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IDRC GRANT / SUBVENTION DU CRDI : - CLIMATE-SMART INTERVENTIONS FOR SMALLHOLDER FARMERS IN ETHIOPIA (CULTIAF-2)

Pre extension and large scale demonstration of improved sorghum production technologies

1. Executive Summary (1-page max.):

Sorghum is one of the staple food grains grown in the poorest and most food-insecure areas of Ethiopia. It is important for income, food, and nutrition security. The consumption of sorghum for food purpose is increasing because of food habits, cost of teff and consumers preference. However, only small number of farmers (28 percent) cultivates improved varieties with preferred trait (high biomass, short duration, good quality for injera making, high yield and striga resistance). To improve this CultiAF project implemented the outreach activities is to extend new short-duration high-biomass sorghum varieties and management packages to smallholder farmers in the target project areas. Based on these, newly released varieties were demonstrated on farmers and farmers' training center (FTCs). The demonstration covers not only the varieties but also the recommended agronomic practices (planting date, fertilizer rate, seed rate, spacing). The improved sorghum varieties included in the demonstration were Argiti, Tilahun, Melkam, Alene, Dekeba , Girana 1 and Fadis 01. The activity was implemented in three regional states namely, Tigray, Amhara and Oromia. However due to the conflict in the northern part of the country, the outreach activities were not implemented as per the plan in Tigray and Amhara regional states in 2021 and 2022.

For the outreach of sorghum technologies, different approaches were used. On-farm demonstration, training, large scale demonstration, field days, print and streaming Medias were used as an approach for the outreach activities.

Table 1: Research released and targeted varieties by the project

Varieties	Flowering date	Plant height (c.m)	Productivity (ton/ha)	Maturity days	Year of release
Melkam	76-82	126-163	35-58	118	2009
Argiti	79	200	37-60	125	2016
Tilahun	78	190	34-60	120	2018
Fedis 01	74-79	143-180	38-48	120	2019
Alene	70	113-140	47.2	116	2019
Girana	76	123-191	40.7	126	2007
Dekeba	75	136	37-45	119	2012

On-farm demonstration of improved sorghum production package:

Starting the first year of the project **323 demonstrations** was established in farmer's field and FTCs. The number of established demonstrations is high compared with the project plan. 134% of the target is achieved in the demonstration establishment. However, due to the ongoing conflicts the distribution of established demonstration plots per regional states were not as per the plan. In all the demonstration plots farmers around the demonstration plots were invited to see the demonstrated varieties with their agronomic performances. In addition, farmers' feedbacks were collected from women and men farmers about their perception on the demonstrated varieties.

Table 2: Summary of established demonstrations

Year	Region	No. demo.	Number of demonstration host farmers		
			Men	Women	FTCs
2019/ 2020	Amhara	31	20	1	10
	Oromia	5	0	0	5
	Tigray	24	17	7	5
2020/ 2021	Amhara	42	26	7	9
	Oromia	62	45	11	6
	Tigray	80	66	14	0
2021/ 2022	Oromia	54	41	12	1
	Amhara	25	15	10	0
Total		323	230	62	36

The demonstrated varieties were evaluated and performed well. Here below are the on farm potentials of the demonstrated varieties during the project years.

In East Hararghe areas, three varieties were demonstrated by using Melkam variety and local cultivars side by side as a check. From the demonstration we understood that the highest yield was recorded by Tilahun and followed by Argiti and Fedis-01 varieties. Even in the bad season, the improved varieties performed by very well and farmers may not harvest a grain from the local cultivars.

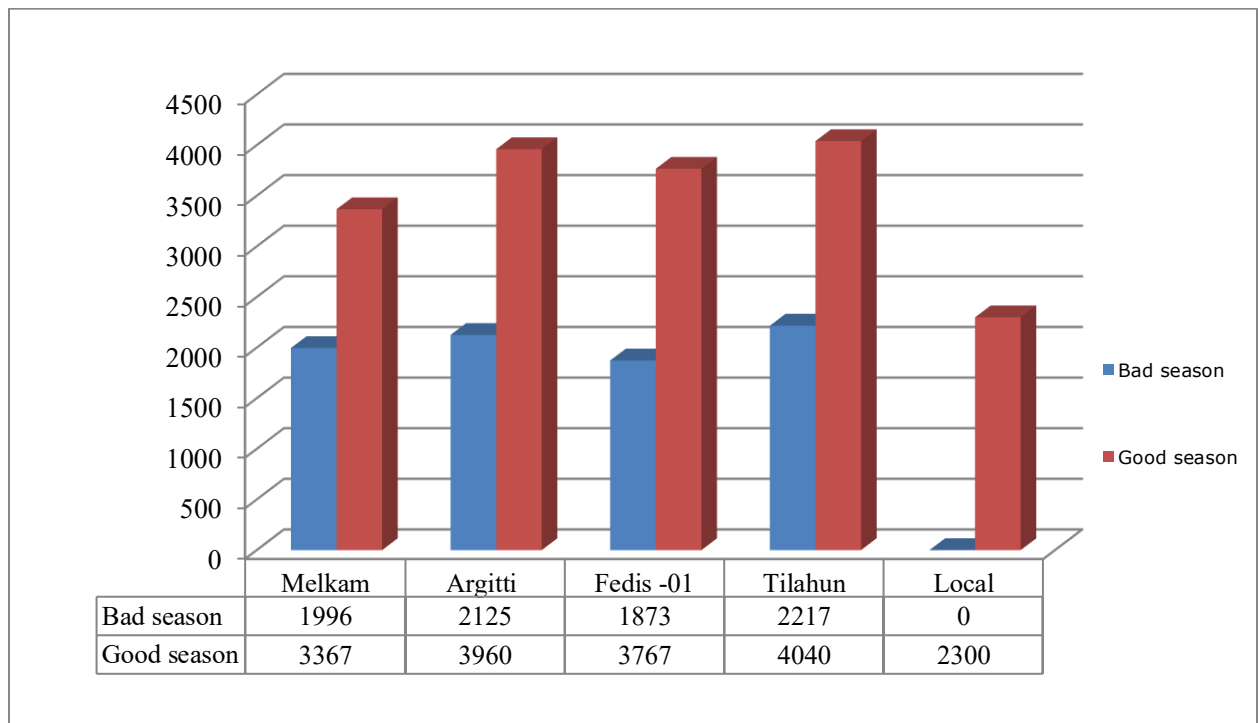


Figure 1: On-farm potentials of demonstrated varieties in Eastern Hararghe

In Amhara region and Arsi zone of ormia regional states, Melkam variety performed very well than Argiti and Tilahun.

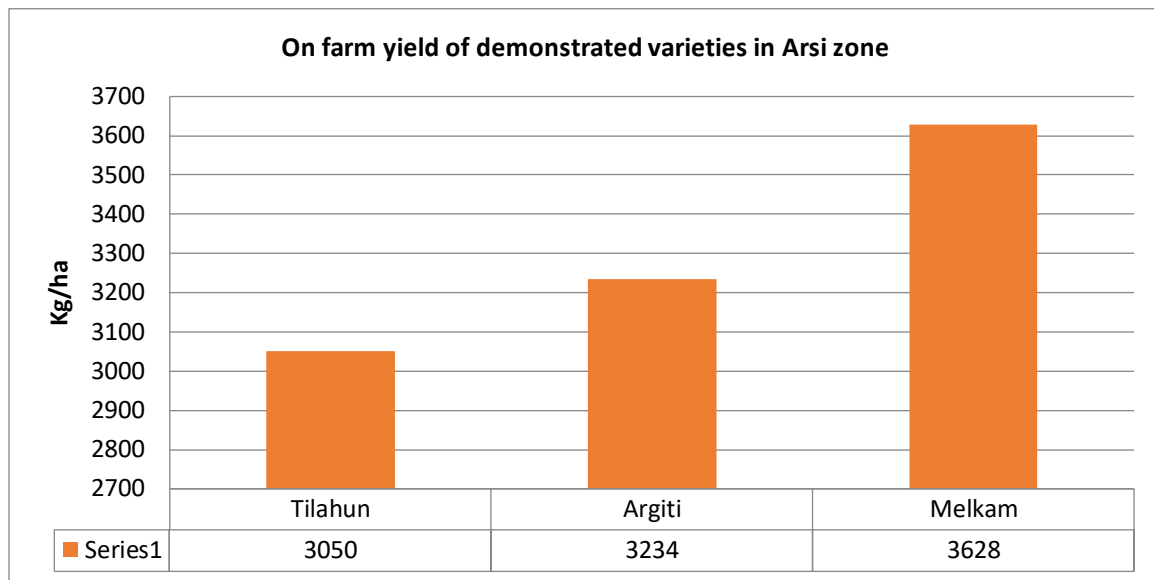


Figure 2: On-farm potentials of demonstrated varieties in Arsi zone

The mean grain yield of the improved sorghum varieties demonstrated was 3050 kg/ha, 3234 kg/ha and 3628 kg/ha for Tilahun, Argiti and Melkam varieties respectively. The highest mean yield was recorded by Melkam variety in 3682 kg/ha in Shanan Kolu district. This means that Melkam variety has a grain yield advantage over Tilahun and Argiti with 15% and 11% respectively. Comparing the improved varieties with the local control (district average yield), a 36% grain yield advantage was recorded by Melkam variety, the highest mean grain yield gap.

The average yield of Argiti and Tilahun was also more than the district average yield which was 2320 kg/ha (CSA, 2021). According to EIAR (2016), the average sorghum productivity at farmers' fields is about 2800 kg/ha, while it is 3000 kg/ha to 5000kg/ha at experimental plots. The mean yield obtained from the improved varieties in this study is therefore superior and promising to smallholder farmers in the study area and similar agroecology. The high yield potential of the improved varieties therefore will provide to improve food security and income of sorghum-producing households in the study area.

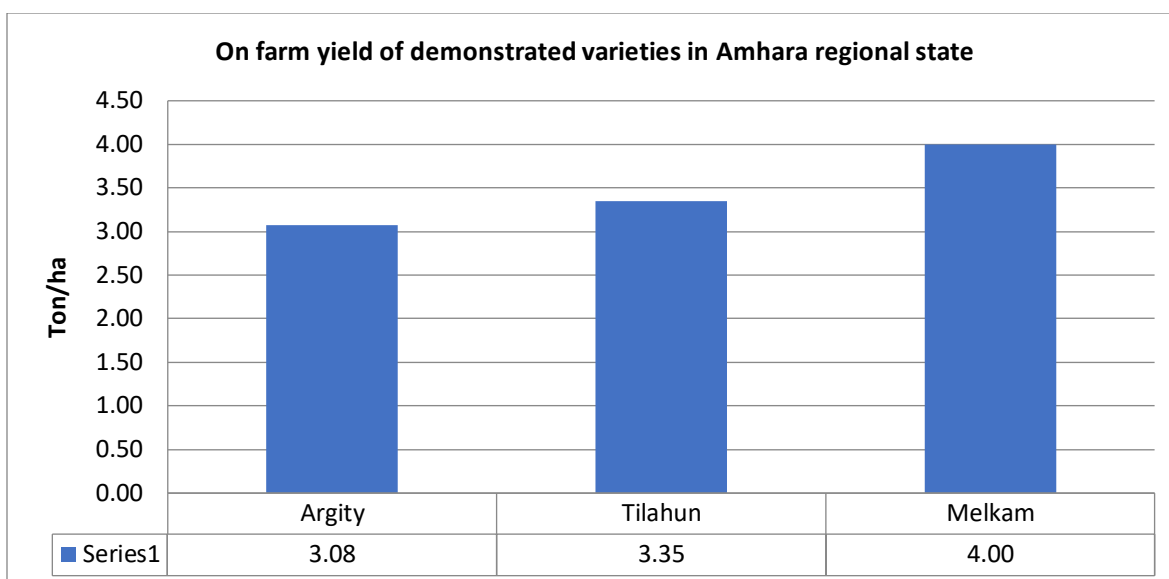


Figure 3: On-farm potentials of demonstrated varieties in Amhara regional state

Evaluation of sorghum varieties

The sorghum varieties were evaluated by farmers' set preference criteria. The criteria used for the evaluation by farmers were fourteen. These are grain yield, good injera-making quality, earliness, high market price, white grain color, large grain size, grain threshability, Striga resistance, stalk sweetness, disease and pest tolerance, large biomass, plant height and bird tolerant. The mean weight score of the selected traits result showed that higher grain yield had the highest weight score followed by good injera-making quality, earliness, high market price and white grain yield. Plant height and bird-tolerant traits have got the lowest weight score. The analysis of preference weight scores, for each characteristic of the sorghum varieties shows that Melkam variety was preferred for most of the characteristics except large grain size, stalk sweetness, large biomass and plant height. Argiti variety was ranked as the second most preferred variety.

Table 3: Farmers trait preference

Farmers treat and variety preference/score (#15 Women and 14 Male) in Arsi zone			
Treat	Mean score	Rank	Varieties preferred
Grain Yield	29.5	1	Melkam
Good injera making quality	27	2	Melkam
Earliness	23	3	Melkam
Higher market price	21	4	The same
Grain Color (white)	20.5	5	Melkam
Grain Size (large)	20	6	Argiti
Grain thresh ability	17.5	7	The same
Striga resistant	15.5	8	The same
Stalk sweetness	13.5	9	Argiti
Diseases and pest tolerant	13	10	The same
Less labor for processing	12.5	11	The same
Biomass (Large)	10	12	Tilahun & Argiti
Plant height (tallest)	9	13	Tilahun & Argiti

Bird tolerant	7	14	The same
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In East Hararghe areas, farmers selected Tilahun, Argiti, and Fedis-01 and Melkam varieties for high grain yield, respectively. Fedis-01 and Argity varieties were selected for their long height and high biomass.

Training: Before establishing the demonstrations, a consultative meeting was held between agricultural experts, developmental agents, and local administrators. Then training was given to 247 experts and development agents (194 men 53 women) on the practices of the improved production practices of low land sorghum production technologies.

Table. Training participants

Year	Region	Participant		Total
		Men	Women	
2019/2020	Oromia	15	10	25
	Amhara	20	2	22
	Tigray	11	2	13
2020/2021	Oromia	26	2	28
	Amhara	62	12	74
2021/2022	Oromia	30	15	45
	Amhara	30	10	40
Total		194	53	247

Scaling up of the improved sorghum production package (Clustered farmers):

In addition to the demonstration of newly released varieties, scaling up of the improved sorghum production package was undertaken in different sorghum producing areas. The varieties were publicized by using large scale demonstration and small seed pack approaches. In the large-scale demonstration, 2806ha of land was covered by participating 8523 farmers out of which 20% of them were women farmers. To reach large number of farmers a small seed pack approach was also utilized where demonstrations and farm clustering is impossible. Seed of the preferred varieties were also distributed through the formal extension through the BOA and it is estimated that more than 12000 farmers were have accessed the improved varieties in the project intervention areas.

Table 4: Large scale demonstration participant and area coverage

Year	Region	Area covered	Number of participant farmers		Total
			Men	Women	
2020/ 2021	Amhara	240	633	44	677
	Oromia	303	552	178	730
	Tigray	1480	4245	810	5055

2021/2022	Oromia	477	980	245	1225
	Amhara	306	725	111	836
Total		2806	7135	1388	8523

Field days: The demonstrated technologies were publicized for large communities and other stakeholders through promotional materials (brochures and leaflets) which disclose information about improved varieties of sorghum and its production and productivity. In addition to this, farmers and stakeholders were also invited to visit and share experience in the demonstrated technologies. Farmers, experts, agricultural extension agents and other stakeholders participated in field days.

Table 5: Number of persons participated in field days

Year	Farmer		Experts		Researchers		Others		Total	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
2020/21	1985	519	85	13	43	2	14	0	2127	534
2021/22	2168	581	67	20	15	8	51	8	2301	617
Total	4153	1100	152	33	58	10	65	8	4428	1151

In addition to this social and mainstream Medias were utilized in promotion and popularizing the work done by the project. The Medias were Facebook pages of target district, EIAR/MARC and ETV and OBN TV and radio.

1. The research problem

Farmers in Ethiopia have been cultivating sorghum over the years for household food consumption. The production of the crop has had lower yields due to drought and long maturing characteristics of the crop. To overcome the challenges, research centers have developed early maturing sorghum varieties which have good yield and test. To enhance the productivity of smallholder sorghum producer farmers, extending the new short duration high biomass varieties with the recommended management practices are among the main objective of the project.

2. Progress towards milestones:

Objective 2. Enhance small-holder productivity by extending new varieties, improved agronomy, labor-saving threshing technologies and grain storage technologies

2.2. Extending new short-duration high-biomass sorghum varieties and management packages to smallholder farmers			
Activity	Milestone/expected outputs for the year 2019 and 2021	Achievements: (Evidence/Indicator)	Remark/s
Training to extension agents on the improved sorghum production	360	247 experts and development agents trained on the improved production management of sorghum.	68% of the plan was achieved. This is due to the limited budget availability and the was undergoing on in the northern part of the country.
On farm demonstration of improved sorghum production package	350	Totally, 323 demonstrations were established in farmers' field and FTCs. The improved sorghum varieties included in the demonstration were Argiti, Tilahun, Melkam, Kalu, Alene, Dekeba , Girana 1 and Fadis 01.	92 % of achievement was recorded in the number of demonstrations established
Number of participants in the field day	900	5579 stakeholders (4428 men and 1151 women) are participated and gave constructive feedback	Morethan the target of the project achived.
Number of farmers who have access to the improved sorghum varieties	25000	14102 farmers (2539 women) were involved in the scaling up activity (had access / used the improved sorghum varieties)	The achievement is 56 percent of the target. We will try to reach more farmers the coming years of the project.

3. Synthesis of research results to date:

240 demonstration plots established in a farmer's field and farmers training (FTc) centres

- Totally, 323 demonstrations were established in farmers field and selected farmers training center (FTCs). The improved sorghum varieties included in the demonstration were Argiti, Melkam, Dekeba, Girana, Fadis01 and Tilahun. In all the demonstration plots farmers around the demonstration plots were invited to see the demonstrated varieties with their agronomic performances. In addition, farmers feedbacks were collected from women and men farmers about their perception on the demonstrated varieties. As a result Melkam was the most preferred one in Gololcha and Shanana kolu areas. In Fadis and Babile areas, Tilahun and Argiti are preferred ones by farmers set criteria.

300 development agents and experts trained on improved sorghum production

- We gave training to 247 experts on sorghum production and management.

900 persons participated in the field days organized

- 5579 farmers and experts were participated in the organized field days. From the total participants in the field day events, 1151 of them were women farmers/ experts. We are very much successful in participating farmers in the field days.

4. Synthesis towards AFS themes

Improving production, productivity and income

- Farmers in lowland areas are cultivating long maturing cultivar in which they are harvesting low due to stress/ low rain distribution. In this regard, the introduction and demonstration of improved sorghum varieties which are short duration and productive than the current farmers harvest is contributing to farmers' production and productivity. Farmers can harvest around 70,000 birr to 90,000 birr per hectare by using the improved varieties and recommended management practices. Comparing the farmers practice (30,000 birr income per hectare) a farmer can harvest around 40,000 birr advantage.
- In some of the large scale demonstration fields, farmers are benefited not only in the yield advantage of the improved varieties. They are also selling the product as a seed and receiving a minimum of 30% income advantage from the price of the sorghum grain.
- In addition to the productivity benefits of the new varieties, farmers are also beneficial in using the short duration varieties to scape the drought and securing food for the family early.
- The project is also improving the involvement and benefits of women and men farmers (in evaluating the performance of varieties in demonstration plots).

5. Challenges encountered / Actions taken

- The outbreak of COVID-19 pandemic.
- Conflict in northern part of the country and in some areas of Oromia regional state. The action taken is to cover the planed targets of Tigray and Amhara region in Oromia.

Annex 3: Digital File Formats Supported by the IDRC Digital Library

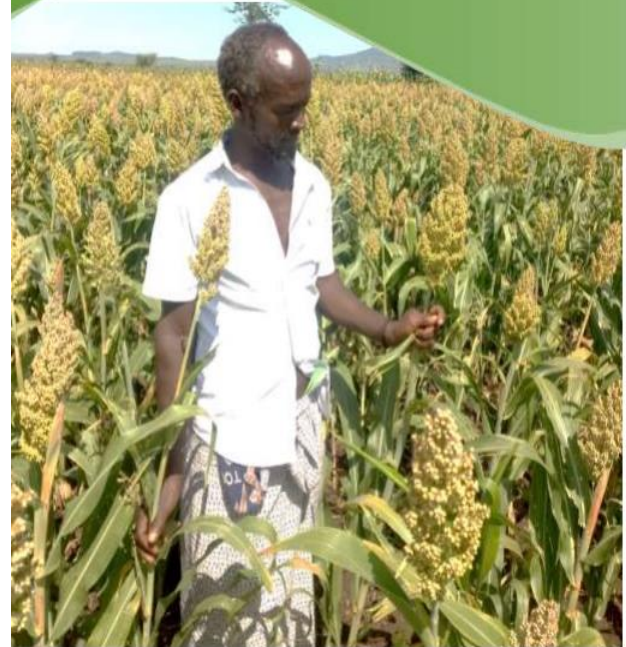


Farmers LSD field and harvest in Arsi and E. Hararghe

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