



EU H2020
PROJECT
GA 862848

*Linking East and West African
farming systems experience into
a BELT of sustainable intensification*



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D 4.1

Biophysical and economic database of case study technologies and practices

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CHAPTER 1: INTRODUCTION

1.1 Background

New technologies create new patterns of resource use, for example by altering labour requirements or the cost of management inputs. A key objective of EWABELT is to see how new technologies or practices alter and impose new patterns of resource use in comparison with a current baseline, by comparing the effects on profitability and feasibility, in terms of inputs such as capital inputs, labour, and land requirement.

D4.1 biophysical and economic database of case study technologies, collects data for this evaluation, so that the impacts of the new technologies being proposed and trialled can be compared with a counterfactual that the farmers might currently use. The database, which is part of **Task 4.2** Quantification of the set of capital, land and labour requirement associated with each technology and practice (Month 8-48), will then be used to support **Task 4.3** Economic and financial modelling of new technologies and practices (Month 17-48).

1.2 Description

D4.1 is a spreadsheet database named “DS_WP4_CRAN_Biophysical and economic database_technologies_H2020_EWABELT_v1” being stored at the following location: EWA-BELT Sharing Point Platform (<https://app.ewabelt.eu/drive>).

Once the dataset is approved by the EC and is fully completed, it will also be made available on the EWA BELT website under the section “deliverables” (<https://www.ewabelt.eu/deliverables>) and uploaded to the Zenodo repository and related locations as explained in the Data Management Plan second version (D.1.8).

It contains the following data from the following countries as shown in Table 1:

Table 1: Country, crop, and partner with data so far included in D4.1

Country	Crop	Partner
Ghana	Maize Fonio	KDC
Burkina Faso	Cotton Sorghum Maize	UNB/INERA
Kenya	Maize Groundnut Finger millet	KALRO
	Groundnut varieties Maize	UON





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In Ghana, Kundok Development Consult (KDC) has been recording data on the following technologies;

- Integrated Soil Fertility Management (ISFM) in maize
- Water management (Bunding in maize)
- Fonio intercropping with Legumes

In Burkina Faso, The Institut de l'Environnement et de Recherches Agricoles (INERA) and the Université Nazi BONI (UNB) have been recording data on:

- Sorghum-cotton-mixed farming systems
- Maize-cotton-mixed farming systems
- Sole cotton farming systems

In Kenya, the Kenya Agricultural and Livestock Research Organisation (KALRO) has recorded data on:

- Integrated soil fertility management in Neglected/Underutilized crops species (Finger millet and Maize)
- Peanut rotation of with cereals
- Groundnut production with Aflasafe KE-01
- Maize production with Aflasafe KE-01
- Finger millet production with Aflasafe KE-01

Also in Kenya, the University of Nairobi (UoN) has collected data on following technologies;

- Evaluation of peanut varieties with Aflasafe

So far, **D4.1** covers the 2021 production season. **D4.1** will continue to be updated during the lifetime of the project as new project technologies are implemented and as new data is made available through further project research.

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CHAPTER 2: METHOD

As part of effort to achieve these tasks, an internal meeting was organized within Cranfield to discuss the data requirement for the economic analyses being undertaken by the team considering the variance in terms of technologies been promoted by partners in East and West Africa. The challenge is in the diversity of technologies being evaluated and the different recommendation domains they represent. Identifying the appropriate means of conducting the analyses is therefore very important. The initial need for **Task 4.2** was to develop a data collection tool and circulate to partners to help them collect data needed for economic analysis having identified the relevant variables to collect data on. These however varies with different technologies.

The data tool was shared with project partners to obtain their feedback. After receiving feedback from partners, the data collection tool was finalized and shared with West African partners (KDC, CSIR-SARI, UNB, UNIMAK, INERA), and East Africa partners (HU, JU, KALRO, NM- AIST, TARI, UoN) across the six African countries in July 2021 to collect the relevant socio-economic data from their field experiments and demonstrations (see Appendix 5 for full name of partners).

Data collected included data for the following technology groupings: Neglected and underutilised crop species (**Sub-task 2.1.1**), Sustainable soil management (**Sub-task 2.1.1**), Sustainable water management (**Sub-task 2.2.2**).

Data collected from the experimental sites and on-farm trials includes information on land preparation, sowing, weeding, fertilizer applications, harvesting, threshing and bagging. Data has been collected at each stage of the farm operation as they are implemented throughout the season.

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2.1 Structure of the data collection tool

The data collection tool was designed to allow for the calculation of gross output, gross margins, and net margins.

The tool has four main sections which include:

Section 1: Technology Listing

Section 2: Detail economic data collection section

Section 3: Summary economic data of each treatment of the technology

Section 4: Input market prices and exchange rate monitor

Section 1: Technology listing

This section of the tool (see Appendix 1) collects meta data on the technologies being developed or validated by each partner. It requests a brief description of the experiment, the crops under study, the work package, the project tasks and sub-tasks that the trial relates to, and the lead contact. The information collected include the following:

Metadata

- Region (East or West Africa)
 - Country
 - Partner
 - Lead scientist
 - List of technologies
 - Related crops
 - Work package
 - Task and sub-task
-

Section 2: Detailed economic data collection

This section of the tool (see Appendix 2) collects further profile data (Section 2.1) and field operations, inputs and outputs data (Section 2.2):

Section 2.1: Site profile data

Profile data

- Country
 - FRRU Code
 - Lead Farmer code
-





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-
- Task No
 - Name of Partner:
 - Contact person:
 - Contact person email:
 - Location of plot: (on-farm or on-station)
 - Description of technology/protocol/method
-

Section 2.2: Field operations, inputs, and outputs data

1) Labour used

- Land clearing (h/ha and USD/h)
- Ploughing/ridging/etc (h/ha and USD/h)
- Sowing (h/ha and USD/h)
- Thinning/transplanting (h/ha and USD/h)
- Staking (h/ha and USD/h)
- Inorganic Fertilizer application 1 (h/ha and USD/h)
- Inorganic Fertilizer application 2 (h/ha and USD/h)
- Organic Fertilizer application (h/ha and USD/h)
- Weeding/herbicide 1 (h/ha and USD/h)
- Weeding/herbicide 2 (h/ha and USD/h)
- Manual weeding (h/ha and USD/h)
- Insecticide/pesticide application 1 (h/ha and USD/h)
- Insecticide/pesticide application 2 (h/ha and USD/h)
- Insecticide/pesticide application 3 (h/ha and USD/h)
- Harvesting (h/ha and USD/h)
- Threshing and bagging (h/ha and USD/h)

2) Input used

- Seed of crop 1 (kg/ha and USD/kg)
- Seed of crop 2 (kg/ha and USD/kg)
- InorganicFertilizer 1 (kg/ha and USD/kg)
- InorganicFertilizer 2 (kg/ha and USD/kg)
- InorganicFertilizer 3 (kg/ha and USD/kg)
- Organic fertilizer 1 (t/ha and USD/t)
- Organic fertilizer 2 (t/ha and USD/t)
- Pesticide/insecticide 1 (l/ha and USD/l)
- Pesticide/insecticide 2 (l/ha and USD/l)
- Pesticide/insecticide 3 (l/ha and USD/l)
- Weedicide/herbicide 1 (l/ha and USD/l)
- Weedicide/herbicide 2 (l/ha and USD/l)
- Weedicide/herbicide 3 (l/ha and USD/l)

3) Output obtained

- Grain crop 1 (t/ha)
-

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-
- Grain crop 2 (t/ha)
 - Stover crop 1 (t/ha)
 - Stover crop 2 (t/ha)
-

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Section 3: Summary economic data

This section (see Appendix 3) calculates the monetary value of the inputs and outputs on a per hectare basis, dividing these into the total value of the outputs (Section 3.1), and the total costs of the inputs (Section 3.2).

Section 3.1 Total value of output

Product and output prices

- Yield crop 1 (t/ha)
 - Output price 1 (USD/t)
 - Yield crop 2 (t/ha)
 - Output price 2 (USD/t)
 - Stover 1 (t/ha)
 - Stover 2 (t/ha)
 - Stover 1 price (USD/t)
 - Stover 2 price (USD/t)
 - Other price
 - Other yield
-

3.2 Total cost of all inputs

Cost of land preparation

- Land clearing (USD/ha)
 - Tractor Ploughing (USD/ha)
 - Bullock Ploughing (USD/ha)
 - harrowing (USD/ha)
-

Cost of Seed

Seed 1:

- Seed quantity (kg/ha)
- Certified Seed price (USD/kg)
- Cost of dibbling/drilling (USD/ha)
- Cost of planting (USD/ha)

Seed 2:

- Seed quantity (kg/ha)
 - Certified Seed price (USD/kg)
 - Cost of dibbling/drilling (USD/ha)
-





-
- Cost of planting (USD/ha)

Cost of Herbicides/Weedicides

- Herbicide 1:
- Quantity of herbicide 1 (kg/ha)
- Price of herbicide 1 (USD/Ltr)
- Herbicide 2:
- Quantity of herbicide 2 (kg/ha)
- Price of herbicide 2 (USD/Ltr)
- Herbicide 3:
- Quantity of herbicide 3 (kg/ha)
- Price of herbicide3 (USD/kg)

Cost of Fertilizers

- Inorganic Fertilizer 1:
- Quantity of fertilizer 1 (kg/ha)
- Price of fertilizer 1 (USD/kg)
- Inorganic Fertilizer 2:
- Quantity of fertilizer 2 (kg/ha)
- Price of fertilizer 2 (USD/kg)
- Inorganic Fertilizer 3:
- Quantity of fertilizer 3 (kg/ha)
- Price of fertilizer 3 (USD/kg)
- Organic Fertilizer 1:
- Quantity of fertilizer 3 (kg/ha)
- Price of fertilizer 3 (USD/kg)
- Organic Fertilizer 2:
- Quantity of fertilizer 3 (kg/ha)
- Price of fertilizer 3 (USD/kg)

Cost of Pesticides/insecticides

- Pesticide 1:
- Quantity of herbicide 1 (kg/ha)
- Price of herbicide 1 (USD/kg)
- Pesticide 2:
- Quantity of herbicide 2 (kg/ha)
- Price of herbicide 2 (USD/kg)
- Pesticide 3:
- Quantity of herbicide 3 (kg/ha)
- Price of herbicide3 (USD/kg)

Labour Cost (LC)

- Weed control LC (USD/ha)
 - Insectice application LC (USD/ha)
-



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-
- harvesting LC (USD/ha)
 - Dehusking LC (USD/ha)
 - Shelling/Threshing LC (USD/ha)
 - Staking LC (USD/ha)
 - Manual weeding LC (USD/ha)
-

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Section 4: Input prices and exchange rate monitoring

This section (Appendix 4) captures the market prices of the inputs used in production within the FFRU where the trial/demonstrations were implemented. It also monitors the exchange rate movement within the period.

Input price data

- Seed of various crops
 - Inorganic fertilizers
 - Organic fertilizers
 - Pesticides/Insecticides
 - Weedicide/Herbicides
-

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APPENDICES

Appendix 1: Technology listing tool

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1		Group (EA or WA)	Country	Partner	List of Technologies/Protocols	Crop/s	WP	Task/s	Sub-Task/s	Trial Lead Person				
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														

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Appendix 2: Detail economic data collection tool

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ECONOMIC DATA SHEET

Country:
FAO Code:
Small Farmer code:
Task No:
Name of Farmer:
Contact person:
Contact person email:
Location of plot (on-farm or On-station):
Description of technology/practice/method:

Abbreviations:
Meaning:
Baseline data guide:

Plot Size: Number: Unit:

A. LABOUR USED

Baseline data for the FFRU:

Activity: Month:

Crop 1 name:
Crop 2 name:

Hired and Family Labor

Total number of people (n): Average number of hours per person (hrs/person): Wage rate per hour (USD/hr): Notes:

Land clearing
Ploughing/digging/etc.
Weeding
Thinning/trimming/pruning
Staking
Inorganic fertilizer application 1
Inorganic fertilizer application 2
Organic fertilizer application
Weeding/pesticide 1
Weeding/pesticide 2
Manual weeding
Insecticide/pesticide application 1
Insecticide/pesticide application 2
Insecticide/pesticide application 3
Harvesting
Threshing and bagging
Other 1
Other 2

B. INPUT USED

Input: Month:

Crop 1 name:
Crop 2 name:

Quantity used (n): Units (e.g. kg or litres, etc. Please specify): Input price per unit (USD/unit): Notes:

Seed of crop 1
Seed of crop 2
Inorganic fertilizer 1
Inorganic fertilizer 2
Inorganic fertilizer 3
Organic fertilizer 1
Organic fertilizer 2
Pesticide/insecticide 1
Pesticide/insecticide 2
Pesticide/insecticide 3
Weeding/pesticide 1
Weeding/pesticide 2

Tech1_Econs_datasheet(EDS) Tech1_EDS_sumsheet Tech2_Econs_datasheet(EDS) Tech2_EDS_sumsheet Tech3_Econs_datasheet(EDS) Tech3_EDS_sumsheet Tech4_Econs_datasheet(EDS)

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Appendix 3: Summary economic data of each technology

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	A	B	C	D	E	F	G	H	I
1									
2		Plot Level Data							
3		Country				Description of technology/protocol/method:			
4		FRRI Code							
5		Lead Farmer code							
6		Task No							
7		Name of Farmer:							
8		Contact Person:							
9		Contact Person email:							
10									
11		Experiments:	Baseline data	Treatment 1	Treatment 2	Treatment 3	Treatment 4	Notes	
12		Output Data							
13		Product						Responses should be based on what happened on the plots/farm	
14		Yield crop 1 (Qty/ha)						What is the Quantity of output obtained. The yield from the plot should be measured and extrapolated to 1 ha	
15		Output price 1 (USD/t)						What is the current market price of the output. This should be the price per t	
16		Yield crop 2 (Qty/ha)						What is the Quantity of output obtained. The yield from the plot should be measured and extrapolated to 1 ha	
17		Output price 2 (USD/t)						What is the current market price of the output. This should be the price per t	
18		Stover 1						What is the stover yield for crop 1	
19		Stover 2						What is the stover yield for crop 2	
20		Stover 1 price (USD/t)						What is price of the stover 1	
21		Stover 2 price (USD/t)						What is the price of stover 2	
22		Other price							
23		Other yield							
24		Inputs							
25		Land preparation							
26		Land clearing (USD/ha)						What is the cost of clearing 1 ha	
27		Tractor Ploughing (USD/ha)						What is the cost of ploughing 1 ha	
28		Bullock Ploughing (USD/ha)						What is the cost of Bullock ploughing 1 ha	
29		harrowing (USD/ha)						What is the cost of harrowing 1 ha	
30									
31									
32		Seed							
33		Seed 1:						Name of crop one	
34		Seed quantity (kg/ha)						What is the quantity of seed that was used. Extrapolate to 1 ha	
35		Certified Seed price (USD/kg)						What is the cost of 1 kg of the seed	
36		Cost of dibbling/drilling (USD/ha)						What is the cost of dibbling to plant. Extrapolate to 1 ha	
37		Cost of planting (USD/ha)						What is the cost of planting. Extrapolate to 1 ha	
38									
39		Seed 2:						Name of crop two	
40		Seed quantity (kg/ha)						What is the quantity of seed that was used. Extrapolate to 1 ha	
41		Certified Seed price (USD/kg)						What is the cost of 1 kg of the seed	
42		Cost of dibbling/drilling (USD/ha)						What is the cost of dibbling to plant. Extrapolate to 1 ha	
43		Cost of planting (USD/ha)						What is the cost of planting. Extrapolate to 1 ha	
44									
45		Fertilizers							
46		Inorganic Fertilizer 1:						Name of fertilizer 1	
47		Quantity of fertilizer 1 (kg/ha)						What is the quantity fertilizer one used. Extrapolate to 1 ha	
48		Price of fertilizer 1 (USD/kg)						What is the cost of 1 kg of the fertilizer	
49		Inorganic Fertilizer 2:						Name of fertilizer 2	
50		Quantity of fertilizer 2 (kg/ha)						What is the quantity fertilizer 2 used. Extrapolate to 1 ha	
51		Price of fertilizer 2 (USD/kg)						What is the cost of 1 kg of the fertilizer	
52		Inorganic Fertilizer 3:						Name of fertilizer 3	

◀ ▶ List of Technologies Tech1_Econs_datasheet(EDS) Tech1_EDS_sumsheet Tech2_Econs_datasheet(EDS) Tech2_EDS_sumsheet Tech3_E

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	A	B	C	D	E	F	G	H	I
44									
45		Fertilizers							
46		Inorganic Fertilizer 1:					Name of fertilizer 1		
47		Quantity of fertilizer 1 (kg/ha)					What is the quantity fertilizer one used. Extrapolate to 1 ha		
48		Price of fertilizer 1 (USD/kg)					What is the cost of 1 kg of the fertilizer		
49		Inorganic Fertilizer 2:					Name of fertilizer 2		
50		Quantity of fertilizer 2 (kg/ha)					What is the quantity fertilizer 2 used. Extrapolate to 1 ha		
51		Price of fertilizer 2 (USD/kg)					What is the cost of 1 kg of the fertilizer		
52		Inorganic Fertilizer 3:					Name of fertilizer 3		
53		Quantity of fertilizer 3 (kg/ha)					What is the quantity fertilizer 3 used. Extrapolate to 1 ha		
54		Price of fertilizer 3 (USD/kg)					What is the cost of 1 kg of the fertilizer		
55		Organic Fertilizer 1:					Name of organic fertilizer 1		
56		Quantity of fertilizer 3 (kg/ha)					What is the quantity of organic fertilizer 1 used. Extrapolate to 1 ha		
57		Price of fertilizer 3 (USD/kg)					What is the cost of 1 kg of the organic fertilizer 1		
58		Organic Fertilizer 2:					Name of organic fertilizer 2		
59		Quantity of fertilizer 3 (kg/ha)					What is the quantity of organic fertilizer 2 used. Extrapolate to 1 ha		
60		Price of fertilizer 3 (USD/kg)					What is the cost of 1 kg of the organic fertilizer 2		
61									
62									
63									
64		Herbicides/Weedicides							
65		Herbicide 1:					Name of herbicide 1		
66		Quantity of herbicide 1 (kg/ha)					What is the quantity of herbicide 1 used. Extrapolate to 1 ha		
67		Price of herbicide 1 (USD/Ltr)					What is the cost of 1 Ltr of the fertilizer		
68		Herbicide 2:					Name of herbicide 2		
69		Quantity of herbicide 2 (kg/ha)					What is the quantity of herbicide 2 used. Extrapolate to 1 ha		
70		Price of herbicide 2 (USD/Ltr)					What is the cost of 1 Ltr of the fertilizer		
71		Herbicide 3:					Name of herbicide 3		
72		Quantity of herbicide 3 (kg/ha)					What is the quantity of herbicide 3 used. Extrapolate to 1 ha		
73		Price of herbicide3 (USD/kg)					What is the cost of 1 Ltr of the herbicide		
74									
75		Pesticides/Insecticides							
76		Pesticide 1:					Name of pesticide 1		
77		Quantity of herbicide 1 (kg/ha)					What is the quantity of pesticide 1 used. Extrapolate to 1 ha		
78		Price of herbicide 1 (USD/kg)					What is the cost of 1 Ltr of the pesticide		
79		Pesticide 2:					Name of pesticide 2		
80		Quantity of herbicide 2 (kg/ha)					What is the quantity of pesticide 2 used. Extrapolate to 1 ha		
81		Price of herbicide 2 (USD/kg)					What is the cost of 1 Ltr of the pesticide		
82		Pesticide 3:					Name of pesticide 3		
83		Quantity of herbicide 3 (kg/ha)					What is the quantity of pesticide 3 used. Extrapolate to 1 ha		
84		Price of herbicide3 (USD/kg)					What is the cost of 1 Ltr of the pesticide		
85									
86		Labour Cost (LC)							
87		Weed control LC (USD/ha)					What is the cost of labour that was used to apply the herbicides. Extrapolate to 1 ha		
88		Insecticide application LC (USD/ha)					What is the cost of labour that was used to apply the insecticides. Extrapolate to 1 ha		
89		harvesting LC (USD/ha)					What is the cost of harvesting. Extrapolate to 1 ha		
90		Dehusking LC (USD/ha)					What is the cost of dehusking. Extrapolate to 1 ha		
91		Shelling/Threshing LC (USD/ha)					What is the cost of shelling. Extrapolate to 1 ha		
92		Staking LC (USD/ha)					What is the cost of staking. Extrapolate to 1 ha		
93		Manual weeding LC (USD/ha)					What is the cost of manual weeding. Extrapolate to 1 ha		
94		Other LC1							
95		Other LC2							
96									
97									
98									

Ready Accessibility: Investigate

List of Technologies Tech1_Econs_datasheet(EDS) Tech1_EDS_sumsheet Tech2_Econs_datasheet(EDS) Tech2_EDS_sumsheet Tech3_E



EU H2020
PROJECT
GA 862848

Linking East and West African
farming systems experience into
a BELT of sustainable intensification



Appendix 4: Input market prices and exchange rate monitor

Excel File Edit View Insert Format Tools Data Window Help										
AutoSave ON										
CRAN_EWA-BELT_WP4_EDatasheet1_190721 A8 — Saved										
Home Insert Draw Page Layout Formulas Data Review View Tell me										
Q8										
A	B	C	D	E	F	G	H	I	J	K
1	Input Prices Data 2021:				Exchange Rate Monitor					
2										
3	Input	Unit	Prices		Exchange Rate Data 2021					
4			Subsidized	Not Subsidized	Month	USD	Local currency:			
5	Seed of crop 1:	USD/kg			July	1				
6	Seed of crop 2:	USD/kg			August	1				
7	Seed of crop 3:	USD/kg			September	1				
8	Seed of crop 4:	USD/kg			October	1				
9	Inorganic Fertilizer 1:	USD/kg			November	1				
10	Inorganic Fertilizer 2:	USD/kg			December	1				
11	Inorganic Fertilizer 3:	USD/kg								
12	Organic Fertilizer 1:	USD/kg								
13	Organic Fertilizer 2:	USD/kg								
14	Pesticide/Insecticide 1:	USD/tr								
15	Pesticide/Insecticide 2:	USD/tr								
16	Pesticide/Insecticide 3:	USD/tr								
17	Weedicide/Herbicide 1:	USD/tr								
18	Weedicide/Herbicide 2:	USD/tr								
19	Weedicide/Herbicide 3:	USD/tr								
20	Other 1:									
21	Other 2:									
22	Other 3:									
23	Other 4:									
24										
25										
26										
27										
28										



Appendix 5. Full name of African partners

West African partners;

Sub-region	Country	Institution	
West Africa	Sierra Leone	University of Makeni	UNIMAK
	Burkina Faso	Institut de l'Environnement et de Recherches Agricoles	INERA
	Burkina Faso	Université Nazi BONI	UNB
	Ghana	Council for Scientific and Industrial Research Savanna Agricultural Research Institute (CSIR-SARI)	CSIR-SARI
	Ghana	Kundok Development Consult	KDC

East Africa partners;

Sub-region	Country	Institution	
East Africa		Hawassa University	HU
		Jimma University	JU
		Kenya Agricultural and Livestock Research Organisation	KALRO
		The Nelson Mandela African Institute of Science and Technology	NM-AIST
		Tanzania Agricultural Research Institute	TARI
		University of Nairobi	UoN