with the close interaction with ARARI and CIMMYT researchers. Experts from the district Office of Agriculture and extension agents at the treatment villages are helpful in monitoring the demonstration plots and assisting farmers' field day preparations. Agricultural input marketing cooperatives and private agro-dealers were also invited to the project briefing and planning workshops made at the two districts. These input suppliers could potentially help in the wider adoption of CA-

based practices through making the necessary inputs available and accessible to interested farmers.
Similarly, CASFESA project is partnering with KARI-Embu in Kenya for the same purpose.

6. Integration of project in Maize CRP 3.2

CASFESA project is under maize CRP 3.2 and contributing to strategic Initiative (SI-2) - *Sustainable intensification and income opportunities for the poor*. The core objective of CASFESA project is assessing the role of institutional and market innovations on the uptake of conservation agriculture practices by smallholder farmers. Through enhancing crop productivity and reducing downside risks in crop production, adoption of CA-based practices could secure sustainable intensification in smallholder agriculture and improve the income level of resource poor farmers. These all are in line with the methods and outstanding innovations stated under SI-2 in Maize CRP 3.2.

7. Annexes

This section gives additional information on topics not discussed above but activities accomplished during this reporting period February –July 2013.

7.1. Stakeholders' planning meeting in Kenya

On 22nd February 2013, a stakeholders' project planning meeting was held at Embu. The meeting was attended by 30 farmers hosting demo plots, 16 officers (mostly frontline extension agents) from the Ministry of Agriculture, Experts from the District Extension and Agriculture Office, CIMMYT scientists and Kenyan Agricultural Research Institute (KARI). Other participants were the Kenyan Equity Bank, Kilimo Salama and Organic Africa representatives, providing farming credits insurance and inputs, respectively. The workshop included updates on project objectives and work plans and planning for the next year. The workshop ended with some notable positives, such as an agreement among stakeholders regarding planting procedures and periods, as well as notable enthusiasm among farmers.

Figure 6. Stakeholders' planning meeting at Embu (Kenya)

7.2. Farmers' Field days

Ethiopia:

Since the reporting period is off-season in Ethiopia, there was no field day organized.

Kenya:

Farmers' field days were organized in all the 15 treatment villages where the CA demonstration plots have been established. Different stakeholders wre invited to participate in the field days and evaluate crop stands on zero tillage and conventional tillage, benefits of intercropping over sole maize cropping, etc. Particpants include: Division heads of Agricultural Extension, Sub-division extension leaders, local extension agents, neighboring farmers in the same treatment village, hosting farmers, Farmers' Insurance Company (Kilimo Salama), private agro-cheminal and seed dealers, etc.

Figure 7. Farmers' field day at Embu (Kenya)

Table 10. Number of farmers participated on the farmers' field days in Kenya by village

No	Village Name	Male	Female	Total
1	Kamutungi	25	31	56
2	Kirigi	39	28	67
3	Gacuthri	17	23	40
4	Kavata	34	18	52
5	Kathutri	33	20	53
6	Mbogori A	35	39	74
7	Karingari	19	20	39
8	Rwarari	37	39	76
9	Kathageri A	11	20	31
10	Gicegeri	12	25	37
11	Kigangari	37	34	71
12	Gwakairu	27	15	42
13	Iriari	6	46	52
14	Mageca	15	31	46
15	Kiethiga	48	23	71
	Total	**395**	**412**	**807**

In 9 of the 15 treatmemnt villages, the number of female participants in farmers' field-day is larger than the number of male farmers. On average 50 farmers from each village have visited the demonstration plots, evaluated the CA technologies in comparison with the conventional one. List of farmers' field day participants are well documented for further follow up in monitoring the adoption process of CA technologies.

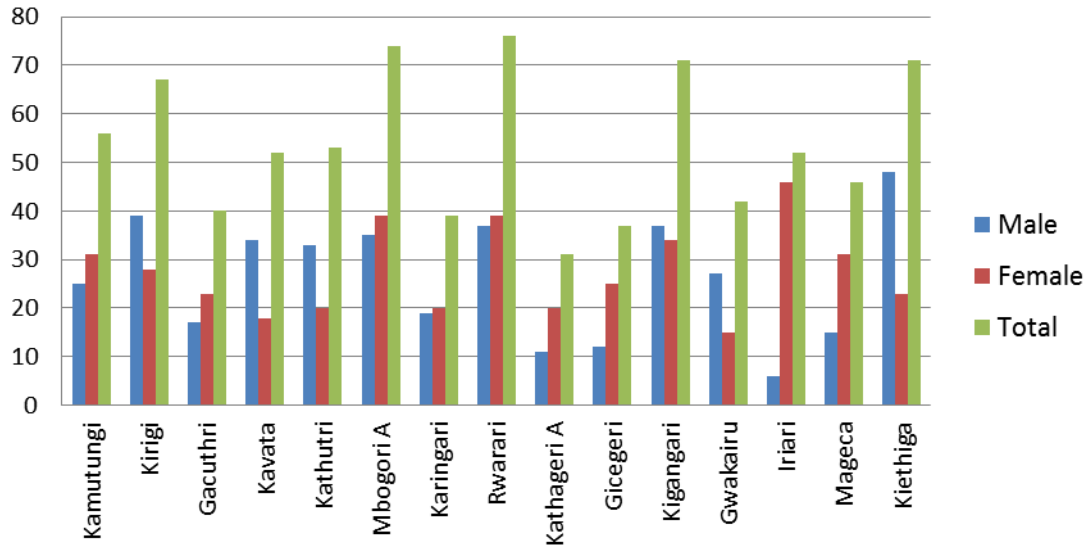

Figure 3. Farmers' field-day participants in the 15 treatment villages

7.3. Field monitoring

In both countries, staffs from CIMMYT and national Partiners (KARI in Kenya and EIAR in Ethiopia) regularly travel to the demosntration plots and get the hosting farmers and development agents to monitor their field activities.

Field Monitoring_Kenya:

Figure 8. Field monitoring at Embu (Kenya)

Field monitoring_Ethiopia:

During the off period, demonstration plots were moniotored to make sure that adequate amount of residue is left on the farm through fencing the CA demo plots. Since these demo plots are at the middle of farms where livetock is free to greath during the dry season, maintaining crop residue on dempnstration plots without fensing is impossible.

During the reporting period (specially in June and July), there was a field a field monitoring

Figure 9. Field monitoring visit at different stages of planting and intercropping (Ethiopia)

It is believed that periodic monitoring of the filed activities is very important to track progresses and take corrective action if there are any deviation from the a prior planned activities (like, inputs use and application and other agronomic practices). In this regard, researchers from ARARI, CIMMYT and experts from the south Achefer and Jabitehnan districts have been actively involved in monitoring the activities of the plot level technology demonstration and dissemination periodically. In this reporting period, active and close follow up were made during critical times (like during planting, intercropping maize with cow pea, top dressing and weeding activities). Some Pictures depicting field visits are shown below:

7.4 Project review and planning workshop_Ethiopia (May 2013)

On 9th and 10th May 2013 project review and planning workshops were conducted at South Achefer (Durbete) and Jabitehnan (Finoteselam) districts. Participants include, CA-Demonstration plots hosting farmers, extension agents supporting the CA-Demonstration plots, agricultural experts from the respective District Office of Afgriculture, Agrochemical dealres, representative form Cooperative office, researchers from ARARI and CIMMYT.

The main objective of the meeting was to review the last season performance (lessons learned, challenge encountered) and plan for the upcoming season. The meeting gave an opportunity for hosting farmers, woreda agricultural experts including head of the office, developments agents who are closing working with hosting farmers and woreda administrators about the performance of the preceding project activities. It was conducted in such a way that participants (specifically the CA-demonstration hosting farmers and

respective DAs) share their experiences and challenges they faced during the implantation of the project activities of the last season.

On the meeting refreshment training in the form of presentation was made for the participants as some of the DAs were new to the project activities being implemented in some selected kebeles of the districts. Accordingly, presentation was made by ARARI researcher and discussion was held among the participants with the facilitation of respective woreda head of agriculture and administrator.

Table 11. Summary of review and planning workshop participants

		South Achefer			Jabitehnan		
No.	Participants	Male	Female	Total	Male	Female	Total
1	Farmers	26	0	26	25	2	27
2	Extension agents	10	4	14	11	1	12
3	Agricultural experts (District)	4	0	4	7	0	7
4	Administration (District)	2	0	2	2	0	2
5	ARARI	4	0	4	4	0	4
6	CIMMYT	1	0	1	1	0	1
7	Agrochemical dealer				1	0	1
	Total	**46**	**4**	**50**	**51**	**3**	**54**

Figure 10. Second round review and planning stakeholders' workshop (May 2013, Ethiopia)

7.5 Field Visist_Malawi

CASFESA research team from CIMMYT-Ethiopia (Moti Jaleta, Kindie Tesfaye) CIMMYT-Kenya (Pradyot Jena) and CIMMYT-Zimbabwe (Munyaradzi Mutenje and Angelina Mujeyi) visited CA on-

farm experimental plots in three districts of Malawi (Nkhotakota, Salima and Balaka distrcits). CA adoption in Malawi is ahead of the case in Kenya and Ethiopia. Discussions made with farmers and extension agents in these three districts show that farmers have benefited from CA practices that saved labour cost and increased their maize productivity.

Figure 11. Malawi field visit and discussions with farmers on CA (*Salima, Balaka and Nkhotakota*)

7.6 Lessons Learned

Kenya

Effect of CA on crop productivity is a long term gain which can't be realized in one seaosn. This was confirmed by the average beans productivity from conventional and zero-tillage plots at Embu.

Angles of drainage in making furrow and ridges on CA plots matter in retaining limited water in or draining excess water from the farm plots. Depending on the amount of rainfall in the area, farm slope and soil type, different techniques must be used either to retain or discharge excess water. Furrow and ridge with tie-ridges is identified to control the problems of runoff and floods.

7.7 Challenges Encountered_ Ethiopia

In this reporting period, outbreaks of army worm was observed on some plots in Jabitehnan district. After the outbreaks, the farmers and Development agents promptly reported to district office for the immediate action. District level experts immediately went on to the problem areas and spread chemicals that can destroy the worm. Consequently, maize plants are survived without much devastation.

7.8 Draft paper developed

During this reporting period, a draft paper have been developed using secondary data and ground truth field visits on targeting CA in the three countries based on bio-physical suitability and potential adoptions given human and livestock population densities. The paper is under internal review and to be submitted for journal publication.

- Kindie Tesfaye, Moti Jaleta, Pradyot Jena, Munyaradzi Mutenje. Identifying Recommendation Domains for Conservation Agriculture in Eastern and Southern Africa. (Draft Document)

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