



Scaling for impact – Pathways to Scale in Agri-food systems: Technical report

CIMMYT in collaboration with Sidama Agricultural Research Institute, Hawassa, Ethiopia

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1. INTRODUCTION

The joint venture of CIMMYT and Sidama Agricultural research Institute during the 2024 cropping season was funded by Ukama Ustawi. These demonstration and evaluation endeavors of maize and legume varieties were with remarkable achievements in the southern central rift valley of Ethiopia. To continue the assessment, we designed large scale evaluation in a participatory arrangement to draw attention of local non-governmental organizations and government stakeholders working from grass root to ministerial levels. Once, the large scale evaluation was put in place in the fields of adjacent farmers, we thought that it would be easy to create impact and to get visibility of the technologies at the level of decision makers. However, farmers still have the right to choose any combination of maize and legume varieties among the top three lists from the results of their previous year based on their production objectives. This way, we are planning to fasten the evaluation phase and will be able to raise awareness of key stakeholders on the sustainable intensification of maize-legume production systems using conservation agriculture practices.

As an entry, we trained farmers and development agents on the plans and targets for the years 2025. The presentations included pulse crop production, maize production, conservation agriculture and modalities of the practices. Plenary session helped to clear any doubts among the farmers and experts. Consensus has been reached for timely engagement in the program among the farmers, development agents, the woreda office of agriculture, the agricultural research system and CIMMYT. This document elaborates the entire qualitative and quantitative issues rose in the training. Moreover, this report uncovers the details of activities carried during geo-referencing, input dispatch, planting and monitoring of the trials. All the three trials

1. Maize-pigeon pea intercropping under conservation agriculture
2. Maize-soybean intercropping under conservation agriculture and
3. Maize-common bean intercropping under conservation agriculture were being implemented in six villages (kebeles) of the two woredas (Bilate and Hawassa). The experiments were successfully implemented. If the rain conditions become reliable, farmers are hoping for better harvest in both areas. In fact, the weather was variable and out of farmers' control, which they can't help; But, intercropping, mulching and no-till practices would help to adapt the stress period somehow. The activities remaining would be
 - a. Data collection on both cereal and legume components
 - b. Identification of stakeholders for expansion of conservation agriculture
 - c. Field monitoring and follow up to help farmers escape any risk
 - d. Show-casing on lessons learnt through conservation agriculture

Farmers were found of using materials like grasses, maize stalk, finger millet stover, common bean straw, banana and enset leaves as mulch, which provided alternatives for promotion of conservation agriculture in places where other crop residues are in short fall. More importantly, there is a need to organize a platform of stakeholders to discuss on key issues required to expand conservation agriculture in the areas where success stories were recorded.

2. LAYING THE GROUND FOR TRIAL IMPLEMENTATION THROUGH TRAINING

It was to be recalled that the Sidama regional agricultural research Institute has undertaken rigorous research on Sustainable maize–legume intensification using conservation agriculture practices in Sidama region on those research agendas approved by the UU-CIMMYT program. The follow up research activities were

1. Evaluation of maize-pigeon pea intercropping under conservation agriculture at wider plots
2. Evaluation of maize-soybean intercropping under conservation agriculture at wider plots

However, awareness was not created for host farmers and experts to establish roles and responsibilities, and achieve desired level of commitment by all stakeholders for each of these research activities until the present training, and thereby to ensure careful planning and ease implementation schedules (Fig 2.1 – 2.7).

Expected output:

- Awareness created on sustainable maize based legume intensification;
- Roles and responsibilities shared, and
- Consensus established on implementation modality of each research activity

Objective: to create awareness on newly designed UU-CIMMYT research proposals

2.1 Participants of the training by gender

A total of 60 farmers (45 male and 15 women), 12 development agents (7 male and 5 women), 6 experts (4 male and 2 women), 7 researchers (6 male and 1 women) have participated on the awareness creation and consensus building workshop between 15-16 April 2025 in Bilate and Hawassa youth center and administration hall, respectively.

Table 1. Gender of participants of the training in Bilate and Hawassa zuria woredas

Woredas	Kebeles	Farmers		Development agents		Experts		Focal persons		Researchers	
		M*	F**	M	F	M	F	M	F	M	F
Hawassa	Udowotate Galobadiye Samaejersa	20	10	3	3	2	1	1	0	6	1

Bilate	Shamanagodo	25	5	4	2	2	1	1	0	6	1
	Yirbagangeso										
	Gonowa bulano										

* = male participants, ** = Female participants

2.2 Training topics and training summary

1.1 Pulse crop production, integration in cropping system and utilization

This training was offered on pigeonpea, soybean and common bean production by researcher Tasew Derese. He covered topics on agronomy, variety compatibility and cropping system inclusive of utilization and marketing opportunities.

1.2 Maize production national, regional and local trends

This presentation made by Mr. Shegaw Derebew focusing on varieties of maize, suitable agro-ecologies and key issues required in conservation agriculture. He also introduced key management issues required to enhance maize production in the area.

1.3 Conservation agriculture based sustainable intensification of maize – legume production

This presentation was delivered by Dr. Daniel Markos, and covered topics on why conservation agriculture out-yielded conventional one, the need for conservation agriculture, residue management, pre-emergence herbicide application and weed management, land preparation and compatibility or integration of the maize-legume systems.

1.4 Feeds and feed management in the conservation agriculture systems

This topic was covered by Dr Daniel Markos and covered feeding systems for pigeonpea, soybean and common bean left-overs after crop harvest. The system of mixing up maize stover with legume straw was a key agenda.

1.5 Implementation modality for 2025 for the stakeholders

This topic was presented by Mr. Muluken Melese. He highlighted independent roles and responsibilities of CIMMYT, Regional agricultural research Institute, woreda office of agriculture, development agents and farmers. This helped to know the roles and responsibilities, and contribute accordingly for the success of the project.

2.3 Choice of technologies for large scale evaluation by farmers

After series of presentations and discussions of the event, farmers were informed to choose a maize and legume varieties for large scale demonstration and evaluation. All the top three performer lists of maize and legume varieties were given to them. Accordingly all the sixty farmers have chosen their own

choice of maize-legume combinations based on the presentation of last year achievements and their preferences.

Table 2. choice of maize varieties by farmers of Bilate and Hawassa zuria woredas

Maize variety	Woreda		Total	Remark
	Bilate	Hawassa		
Damot	13	5	18	All the sixty farmers have chosen their own choice of maize variety among the top three yielders of 2024 trials
Shone	5	1	6	
Limu	12	24	36	
Total	30	30	60	

Similarly, all the sixty farmers chosen their own legume crop based on their observation during the field day and their own production goals.

Table 3. Choice of legume crops by farmers of Bilate and Hawassa zuria woredas

Legume	Woreda		Total	Remark
	Bilate	Hawassa		
Soybean	8	1	9	All the sixty farmers have chosen their own choice of legume crop among the top three yielders of 2024 trials
Pigeonpea	14	16	30	
Common bean	8	13	21	
Total	30	30	60	

2.4 Plenary session

Farmer Endrias debela (Hawassa woreda): We are adopting reduced tillage already mainly because of erosion reduction during extreme rainfall events. However, adopting residue cover seems challenging. What shall we do for it?

Response: Residue has multiple and contrasting benefits leading to intense competition between the livestock, domestic fuel wood, construction and mulching. One way to enhance residue cover is to increase biomass production while the other was to increase improved feed for livestock as hedge rows and separate plots.

Farmer Yisak Hayeso (Hawassa woreda): We know the short and long term benefits of conservation agriculture. Thank you. We also practiced it last year. The plans sounds good as you are aiming for larger scale evaluation. However, beyond April 23rd, 2025, it will be too late for us for planting.

Response: we will kick of herbicide spray right after the training and hopefully commence planting on time. Thank you for the reminder.

Framer Bonti Hamaro (Hawassa woreda): Last year I had soybean and pigeon pea trial with conservation agriculture. The weeds that emerged this year were broadleaved and the soil seems spongy. I even feel to reduce fertilizer use sooner due to conservation agriculture practices.

Response: Yes, gradually you are realizing the benefits of conservation agriculture. We are glad to hear it. But, the exact fertilizer rate can be determined through independent fertilizer studies.

Farmer Alazar shura (Bilate woreda): Please provide pre-emergence herbicide, seeds and fertilizer on time as planting window is running out.

Response: Thanks for the request. We will try as much as I can.

Endrias Debela (Hawassa zuria) and Sinacho siramba (Bilate woreda): How can the untilled lands gave a superb yield you showed us in your presentation?

Response: In fact, there is tillage, weed management and fertilizer management practices in conservation agriculture. In conservation agriculture, weeds are managed through pre-emergence herbicide, intercrops and residue mulch application. These practices require commitment and hard work than the actual manual weeding. For tillage, the pre-emergence herbicide kills the weeds; the dead weeds will cover the soil. This coupled with mulching and minimal soil disturbance would suffice for planting purpose. In fact, it reduces costs for tillage. Moreover, you shall see in your own farm if you allocate separate plots for conservation and conventional plots, and if you plant and manage simultaneously using their own principles.

2.5 Photos of key events



Figure 2.1 Woreda head of agriculture and natural resources management, Mr. Addisu, making a key note message for the participants in Hawassa zuria woreda



Figure 2.2. Dr. Daniel Markos, presenting previous year results of sustainable intensification in Hawassa zuria woreda



Figure 2.3. Shegaw, maize breeder presenting results of variety trial and Mr. Muluken presenting the working modality in Hawassa zuria woreda



Figure 2.4. Plenary session was led by Dr. Atnafua and Mr. Edaso, both representing SIRARI and Woreda office of Agriculture in Hawassa zuria district, respectively



Figure 2.5. Dr. Atnafua Bekele, representing SIRARI made an opening remark at Bilate Zuria



Figure 2.6. Training on conservation agriculture based sustainable intensification at Bilate Zuria woreda



Figure 2.7 Closing remark and plenary session lead by Woreda agriculture head Mr. Eyob Assefa and Dr. Atnafua Bekele in the Bilate woreda

3. GEO-REFERENCING THE EXPERIMENTAL FIELDS

At Hawassa zuria, Conservation agriculture clusters were located between altitudinal range of 1686 – 1720 m *a.s.l.* whereas at Bilate the host farmers were situated between 1797 – 1903 m *a.s.l.* Thus, the areas show contrasting altitudinal ranges. Normally planting was done at the beginning of April in Bilate whereas planting was done by the end of April at Hawassa zuria (Table 4).

Table 4. Clusters of farmers experimenting conservation agriculture in Hawassa zuria area

No.	Farmer	Alt (m <i>a.s.l.</i>)	Lat	long
1	Chilota Yohanis	1686	7.06'4982''	38.39'5734''
2	Endrias Dawasa	1697	7.06'8065''	38.39'5193''
3	Mengistu Negeso	1696	7.06'7550''	38.39'7264''
4	Hana Mamush	1698	7.06'6380''	38.39'7559''
5	Elsabeth Dawit	1696	7.06'4705''	38.39'6465''
6	Tadese Rike	1700	7.06'8514''	38.40'1363''
7	Esreal Yute	1699	7.06'8392''	38.40'6515''
8	Abera Getachew	1698	7.06'8445''	38.40'6320''
9	Petros Mochona	1690	7.06'5463''	38.40'4196''
10	Adala Alito	1690	7.06'9010''	38.39'4007''
11	Milkias Tunga	1701	7.07'0071''	38.39'3379''
12	Tore Andamo	1692	7.06'9422''	38.39'3463''
13	Hanako Sawa	1709	7.08'0151''	38.38'0383''
14	Balguda Barasa	1714	7.08'1320''	38.38'0597''
15	Abraham Manja	1711	7.08'1556''	38.38'0426''
16	Yosef Yonana	1699	7.06'9680''	38.37'7930''
17	Ayele Amalo	1707	7.06'8602''	38.37'8134''
18	Yohanis Yonana	1704	7.06'8676''	38.37'7767''
19	Endrias Tunke	1702	7.06'8478''	38.37'7565''
20	Arebe Tafese	1703	7.06'8358''	38.37'7292''
21	Chinkiso Barasa	1704	7.06'8597''	38.37'6290''
22	Hela Hemacha	1706	7.06'7484''	38.37'8380''
23	Kunbi Tadesse	1711	7.06'9622''	38.37'8269''
24	Sarmiso Kamiso	1708	7.06'8562''	38.37'7328''
25	Timotos Kakawo	1699	7.06'8402''	38.37'7565''
26	Yisak Wayiso	1710	7.06'3165''	38.37'8291''
27	Amano Aliye	1720	7.06'5227''	38.37'7389''
28	Elias Gabe	1718	7.06'2608''	38.37'4118''
29	Bonti Hamaro	1716	7.06'79668''	38.36'0371''
30	Biruk Tesfaye	1714	7.06'59534''	38.36'5371''

At Hawassa the latitudes ranged between 7.08'1556'' to 7.06'2608'' whereas the longitude ranged between the longitudes ranged between 38.40'6515'' to 38.36'0371''. At Bilate the latitudes ranged between 7.00'7180'' to 7.02'3918'' whereas the longitude ranged between the longitudes ranged between 38.22'36119'' to 38.26'2336'' (Table 5).

Table 5. Clusters of farmers experimenting conservation agriculture in Bilate' zuria area

No.	Farmer	Alt (m <i>a.s.l.</i>)	Lat	long
1	Farmer	1800	7.00'7180''	38.22'9214''
2	Sime Mela	1814	7.01'4294''	38.23'6549''
3	Cherkamo Kina	1813	7.01'14520''	38.23'6770''
4	Bergene Kina	1985	7.00'6440''	38.22'4460''
5	Samato sirbamo	1817	7.01'4079''	38.23'6525''
6	Baraso Kina	1820	7.01'5972''	38.22'36119''
7	Munasa Mura	1812	7.01'6232''	38.23'6555''
8	Henok Kebede	1797	7.00'7092''	38.22'9390''
9	Hasamo Ledamo	1799	7.00'702''	38.22'9500''
10	Mabiru Mala	1802	7.00'7100''	38.22'9676''
11	Zinabu Markos	1835	7.00'8656''	38.24'5559''
12	Ermias Bonge	1822	7.01'2607''	38.24'4260''
13	Alazar Shu'ura	1824	7.01'2691''	38.24'4558''
14	Desta Alazar	1827	7.00'9411''	38.24'4034''
15	Mesfin Ermias	1825	7.00'9526''	38.24'3871''
16	Esaias Ermias	1828	7.01'2754''	38.24'4677''
17	Tuke Shu'ra	1829	7.02'838''	38.24'5156''
18	Nuge Chamara	1831	7.01'2553''	38.24'4850''
19	Abayneh Tuke	1823	7.01'0056''	38.24'3357''
20	Oshila Anato	1830	7.00'9956''	38.24'3646''
21	Dimos Anato	1861	7.02'3313''	38.25'1258''
22	Yona Esias	1855	7.02'3485''	38.25'1345''
23	Wo'ma Batiso	1860	7.02'3736''	38.25'1169''
24	Hayiso Tamiso	1858	7.02'3918''	38.25'1064''
25	Jaja Kunde	1859	7.02'3576''	38.25'1084''
26	Bado Yuntura	1896	7.02'1270''	38.28'2289''
27	Almaz Yunka	1903	7.02'1333''	38.26'2336''
28	Maja Doyamo	1895	7.02'0693''	38.26'2168''
29	Tonosha Doyamo	1898	7.02'0469''	38.26'2212''
30	Legese Ledamo	1902	7.02'0690''	38.26'2101''

3. INPUT DISTRIBUTION AND PRACTICAL DEMONSTRATIONS

The improved varieties chosen by the host farmers through serious of observations and group discussions were fetched to farmers by collaborative efforts of CIMMYT Addis Ababa office and Sidama Agricultural Research Institute. The selected maize varieties (Limu, Shone and Damot) were purchased from Holeta Menagesha Pioneer Hybrid store whereas the common bean (Hawassa dume variety) and soybean (Hawassa-04 variety) seeds were collected through purchase from seed multiplication unit of Hawassa Agricultural Research Center. The pigeon pea variety named Ashenafi was purchased from farmers who planted these seeds by previous year.

3.1 Bilate zuria

At Bilate area, ten farmers from each of the three kebeles (Shamana godo, Yirbagangeso and Gonowa bulano) were called together to collect their own seed and herbicide (Fig 3.1; Table 6). Next, practical demonstrations were made in the farm of Alazar Yu'ura at Shamana godo, Bilate for all farmers on subjects of 1:1 intercropping ratio, fertilizing intercrops, mulching and weeding systems required in conservation agriculture.



Figure 3.1. Farmers of Bilate area accessing conservation agriculture inputs

3.2 Hawassa zuria

Farmers' at Hawassa zuria were split into two nearby locations to collect the input for conservation agriculture as shown below in the picture (Fig 3.2; Table 7). 6.25 kg of maize seeds/farmer was provided to enable planting on 0.25 ha of land allocated to conservation agriculture. They were all happy to implement the conservation agriculture trials. Next, practical demonstrations were made in the farm of Chilota Yohannis and Yisak Wayiso at Udo wotate, Hawassa zuria for all farmers on subjects of 1:1 intercropping ratio, fertilizing intercrops, mulching and weeding systems required in conservation agriculture.



Figure 3.2. Farmers of Hawassa area accessing conservation agriculture inputs

Table 6. Amount (kg) of maize varieties dispatched to farmers in Bilate and Hawassa zuria

Maize variety	Woreda		Total	Remark
	Bilate	Hawassa		
Damot	81.25	31.25	112.5	6.25 kg of maize seeds/farmer was provided to enable planting on 0.25 ha of land allocated to conservation agriculture
Shone	31.25	6.25	37.5	
Limu	75	150	225	
Total	187.5	187.5	375	

Similarly, 10 kg of soybean Hawassa-04, 5 kg of pigeon pea *Ashenafi* variety and 25 kg of Hawassa-dume common bean variety was distributed based on their choice.

Table 7. Amount of legume varieties dispatched to farmers in Bilate and Hawassa zuria

Legume	Woreda		Total	Remark
	Bilate	Hawassa		
Soybean	120	15	135	10 kg of soybean Hawassa-04, 5 kg of pigeon pea AShenafi variety and 25 kg of Hawassa-dume common bean variety
Pigeonpea	70	80	150	
Common bean	200	325	525	
Total	390	420	810	

4. PLANTING INTERCROPPING TRIALS

4.1 Maize –pigeon pea

Planting of both maize and pigeon peas was done between 22-29 April 2025 in Bilate and Hawassa woredas (Fig 4.1). The Bilate farmers actually planted earlier than the Hawassa once within last week of April, 2024 due to their planting calendar. The growth of pigeon peas was slow at early growth stages as shown on the photos below compared to those of maize in both locations.



Figure 4.1. Maize-pigeon pea intercropping – planting and mulching

4.2 Maize –soybean

Planting of both maize and soybean was done between 22 - 29 April 2025 in Bilate and Hawassa woredas (Fig 4.2.). The Bilate farmers actually planted earlier than the Hawassa once within last week of April, 2024 due to their planting calendar. The growth of soybeans was not slow at early growth stages as shown on the photos below compared to those of maize in both locations. However, soybeans seeds were picked by pigeon birds at planting, identified and eaten by other birds during emergence, and by wild animals like rabbit and gazelle during vegetative growth. But it regenerated somehow as shown below.





Figure 4.2. Maize-soybean intercropping – planting and mulching

4.3 Maize – common bean

Planting of both maize and common beans was done simultaneously between 22 - 29 April 2025 in Bilate and Hawassa woredas. The Bilate farmers actually planted earlier than the Hawassa once within last week of April, 2024 due to their planting calendar. The growth of common beans was not fast starting the early stages of growth as shown on the photos below compared to those of maize in both locations (Fig. 4.3.). There was no reported attack for common beans during planting and vegetative growth stages by birds and wild animals.





Figure 4.3. Maize-common bean intercropping – planting and mulching

5. MONITORING AND EVALUATION ACTIVITIES

Two separate teams have made monitoring and evaluation visits to the conservation agriculture trials. The first team was the one from Sidama Agricultural Research Institute, who made the supervision on June 02, 2025 whereas the second team made a visit on 20 June 2025 from CIMMYT Addis Ababa (Fig 5.1). Both team advised farmers to mulch their conservation agriculture plots as much as they can. Mulching was done in both Hawassa and Bilate woredas, but with higher intensity and ground cover in Bilate than Hawassa. The farmers at Hawassa were reporting lack of mulching materials due to

higher number of livestock in their homes. Farmers in Bilate were found of using materials like grasses, maize stalk, finger millet stover, common bean straw, banana and enset leaves as mulch, which provided alternatives for promotion of conservation agriculture in places where other crop residues are in short fall. The next advice made from both teams was to reduce soil disturbance during urea application, which was also well done in Bilate than Hawassa areas. The following are pictures of field.



Figure 5.1. Monitoring and evaluation during planting, weeding and vegetative growth stages

6. CURRENT STATUS OF RESEARCH ACTIVITIES

The common beans planted in May, 2025 were already harvested in July, 2025. We planted second common bean in August, 2025, which are now at six to eight leaf stage during preparation of this report. The pigeon peas intercropped with maize were at branching stage while soybeans intercropped with maize have already set pods. We planned harvesting of maize for October 2025 with second common beans also ready for harvest by then. Soybeans will be harvested in early October, 2025. However, pigeon peas would stay for eighth month until December, 2025 (Fig 6.1-6.3).

6.1 Maize – common bean intercropping



Fig 6.1. Current status of maize-common bean intercropping for the second time

6.2 Maize – Soybean intercropping



Fig 6.2 Current status of maize-soybean intercropping

6.3 Maize – pigeon pea intercropping



Fig 6.3 Current status of maize-pigeon pea intercropping

7. FOLLOW UP ACTIVITIES

The experiments were successfully implemented. If the rain conditions become reliable, farmers are hoping for better harvest in both areas. In fact, the weather was variable and out of farmers' control, which they can't help; But, intercropping, mulching and no-till practices would help to adapt the stress period somehow. The activities remaining would be

1. Identification of stakeholders for expansion of conservation agriculture
2. Field monitoring and follow up to help farmers escape any anticipated risk
3. Show-casing on lessons learnt through conservation agriculture
4. Data collection on both cereal and legume components, and compilation of best practices

More importantly, there is a need to organize a platform of stakeholders to discuss on key issues required to expand conservation agriculture in the areas where success stories were recorded. These stakeholders and their potential role in the expansion and adoption of conservation agriculture have been listed in the table 8.

Table 8. List of CA stakeholders and their role in the adoption and utilization of CA

No.	Stakeholders	Potential roles derived from their mandates
1	Farmers	Practice zero/minimum tillage, mulching and intercropping and or double cropping maize with legumes; Scale up/out best practices, Provide the produce to the cooperatives for collective sales
2	Agriculture and natural resources development ministry/Bureau	Lead the conservation agriculture initiatives, initiate alternative extension models of premium price or contractual farms, design policies that support conservation agriculture, and awareness creation through its zonal, woreda and kebele experts
3	Sidama Agriculture Research Institute/EIAR	Generate alternative technologies and research data for policy makers and provide research recommendations for successful implementation of conservation agriculture; Develop appropriate value chain for the products
4	CIMMYT	Identify challenges and bottlenecks for adoption of CA, Suggest and experiment possible solutions, Generate research data for policy makers and provide research recommendations; Develop appropriate value chain for the products
5	Hawassa University	Educate trained and skilled man-power on conservation agriculture, Generate research data for policy makers and provide research recommendations; Develop appropriate value chain for the products
6	Marketing and/or Cooperatives office	Provision of market access for soybean and pigeon peas produced by farmers plus awareness creation
7	Input authority	Provision of seeds, herbicides and equipment required for conservation agriculture

- | | | |
|---|--|--|
| 8 | Private sector eg. Agro-processors, feed formulators and oil companies | Present effective demand with attractive price for the produce. This should consider the production cost at farmers' disposal together with current market value at the nearest town market. |
| 9 | Non-governmental organizations working in the area | Train and assist farmers in the adoption of conservation agriculture through awareness creation of its uses, practical field work, exchange visits and technical support |
-