Wolkite University

College of Agriculture and Natural Resources

Department of Plant Science

Project Proposal

On

Capacitating Farmers through Demonstrating Improved Agronomic Practices in Gurage Zone, Southern Ethiopia

By

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Project Proposal Submitted to:

Catholic Relief Service (CRS) Farmer-to-Farmer (F2F) Program

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Wolkite Ethiopia

Short Project team members resume

Name of the team member	Project share	Details	
Tatek Tamiru	***Project technical committee***	Highest degree	MSc.
		Specialization	Agronomy
		Academic Position	Lecturer
		Professional research experience	Completed two internally granted research and community service.
		Position in the team	Principal investigator will manage agronomic activity of the project
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Worku Mengesha (Asst. Professor)	***Project technical committee***	Highest degree	MSc.
		Specialization	Plant pathology
		Academic Position	Assistant professor
		Professional research experience	Completed four internally granted research and community service at Aksum and Wolkite Universities
		Position in the team	Technical committee member and implement activates related with pest management
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Abrham Mulatu(Asst. Professor)	***Project technical committee***	Highest degree	MSc.
		Specialization	Horticulture
		Academic Position	Assistant professor
		Professional research experience	Six completed research granted by WKU, externally funded Project coordination ,two ongoing research with external funding and one accepted research proposal as co-researcher, community service more than five as completed and ongoing projects
		Position in the team	Proposal development with other team, professional contribution during project life and data collection and report preparation on the research outcome
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Girma Wolde(Asst. Professor)	***Project technical committee***	Highest degree	MSc.
		Specialization	Soil Sc.
		Academic Position	Assistant professor
		Professional research experience	Completed 7 internally granted research projects on bio fertilizer, fertilizer and acid soil management at Mizan-Tepi University, Completed 3 community service projects at Wolkite and Mizan-Tepi Universities ; delivered training on bio-fertilizer and weed management at Gurage zone
		Position in the team	-Project technical team member and will implements and mange activities on bio-fertilizer, lime application and chemical fertilizer management - Research publication and partnership coordination officer
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Teshome Yitbarek(PhD)	***Project Director***	Highest degree	PhD
		Specialization	Soil Science
		Academic Position	Associate professor
		Professional research experience	About 10 published research work & I have advised MSc and PhD Students in the area of soil science & agronomy.
		Position in the team	Aver all coordination of the project.
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Minyahel Tilahun (Asst. Professor)	***Project coordinator***	Highest degree	MSc.
		Specialization	Animal Production
		Academic Position	Assistant professor
		Professional research experience	Completed more than 5 internally granted research and community service projects at WKU; Three projects with external funding
		Position in the team	CANR, RCSUIL coordinator
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Executive summery

Agriculture is the fundamental driver for Ethiopia's economy and long-term food security as it offers about 80-85% of employment, more than 61% of the total export and 38.5% of gross domestic product of the country. Despite its highest share in the country's economy, the performance of the agricultural sector is very poor.

Improving soil fertility, improved weed control and row planting technology at farm level is one of the major productivity enhancing inputs. Hence, increased and efficient use of this technology can be considered as a more plausible alternative in Ethiopia to bridge the wide gap of food shortage (at least in the immediate future). There is still a low inclination to farm level use of the technology of soil fertility improvement, weed control, row planting among the different crop production in Ethiopia.

Scaling up of soil fertility, weed control and row planting technology adoption as a package to increase crop production on the marginal land. Therefore the significance of this demonstration is adopting improved agricultural technologies (weeding, row making and improving soil fertility) to increase the productivity of crop is very imperative to achieve food security in Gurage Zone southern Ethiopia. It would also fill the existing information gap and provide information for row planting technology, fastest and easiest way of weed management and applying soil fertility improving microorganism will enhance farmers benefit.

CRS Farmer-to-Farmer (F2F) Program is a USAID funded that will provide technical assistance from United States (U.S) volunteers to farmers, farmer groups (cooperatives and associations), agribusinesses and other agriculture sector institutions. F2F program will assist agriculture development and firm upgrading by providing technical assistance to introduce new technologies, innovations and development of local capacity for more productive, profitable, sustainable and equitable agriculture systems.

On the top of this, the aim of the project is significantly in line with scope and program of CRS Farmer-to-Farmer, and partner organization of Wolkite University, signed MoU to undertake such community outreach project bilaterally. Therefore, all of the above merits are a driving factor to design this project. The financial fund will be covered by CRS and WKU in collaboration. The total budget required to implement this project will be **10987 USD**.

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1. INTRODUCTION

1.1 Back ground

Agriculture is the fundamental driver for Ethiopia's economy and long-term food security as it offers about 80-85% of employment, more than 61% of the total export and 38.5% of gross domestic product of the country (Degaga and Angasu, 2017). Ethiopia has diverse agro-ecology that permits different agricultural systems and production of different crops. The existence of this diverse agro-ecology together with diverse farming systems, socio-economic, cultures and climate zones provided Ethiopia with various biological wealth of plants, animals, and microbial species, especially crop diversity (Atnaf et al., 2015).

Despite its highest share in the country's economy, the performance of the agricultural sector is very poor. The land productivity is low with an average yield of 1.23 tones/ha for food grains (CSA, 1998). The sector is dominated by smallholder agriculture, which is characterized by the use of traditional technologies, poor resource base and rain fed production system.

Improved technologies are increasingly promoted to farmers in sub-Saharan-African countries and in Ethiopia particularly to address low agricultural productivity in their staple crops. There is, however, a lack of evidence on how adoption affects farmers' labor use and profitability at the farm level, as well as the importance gender roles play in this aspect.

Improving soil fertility, improved weed control and row planting technology at farm level is one of the major productivity enhancing inputs. Hence, increased and efficient use of this technology can be considered as a more plausible alternative in Ethiopia to bridge the wide gap of food shortage (at least in the immediate future). There is still a low inclination to farm level use of the technology which used for enhancement of soil fertility, weed control and row planting among the different crop production in Ethiopia.

The use of microorganisms with the aim of improving nutrients availability for plants is an important practice and necessary for agriculture (Freitas et al. 2007). Nitrogen is a growth-limiting nutrient for many microorganisms, which acquire it from organic and inorganic nutrients. Though nitrogen constitutes about 79% of the atmosphere, relatively few organisms can utilize nitrogen gas. A few bacteria reduce nitrogen gas to ammonia via a process called nitrogen fixation, which is essential to life on Earth. It can play a key role in land remediation. Legumes are very important both ecologically and

agriculturally because they are responsible for a substantial part of the global flux of nitrogen from atmospheric N2 to fixed forms such as ammonia, nitrate, and organic nitrogen. This objective will be achieved through the development of superior legume varieties, improvements in agronomic practice, and increased efficiency of the nitrogen-fixing process itself by better management of the symbiotic relationship between plants and bacteria. Different leguminous crops require specific rhizobium species for the formation of effective nodules and nitrogen fixation (Goss, et al., 2005). For new establishments, seed of legumes are required to be inoculated with the proper rhizobia specie. That is, the seed is coated with a sticking agent and the bacteria applied directly to the seed. At these places the bacteria is in close proximity to the seed at the time of germination.

The expanded interest in ecology has drawn attention to the fact that BNF is ecologically benign and that it's greater exploitation can reduce the use of fossil fuels and can be helpful in reforestation and in restoration of misused lands to productivity. Currently, the subject of BNF is of great practical importance because the use of nitrogenous fertilizers has resulted in unacceptable levels of water pollution (increasing concentrations of toxic nitrates in drinking water supplies) and the eutrophication of lakes and rivers (Dixon, and Wheeler. 1986, Sprent, and P. Sprent. 1990.). Further, while BNF may be tailored to the needs of the organism, fertilizer is usually applied in a few large doses, up to 50% of which may be leached (Sprent, and Sprent. 1990.).

Agriculture is the art of cultivating plants for producing food, feed, medicine and other desired products. To improve the agricultural status, it is necessary to use agriculture equipment in cultivation processes. Agriculture equipment is machinery used in agricultural works to save labor, cost, time and to get high crop yield. There are many types of machinery, from hand tools to power operated machinery. Improved farm equipment has probably had the most significant impact on how farmers raise crops and care for livestock. Inter cultivation is a process involving operations in the rows of standing crops. Weeding, tiling and cultivating are the examples for the same. Though traditional practices exist even today, they have lots of drawbacks. Such practices depend on bullocks and are also labor intensive which results in many practical hassles. Nowadays lots of tools are available to facilitate inter cultivation and thus increase productivity.

In general, to improve the agricultural status, in Gurage zone, it is necessary to use agriculture equipment in cultivation processes to save labor, cost, time and to get high crop yield and improving soil fertility through inoculation of rhizobium bacteria.

Rational of the Project

Food production in Ethiopia failed to keep pace with the population growth rate. Measures to increase agricultural production in Ethiopia may be based on expanding cultivated area and/or increasing agricultural intensification. Farmers in many part of Ethiopia are using traditional technology and living in subsistence way of life this is due to many bottleneck problems. This is also true in Gurage zone, agricultural practices are not supported via modern technologies' which used to maximize productivity and minimize labor intensive. Hence, scaling up of soil fertility, weed control, row planting and others technology adoption as a package to increase crop production on the marginal land and fasten.

Scaling up of soil fertility, weed control and row planting technology adoption as a package to increase crop production on the marginal land and fasten. Therefore adoption of improved agricultural technologies (weeding, row making and improving soil fertility) would be very imperative to increase crop productivity to ensure food security in Gurage Zone, southern Ethiopia. It would also fill the existing information gap and provide information for row planting technology, fastest and easiest way of weed management and applying soil fertility improving microorganism will enhance farmers benefit.

Giving this in consideration, this project aim to be capacitated the farmer and introduces improved agricultural technologies for enhancement of crop productivity in Gurage Zone with financial and technical support of Catholic Relief Service (CRS) Farmer-to-Farmer (F2F). CRS Farmer-to-Farmer (F2F) Program is a USAID funded that will provide technical assistance from United States (U.S) volunteers to farmers, farmer groups (cooperatives and associations), agribusinesses and other agriculture sector institutions. The program objectives are to facilitate economic growth within targeted agriculture sub-sectors, enhance sub-sector inclusiveness to expand participation to a broader range of individuals and communities. F2F program will assist in agriculture development and firm upgrading by providing technical assistance to introduce new technologies, innovations and development of local capacity for more productive, profitable, sustainable and equitable agriculture systems.

On the top of this, the aim of the project is significantly in line with scope and program of CRS Farmer-to-Farmer, and partner organization of Wolkite University, signed MoU to undertake such community outreach project bilaterally. Therefore, all of the above merits are a driving factor to design this project.

1.2 Objectives

1. To deliver demonstration based training on improved agronomic practices.

2. To adopt bio-fertilizers technologies in crop producing districts of Gurage zone.
3. To introduce and disseminate improved agronomic equipment's to model farmers.

2. PROJECT DESIGN AND PLANNING

2.1 Project Activities

Activity One: Project Site Selection and Procedures for Farmers Selection

Farmers will be selected based on their history to adopt technologies (model farmers). Ten farmers will be selected from three districts and demonstration based training will be provided about land preparation, frequency of tillage, row making with row maker, planting methods, handling, inoculation and management of nitrogen fixing biofertilizer bio-fertilizer technologies and how to use weeding material.

For the commencement of this project, selecting appropriate site is mandatory. Hence, three districts that can represent the different cropping system in Gurage zone will be selected as a technology village. The districts will be selected purposively based on their agro-climatic zone (from high land, mid-high lands and lowland), potential for production of leguminous crops and prior experience (exposure of districts for training offered to model farmer by CRS project).

Accordingly, the project will be implemented in three different districts of Gurage zone namely Abeshige, Cheha and Gummer. Ten female, male and youth model farmers will be selected from each district.

Abeshige is considered as lowland agro-ecology and haricot bean and chick peas are the major legume crop produced.

Gumer is considered as highland agro-ecology and bean and pea are the major legumes produced.

Cheha is considered as mid-high land agro-ecology and bean and peas are major legumes produced.

Activities Two: Establishment of demonstration center at Wolkite University

To facilitate the achievement of the first and the second objectives demonstration center will be established at the practical site of Plant Science department, Collage of Agriculture and Natural resource, Wolkite University before activity three (the actual training).

To achieve the first objective, three plots each with a size of 5 m * 10 m will be prepared and the spacing between plots will be 1 m. Maize crop (dominantly growing crop across all agro-ecologies) will be grown using three different agronomic practices:

1) Improved agronomic practices and/or tools (full package),
2) Improved agronomic practices (half package) and
3) Agronomic practices of local farmers and/or traditional tools. The agronomic practice will include weed control practices.

Similarly, to achieve the second objectives (adoption of *Rhizobium* biofertilizer) six plots each with a size of 5m * 5m will be prepared and the spacing between plots will be 1.5 m. The first three plots will be used to grow haricot bean and the remaining three plots will be used for chick pea. The following three practices will be implemented for each crop:

1. *Rhizobium* inoculation with improved agronomic practice
2. Improved agronomic practice without *Rhizobium* inoculation
3. Local farmer practices

The demonstration center will have total of nine plots and will be implemented on an area 310 m^2 land. The filed will be properly managed as per the requirement of each plots.

Activity Three: Capacity building training

To improve the awareness and skill of model female, male and youth farmers, development/extension agents, districts and zonal level agricultural level expertise in Gurage zone, theoretical and demonstration based training will be provided on importance and inoculation techniques of rhizobium-biofertilizer, the 4Rs principles of fertilizer application, improved agronomic practices, use of improved agronomic tools, weeds, disease and insect pest managements. The theoretical training will be delivered through power point presentation and group discussion at the training center of Wolkite University. The practical (demonstration) based training will be implemented at the demonstration site (see activity 2) of the university. Farmers will evaluate the yield difference between improved technologies and their local practices. In this phase of the training 30 model farmers (20 male and 10 female), 6 development extension agents (3 male and 3 female) and 1 zonal expert will be participated.

Activities Four: Establishment of demonstration center at Farmers training center (FTC) of the three districts

Farmer to farmer training approach will be implemented to properly adopt the technologies and to increase direct beneficiaries of the project. For this, three relatively strong farmers training center (FTC) will be selected from Abeshige, Gummer and Cheha districts (one from each). Under the supervision of the trainers those farmers and development agents who were participated on the training at Wolkite University will prepare nine plots in the FTCs of their respective districts to deliver demonstration based training to farmers of their districts on the six practices listed under activity two. During the training, they will follow all the procedures listed under activity two except some changes on the type of crop. In each FTCs 60 farmers (40 males and 20 females) will be participated.

Activity Four: Production and distribution of Improved Agronomic Materials and tools

The original prototypes will be copied for the demonstration work. Those improved weeding materials; Westward 2mvt3 garden hoe, Kwik Edge and row maker will be copied and produced in Wolkite University by Engineering and Technology College.

LONG-HANDLED TOOLS

Westward 2mvt3 garden hoe

Row planter and rake

Activity Five: Rhizobium Bacteria Inoculation

Seeds will be inoculated with *Rhizobium spp*. The seed will be primed with sugar solution in order to attain the attachment of the rhizobium spp. on the seed. All inoculants will be done before planting under shade to maintain the viability of cells (microorganism). Seeds will be air dried for a few minutes before planting. The inoculated and non-inoculated seeds will be planted in separate plot to compare their difference on nodulation and yield. The amount of rhizobium will be inoculated based on the recommendation of the species for specific crop. The nodulation effect of rhizobium will be observed

before flowering carefully by uprooting the crop and count the number of nodule and compared the yield with non-inoculated seed. The rhizobium spp. will be obtained from Addis Ababa (Menagesha).

2.2 Sustainability of the project

For the sustainability of the project the following stakeholders will take shares.

Wolkite University: - Wolkite University will take its responsibility by bringing office, provide technical and professional manpower, provide demonstration site at plant science practical site and undertaking the activities of implementation, monitoring and evaluation of the project. Generally Wolkite University will be undertaken major project activities such as reporting, finance administration, supervision and the alike.

Districts and Gurage zone Agriculture Office:

The Zone and select districts of Agriculture office will select model farmers, extension workers and agricultural experts. Ultimately scale up the successful agronomic technology to adopt at farmers field.

CRS ProjectF2F Program: - will provide lion share of the financial contribution and evaluate the success of the project.

Model Farmers: The selected farmer would participate in capacity building training, adopting the introduced agronomical technologies and show up willingness to implement accordingly.

2.3 Project Monitoring and Evaluation

Wolkite University, Project Director, and Coordination Office, and Project technical committee will be the primary supervisors for all implementation and success of this project. The professional will supervise and technical support for the farmer. The project teams will monitor and evaluate the project implementation.

2.4 Project Beneficiaries

This project will directly benefited farmers, development/extension agents and crop production expertise as indicated in the following table

S.N	Direct beneficiaries	Number of beneficiaries	
		Male	Female

1	Farmers	140	70
2	Development/extension agents	3	3
3	Crop production experts	1	0

In addition to the direct beneficiaries the following will be benefited indirectly

- ☞ District and zonal farming and natural resource officers of Gurage zones.
- ☞ Investors in the area of agriculture
- ☞ Wolkite University
- ☞ SNNPRS farming and natural resource office and
- ☞ The nation at large

2.5 Expected Outcome

- ✍ The target groups which are mentioned here above will improve their awareness on improved agronomic practices
- ✍ Smallholder farmers live in Gurage zone will improve their knowledge and skill on improved agronomic practices
- ✍ Target groups will increase their productivity and plays a role in food security
- ✍ Creates employment opportunity
- ✍ Improved and sustainable agricultural technology will be produced and transferred to the smallholder farmer of the Gurage zones.

3. Project work plan

SN		2020				2021											
	Activity	**July**	**Aug**	**Sep**	**Dec**	**Janu**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1	Proposal writing and submission	**X**	**X**														
2	site selection			**X**			**X**	**X**									
3	demonstration site establishment			**X**				**X**									
4	Training					**X**			**X**								

5	Land preparation			X						X	X	X					
6	copy and production of improved agricultural technology					X	X	X									
7	Sowing			X							X	X	X				
8	Bacterial inoculation and sowing		X	X								X					
9	Weeding		X	X									X	X	X		
10	Harvesting and threshing															X	
11	supervision and evaluation			X		X		X		X		X		X		X	
12	Report writing and submission															X	X

4. Logistics

4.1 Cost (USD)of Demonstration at Wolkite University

Activities	Unit	Site	Number of labour	Rate	No. Day	Total cost(USD)
Land clearance	Man/day	4	6	1.9	6	272
Land preparation 1st	"	4	10	1.9	8	151
Land preparation 2nd	"	4	8	1.9	5	302.4

Planting	"	4	14	1.9	2	212
Weeding	"	4	8	1.9	8	484
Cultivation	"	4	7	1.9	8	423.4
Threshing and evaluation		4	9	1.9	8	547.2
Harvesting		4	6	1.9	4	91
Lime application		2	6	1.9	3	68
					Sum 1	**2551**
Researcher's allowance		Unit	No. Res	No. days	rate	Total
field layout 3 researchers (each 2 days)		man	5	1	8.5	42.7
Material collection (3 researchers) each 5		ETB	5	2	8.5	85.4
plantation, and field management each 6 days		ETB	5	2	8.5	85.4
supervision, data collection and report write-up each 8 days		ETB	6	3	8.5	154
Data collector 2 each 12		ETB	5	2	6.3	63
					Sum2	**430**
Cost for Input						
Item		85.4	unit	Unit price	Num ber	Total
Fertilizer		154	Quintal	50.5	2	101
Lime		63	Quintal	18	2	35.3
					sum 3	136
					Total (Sum1+Sum2 +Sum3)	**3117**

4.2 Training Expense

SN	Person	Number	No of days	Daily rate(usd)	Total (USD)
1	Trainers	6	6	8.5	307
2	Extension agents	6	5	8.5	256
3	Model farmers	30	5	8.5	1281
4	Zonal Experts	1	5	8.5	42.7
Sub total					**1888**

4.3 Cost of Agricultural equipment

SN	Equipment type	Unit cost	No of copy	Total Cost (USD)
1	Row planter and rake	15	50	750
2	Westward 2mvt3 garden hoe	15	50	750
3	Hoe	15	50	750
Total				**2250**

4.4 Cost of Rhizobium Bacteria

SN	Type of bacteria	Unit cost	Amount	Total Cost(USD)
1	*Rhizobium cicero*(for chickpea)	100	2.5	151
2	*Rhizobium etli*	100	2.5	151
3	*Rhizobium leguminosarum*(*Rhizobium phaseoli*)	100	2.5	151
4	*Rhizobium leguminosarum*(*Rhizobium phaseoli*)	100	2.5	151
Total				**604.8**

4.6 Supervision Fees

SN	Activities	Person	No of person	Payment rate	No. of days	Total Cost (USD)
1	Preliminary survey	Researcher	4	8.5428	7	239
2	Material collection and site selection	Researcher	4	8.5428	7	239
3	Field establishment	Researcher	4	8.5428	7	239
4	Supervision	Researcher	4	8.5428	7	239
Project coordinator		Person	1	8.5428	12	102.5
Project director		person	1	8.5428	12	102.5
Total						**1161**

4.7 Administration Cost

SN	Description	Expense (USD)
1	Administration Cost	902
2	Sub Total	**902**

4.8 Budget Summary

SN	Description	Expense (USD)
1	Cost of Demonstration at Wolkite University	3117
2	Training Expense	1888
3	Cost of Agricultural equipment	2250
4	Cost of Rhizobium Bacteria	605
5	Supervision Fees	1161
	Total	9021
	Administrative cost (10%)	902
Partner Cash contribution Total		**9923**

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