American Journal of Life Sciences
2024; 12(1): 16-23
http://www.sciencepublishinggroup.com/j/ajls
doi: 10.11648/j.ajls.20241201.13
ISSN: 2328-5702 (Print); ISSN: 2328-5737 (Online)

Availing Technology Options for Small-Scale Farmers: The Case of Pre-Extension Demonstration of Improved Rice Technology at Ilu-Harar District of Western Oromia, Ethiopia

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To cite this article:
Galmesa Abebe, Effa Wolteji. (2024). Availing Technology Options for Small-Scale Farmers: The Case of Pre-Extension Demonstration of Improved Rice Technology at Ilu-Harar District of Western Oromia, Ethiopia. *American Journal of Life Sciences, 12*(1), 16-23. https://doi.org/10.11648/j.ajls.20241201.13

Received: November 7, 2023; **Accepted**: November 28, 2023; **Published**: January 23, 2024

Abstract: This activity, Pre-extension Demonstration and Evaluation of Improved Rice Technology was carried out in the Ilu-Harar district, Jagan PA of the then Ilu-Ababora zone of Western Oromia on four (4) farmers and on 10*10 m^2 plots of land for each. In addition; this activity was to address and achieve the following objectives; to demonstrate & evaluate improved rice technologies with FRGs, to create awareness of the importance of the commodity, to make better linkage with target beneficiaries and stakeholders, and finally to collect feedback on the performance of rice production technologies. Consequently, the activity was conducted for one year using two varieties; Chawaka and NERICA-1 as a standard check. Accordingly; the Chawaka variety beat the standard check in all of the traits except the time of maturity which takes a longer period than the standard check. To this end farm mean yield performance of the Chawaka and the standard check; NERICA-1 were 45.57 qt/ha and 31.30 qt/ha; respectively, and on average Chawaka had a yield advantage of 45.59 % over NERICA-1 and this implies that Chawaka had higher yield advantage than NERICA-1. Moreover; when comparing the potential of the varieties acquired up on release in terms of the potential gap existing between the performance of the technology/ variety on the research station versus demonstration yield on farmers' fields there exists even similarity on the Chawaka variety but 7.2 qt/ha of yield reduction on NERICA-1 variety. Further; the statistical ANOVA table and mean yield comparison (t-test) results of on-farm yield performances showed that there is a highly significant difference at ($p<0.05$) between the varieties demonstrated. Furthermore; in terms of profitability, the financial analysis result of the study also showed that using the Chawaka variety can make it more profitable than NERICA-1. Eventually; therefore, as the variety has met the intended criteria of the farmers and was selected as the best variety the pre-scaling up activity should follow next for a greater number of farmers and on a wider area in the coming years.

Keywords: Rice Demonstration, Participatory Variety Evaluation and Selection, Yield Advantage, Chawaka and Nerica 1

1. Introduction

1.1. Background and Justification

Rice (*Oryza sativa* L.) is the foremost staple food for more than 50% of the world's population. It is estimated that by the year 2025, farmers in the world should produce about 60% more rice than at present to meet the food demands of the expected world population at that time [14]. Rice is the world's second leading cereal exceeded only by that of wheat [12]. In terms of production, rice is the fourth most important cereal (after sorghum, maize, and millet) in sub-Saharan Africa. It occupies 10 percent of the total land under cereal production and accounts for 15 percent of total cereal production [5]. In the world, the largest volume of rice production is concentrated in countries China, India,

Indonesia, Vietnam, Thailand, Bangladesh, Burma, Philippines, Brazil, and Japan. The percentage share of the above top ten rice-producing countries accounts for about 32.9,24.4, 11.0, 7.0, 6.0, 5.4, 5.3 2.9, and 1.8 % of the world production respectively. Ethiopia is 73rd in the world ranking with almost 0.0% [6].

Rice has become a highly strategic and priority commodity for food security in Africa. Consumption is growing faster than that of any other major staple on the continent because of high population growth, rapid urbanization, and changes in eating habits [13]. It is the single most important source of dietary energy in West Africa and the third most important for Africa as a whole. Although local rice production increased rapidly after the 2007-2008 food crisis, a key problem facing the rice sector in Africa, in general, is that local production has never caught up with demand. The continent, therefore, continues to rely on importation to meet its increasing demand for rice.

Rice cultivation is a recent phenomenon in Ethiopia. The cultivation has started in some regions of the country and has been progressing steadily [9]. Generally, rice has great potential and can play a critical role in contributing to food and nutritional security, income generation, poverty alleviation, and the socio-economic growth of Ethiopia. Amongst the target commodities that have received due emphasis in the promotion of agricultural production, rice is considered the "Millennium crop" expected to contribute to ensuring food security in the country. Besides; Rice in Ethiopia has big potential to contribute to food security and even to generate foreign currency from its export [7]. Since 2006, Ethiopian rice production trends show increases in both area and productivity. The introduction and expansion of rice production in suitable agro-ecologies could be an option to achieve food security and self-sufficiency. Even though rice is not a traditional staple food in Ethiopia, it is considered a high-potential emergency and food security crop. The trend of rice production is increasing both in area coverage, participant farmers, and production. [10].

The trend indicates a high increasing rate, especially since 2006. Rice-producing farmers: increased from 32 thousand in 2006 to 119 thousand in 2013 Area allocated increased from 6 thousand ha in 2006 to 58 thousand ha in 2013, Production increased from 11 thousand tons in 2006 to 184 thousand tons in 2013 [1]. Total current rice consumption is about 353,998 tons with an estimated annual average import of 21,724 tons over the last ten years. Due to the introduction of upland and irrigated rice varieties in the country, rice farming has increased from time to time. There have been twelve upland/lowland NERICAs and Sativa-type, and three irrigated rice varieties released in Ethiopia from 1999 up to 2007 [9]. Further; according to [9], the production potential for rain-fed rice in the country was assessed using GIS techniques. The parameters considered were rainfall, slope, soil texture, altitude, and temperature. There are about thirty million ha (5.6 million ha highly suitable and about 25 million suitable) for rice production in the country. However, it should be noted that these estimates are based on only the above-stated parameters without field-level verification. However [4] reported that about 17 million hectares of land are suitable for rice production, Ethiopia has tremendous potential to increase its rice-growing area and is seeking partnerships to make use of this land.

During the Third General Meeting run by the Coalition for African Rice Development (CARD), the Ethiopian government recognized that rice can significantly contribute to improving food security and poverty reduction. Rice could suitably grow in many parts of the country, the predominant potential areas are the west-central highlands of the Amhara Region (Fogera, Gonder Zuria, Dembia, Takusa, and Achefer); North West lowland areas of Amhara and Benshangul Regions (Jawi, Pawi, Metema, and Dangur); Gameblla regional state (Abobo and Etang Woredas) South and South West Lowlands of SNNPR (Beralee, Weyito, Omorate, Gura Ferda, and Menit); Somali Region (Gode); South-Western Highlands of Oromia Region (Illuababora, East and West Wellega and Jimma Zones) [1].

Even though its productivity is high and a lot of potential rice-producing areas in Ethiopia at large and in western Oromia in particular; major constraints are hindering sustainable increased production and productivity. To mention a few: lack of adequate availability to improved seed, poor access to quality improved rice varieties, especially for irrigated rice, lack of quality improved rice seed, poor access and use of modern postharvest techniques and equipment (lack of milling machine (dehuller)); disease, grassy weeds, and insect pests; poor knowledge of producers and other market actors about rice product quality, expensive price of improved seed, excessive numbers of intermediaries, and price seasonality; and finally, inadequate storage [4].

To tackle such challenges, Bako Agricultural Research Center has been conducting intensive research work on the crop and has recently released a rice variety that has better yield, disease, and insect-pest tolerance than the previous varieties. To this end, Bako Agricultural Research Center has recently released a variety; Chawaka with a potential yield of 33qt/ha and 42 qt/ha on farmers' fields and research stations [11], to reverse the scenario and alleviate the problem of low productivity as well as co-related challenges sustainably. To this end, little has been done to demonstrate, evaluate, and transfer improved upland rice varieties with their agronomic practices. Hence, considering the reality mentioned above Bako Agricultural Research Center extension team initiated this activity aimed at demonstrating, evaluating, and transferring the technologies and varieties at farmers' fields thereby outspreading (scaling up/out) those selected technologies to the end users based on the farmers' selection criteria. These in turn increase household income and contribute more to food security to alleviate food shortage.

1.2. Objectives

This activity was mainly with the following objectives:

1. To demonstrate and evaluate improved rice technologies;
2. To evaluate the productivity and profitability of the technology under farmers' conditions;

3. To create awareness of the importance of the technologies;
4. To collect feedback from the participants for further research design and the way.

2. Methodology

2.1. Description of the Study Area

Ilu-Harar district is located in the mid-altitude sub-humid zone in the southwestern part of Ethiopia. It is one of the administrative divisions under the Ilu Ababora Zone of Oromia Regional National State. It is located 654 km from Addis Ababa and is bordered by Bedele, Diga district from East Zone, and Gimbi district from West Wollega zone. The topography of the study area ranges from gently sloping to hilly lands with ridges and valleys in between. The total surface area of the district is 1,230.2 km^2. The Rainfall of the district is characterized by uni-modal that mostly extends from May to October with the highest rainfall usually recorded in August. The mean annual rainfall varies between 1300 and 2000 millimeters. The mean temperature of the study area is $25.1c^0$. The soil type is dark reddish brown and there is a wide area covered with vegetation.

The total population of Ilu-Harar district is 311,422, out of which 157,952 (51%) are males and 153,470 (49%) are females. In terms of population density, Ilu-Harar district stands last in Ilu-Ababora Zone. Population density per Km^2 is estimated at 20 persons. This is very low especially when it is compared with areas in the southern part of the country. The district is characterized by a mixed crop-livestock farming system where livestock rearing and crop production are the major occupations on which the livelihood of the vast majority is based. Maize, rice, sorghum, and finger millet are among the most common cereals whereas haricot, soybean, and sesame are among the most common pulse and oil crops grown.

2.2. Site and Farmers' Selection

Farmer-participatory approach, FRG, was the main strategy to test and verify the technology during the first year and disseminate it in the subsequent years. Accordingly, the project was carried out in a major rice-producing district of the Iluababora zone. From each district, 1 PA was selected. Then in each PA 1 FRG consisting of 15 members (considering gender balance) was formed and managed based on their interest, land ownership, rice production experience, and other important socioeconomic variables. Improved rice variety (Chawaka) was provided to FRG members for pre-extension demonstration of the technologies. Accordingly; four farmers from Ilu-Harar district (Jagan PA) were selected as our host farmers in collaboration with the district agricultural and natural resource office for the demonstration purpose. Selection of the farmers (FRGs) was based on the underlying criterion; firstly; the social status of the farmers' (that can influence his/ her community in decision making) in the community; secondly, their ability as well as willingness to perform practices as per recommendation; thirdly, their interest in rice production and potential land they have and lastly; gender equality issues (at least 5%).

2.3. Provision of Training and Input Distribution and Planting

After sites and farmers were selected both theoretical and practical training was given to farmers, Development agents, and district experts. Training was provided in the following areas; such as rice production management, breeding aspect, and post-harvesting (seed quality). The training aimed to create awareness among farmers, Development agents, and district experts on rice technology. Finally; after the plots were properly plowed and made ready for planting ahead of the planting date, all necessary inputs (seeds, fertilizers) were delivered to the farmers. Planting was made on the farmers' field by Bako Agricultural Research Center researchers, TAs as well and FRG farmers.

2.4. Design of the Activity

Two rice varieties; one newly released variety; namely, Chawaka and NERICA-1 as a standard check were planted on adjacent plots of 10m*10m each. All the necessary recommended agronomic practices; spacing between rows and plants were 20 cm by 10 cm; respectively and fertilizer rate of 100 kg/ha NPS at planting and 100 kg/ha Urea (splitting into $1/3^{rd}$ at planting and the remaining $2/3^{rd}$ after 35 days of planting) were applied. All recommended cultural and agronomic practices were implemented. At the maturity stage, a participatory variety evaluation platform was arranged to attend to the experimenting farmers, neighboring farmers, researchers from Bako Agricultural Research Center, and other stakeholders.

2.5. Data Collected

For this activity all the necessary qualitative and quantitative data were collected; the collected data includes yield data, the total number of farmers who participated in the training, the total number of farmers, DAs, and experts who participated in field visits, farmers' perception on the attribute of the technology, costs, and income gained was collected.

2.6. Data Analysis

The data was analyzed using descriptive statistics such as mean, frequency distribution, tables, and percentages. Also, quantitative data collected were subjected to SPSS software to analyze the mean, standard deviation, t-test, and ANOVA table. Besides; pair-wise ranking techniques were used to evaluate and select the best bet variety/ies and /or technology/gies and to rank their criteria and parameters according to the real situation of the area. Further, gross margin analysis was used as it is very useful in a situation where fixed capital forms a negligible portion of production. Thus; it is the difference between gross income and the total variable cost [8]. Furthermore; according to (Sumai *et al*., 2000), the technology gap and technology index were also calculated using the following formula.

Technology gap = Potential yield qt/ha – Demonstration yield qt/ha

$$\text{Technology index} = \frac{\text{Potential yield} - \text{Demonstration yield}}{\text{Potential yield}} * 100$$

3. Result and Discussions

This part addresses and narrates results from farmers' participatory variety evaluation and selection, mean yield performances of the varieties, yield advantage between the varieties, the technology gap, and index between research station and farmers' fields, financial analysis, ANOVA table as well as t-test. To analyze and interpret to show a clear picture of the result table, percentage, frequency, mean, standard deviation, and significance levels were employed.

3.1. Farmers' Participatory Variety Evaluation and Selection

At maturity, the varieties were then evaluated based on the farmers' selection criteria. At this juncture, the farmers were assisted to jot their evaluation criteria, which then be ordered using the score ranking technique. Each variety was then evaluated against the criteria ordered based on the weight attached to each parameter. At the end of the evaluation process, the result of the evaluation was displayed to the evaluators, and a discussion was made on the way ahead. To this end; FRG farmers scored each variety for individual traits considered important by them and the ranking of varieties was done on a scale of 1-5, *1 being very poor and 5 being the highest score representing superiority*. Accordingly; yield, number of tillers, plant height, spike length, number of seeds per spike, disease tolerance, lodging tolerance, grain color, and early maturing were the main traits/parameters that farmers gave due attention to during evaluation. Accordingly; in the district, based on overall mean score and rank, Chawaka was selected first in all of its traits and then followed by Nerica-1. This underlines the importance of testing improved varieties in farmer's fields across districts. Scoring of farmers' selection criteria was based on a ranking scale from 1-5, with 1 as the most important to 5 as the least important.

3.1.1. Varietal Total and Mean Score Ranking

According to (table 1) the above ranking and scoring of rice varieties in the district was done; accordingly, the highest score was recorded for the Chawaka variety; 5.00, and then by the Nerica-1 variety; 4.10. Consequently; the Chawaka variety was ranked first followed by the Nerica-1 variety. Hence; in almost all of the traits; except its late maturing character Chawaka beat NERICA-1, otherwise. Though Nerica-1 is an early maturing variety with problems, it is highly exposed to bird attack but not for Chawaka. Eventually, the Chawaka variety was preferred and selected first then by the NERICA-1 variety. To show you the result the following score ranking technique summarized in below (table 1) was used. This underlines the importance of testing improved varieties in farmer's fields. To this end, the overall mean score and rank for all the districts are summarized below in (table 1). Based on this the variety/ies selected, accordingly, will be proposed for further scaling up.

Table 1. *The total and mean score ranks for Rice technologies in the study areas.*

Variety	Score Rank (1-5)			Overall Rank
	Total Score	Mean Score	Rank	
Nerica-1	41	4.10	2nd	2nd
Chawaka	50	5.00	1st	1st

NB: 1-10 Parameter set; 1= Disease tolerant, 2=lodging tolerant, 3= tillering capacity, 4=number of tillers per plant, 5=good stand/ plant height, 6= grain color 7= spike length 8= number of seeds per spike 9=grain Size and 10= early maturity

3.1.2. Varietal Traits Pair-Wise Ranking

At maturity farmers were invited to evaluate the varieties based on their criteria; at the outset, they were helped to jot down their selection criteria at random. Then after brief orientation was given to the farmers as to how they integrate their selection parameters with researchers' criteria to evaluate, rank, and select from the demonstrated varieties according to the reality existing and the importance of their situation. Hence; a pair-wise ranking technique was used to order the criteria based on the weight attached. Then the farmers evaluated, ranked, and selected the varieties against the ordered criteria. At the end of the evaluation process, the result of the evaluation was displayed to the farmers, and discussion was made on the way ahead. The variety selected accordingly will be proposed for further scaling up. Accordingly; yield, number of tillers, plant height, spike length, number of seeds per spike, disease tolerance, lodging tolerance, grain color, and early maturing were the main traits/parameters that farmers gave due attention to during evaluation.

To this end; high yielder, disease resistance, tillering capacity, seed color, and number of seeds per spike were the first five best selected and ranked criteria that researchers should seriously consider for future design and way forward to develop farmer-preferred variety/ ies. Apparently; from the listed criteria/ trait early maturity (earliness) gets less attention or is not included as an important trait for the selection of variety/ies. This is mainly because in Western Oromia the intensity and distribution of rainfall may not be a problem. During the course what has been learned was that the farmers' selection criteria are beyond yield and most of the farmers gave priority to qualitative traits such as resistance to disease- pest, tillering capacity, and seed color (marketability) of the variety.

Table 2. *Pair-wise matrix ranking of the varieties.*

Parameters	Yield	Tillering Capacity	Grain Color	Disease Tolerant	Lodging Tolerant	Plant Height	Spike Length	Number of Seed Per Spike	Maturity Time	Frequency	Rank
Yield		1	1	1	1	1	1	1	1	8	1st
Tillering Capacity			2	4	2	2	2	2	2	6	3rd
Grain Color				4	3	3	7	3	3	5	4th
Disease Tolerant					4	4	4	4	4	7	2nd
Lodging Tolerant						6	7	8	5	1	8th
Plant Height							7	8	8	1	8th
Panicle Length								8	9	3	6th
Number of seeds per spike									9	4	5th
Early Maturity										2	7th

Participant farmers participated in the participatory evaluation and selection of the varieties evaluated, ranked, and selected the varieties best preferred and suitable with the real situation existing on the ground against the criteria they listed for the evaluation process. Accordingly; from the evaluation result the best variety selected and suited utmost by farmers at large and by the weight attached to each of the traits is summarized below (table 3).

Table 3. *Varietal ranking based on farmers' selection criteria.*

No	Varieties	Rank	Reasons
1	Chawaka	1st	High yielder, perfect color, good tillering capacity, disease tolerant, lodging tolerant, perfect plant height/stand, good panicle length, a high number of seeds per spike, long maturing, less susceptible to bird attack
2	NERICA-1	2nd	Low yielder, good color, medium tillering capacity, disease tolerant, lodging tolerant, medium plant height/stand, medium panicle length, medium number of seeds per spike, early maturing, susceptible to bird attack

3.2. On-Farm Yield Performances of Rice Varieties

Despite the inevitable variability in performance between and even within locations, yield performances of the varieties were still promising. Accordingly; in the district; Ilu-Harar, the combined mean analysis result of the on-farm yield performance of the varieties demonstrated is summarized below (table 2). Accordingly; a mean yield of 31.30 ± 1.89 qt/ha and 45.57 ± 1.15 qt/ha for NERICA-1 and Chawaka varieties; respectively was gained. From the above result, one can deduce that the Chawaka variety is a higher yielder than by NERICA-1 variety. From the above fact, the average yield of the Chawaka variety exceeds NERICA-1 by 14.27 qt/ha.

Table 4. *Mean yield of Rice Varieties.*

Variety	N	Min	Max	Mean	SD	t-value	Sig.	Yield difference from standard check (qt/ha)	Yield Advantage over the standard check (NERICA-1) (%)
Chawaka	4	43.26	48.74	45.57 ± 1.15	2.30	8.79	0.0031	14.27	45.59
NERICA-1	4	27.38	35.44	31.30 ± 1.89	3.78				

Table 5. *Analysis of the Variance table for yield for the district.*

Source	DF	SS	MS	F	P
Farmer	3	42.95	14.32	2.72	0.2168
Variety	1	406.98	406.98	77.22	0.0031
Error	3	15.81	5.27		
Total	7	465.74			
Grand Mean	38.43				
CV	5.97				

Moreover, the statistical mean yield comparison (t-test) result summarized above (table 3) verifies that as there is highly significant difference exists between the varieties demonstrated; Chawaka and NERICA-1, at ($p<0.05$). Furthermore; the ANOVA table result summarized below (table 4) also showed that there is a highly significant difference at ($p<0.05$) between the varieties. This means that there is a highly significant difference in mean yield gained between rice varieties; Chawaka and the standard check NERICA-1.

3.3. Yield Advantage

Calculating the yield advantage of the varieties helps: to show the extra benefit in percentage that the farmers obtained from producing improved variety. Besides; it helps to recommend based on the relative yield advantage over other varieties. Accordingly; from the below (table 5) result it could be concluded that on average Chawaka variety had a 45.59% yield advantage over NERICA -1 per hectare of land and calculated using the underlying formula.

$$\text{Yield advantage } \% = \frac{\text{Yield of a new variety} - \text{Yield of standard check}}{\text{The yield of standard check}} \times 100$$

Table 6. *Yield advantage of demonstrated rice varieties over the standard check.*

Demonstrated Varieties	The yield obtained (qt/ha)	Yield advantage over the standard check (Nerica-1)
Chawaka	45.57	45.59
NERICA-1	31.30	

3.4. Technology Gap and Technology Index

This part is to show the real gap potential difference between the research station and on farmers' field of technology. Potential yield (Yp) is the yield of a current cultivar "when grown in environments to which it is adapted; with nutrients and water non-limiting; and with pests, diseases, weeds, lodging, and other stresses effectively controlled" [3]. The technology gap indicates that the gap in the demonstration yield over the potential yield. The observed technology gap is attributed to dissimilarities in fertility, acidity, rainfall, and other natural calamities [2]. According to [2], its contribution is to narrow down the gap between the yields of different varieties and to provide location-specific recommendations. The yield gaps can be further categorized into technology index which is used to show the feasibility of the variety at the farmer's field. The lower the values of the technology index the more the feasibility of the varieties. To this end, the technology gap and index of demonstrated varieties (Chawaka and NERICA-1) were calculated using the underlying formulas and presented below (table 5).

$$\text{Technology gap} = \text{Potential yield} - \text{Demonstration yield}$$

$$\text{Technology index} = \frac{\text{Potential yield} - \text{Demonstration yield}}{\text{Potential yield}} * 100$$

Table 7. *Technology gap and technology index for demonstrated rice varieties.*

Parameter	RiceVarieties	
	Chawaka	NERICA-1
Yield gap (qt/ha)	(-) 3.57	7.2
Technology index (%)	(-) 8.5	18.70

From the above (table 6) result the yield gap is -3.57 qt/ha and 7.2 qt/ha for Chawaka and NERICA-1 varieties; respectively. This means that there was no yield reduction observed in the Chawaka variety from its potential inherited and almost the Chawaka variety retained its potential yield acquired when released and expressed also during the demonstration. Whereas; on the NERICA-1 variety there was yield reduction observed of its potential inherited and expressed below its potential during a demonstration. To this end, there was no gap observed on the Chawaka variety which in turn showed the demonstration yield is almost similar to the potential yield. Moreover; the result of the above (table 5) showed the technology index for both rice varieties were –8.5 % and 18.70 % for Chawaka and NERICA-1 varieties; respectively. That means the Chawaka variety is with the lowest index and this dictates that this variety is feasible to the farmers in the study area and other similar agro-ecologies. Therefore; when compared to the station (research) field and farmers' field there was no gap in the potential of the technology/ies. But on the NERICA-1 variety, there was a wider gap observed and this is to mean that when planted on farmers' fields the potential of the technology was reduced by 18.70 %. This might stem from soil fertility status, the difference in management (such as time and frequency of weeding, fertilizer rate, etc), disease, etc; consequently, inhibiting from expressing its potential intact.

3.5. Financial Analysis

In terms of profitability, the financial analysis result (below Table 6) showed that an average return of 26,660 Birr and 43,808 Birr per hectare can be gained from NERICA-1, and Chawaka varieties, respectively per production season in the areas where the activity carried out. This implies that when compared the highest profit was gained from the Chawaka variety then by NERICA-1. Besides; the result below (table 7) also implied that the highest returns; 4.02 and 2.44, were gained from Chawaka and NERICA-1 varieties; respectively. Therefore; from this result, it can be concluded that the Chawaka variety is a higher yielder than the NERICA-1 variety and in general using improved variety seeds was more economically profitable than commercial (local) variety.

Table 8. *Gross margin analysis of rice demonstration for Ilu-Harar district.*

Variety	Yield (qt/ha)	Market price (Birr)	Fertilizer Cost (Birr)	Seed cost (Birr)	Labor cost (Birr)	TVC	TR (P*Q)	GM (Profit)	Return to investment
NERICA-1	31.30	1200	2900	2000	6000	10,900	37,560	26,660	2.44
Chawaka	45.59	1200	2900	2000	6000	10,900	54,708	43,808	4.02

3.6. Training of Farmers, Experts, and DAs

A total of 48 participants (40 farmers, 4 DAs and Supervisors, and 4 agricultural experts) participated in this training (Table 9) in the district.

Table 9. *Stakeholder training participants across the demonstration districts.*

Participants	District	Total
	Ilu-Harar	
Experts	4	4
DAs and supervisors	4	4
Farmers	40	40
Total	48	48

3.7. Farmers on Field Visit Event

A field visit was also arranged across the districts to evaluate/select best-performing varieties, enhance farmers' knowledge on rice production and management, and collect feedback from all relevant stakeholders for further ways forward. On the field visit event, a total of 400 participants; 350 farmers, 30 DAs and Supervisors, and 20 agricultural experts participated in this field visit in the district.

3.8. Farmers' Perception of the Technology

In participatory variety evaluation and selection, farmers set their criteria by their real situation. Accordingly; farmers evaluated, ranked, and selected Chawaka first and then NERICA-1 second against the criteria they set. Hence; farmers preferred Chawaka because it is late maturing variety, is a high yielder, is disease tolerant, has no bird attack, has a high number of seeds per spike, seed color, and high number of tillers as compared with the standard check; NERICA-1. Apart from this fact, though the second selected NERICA-1 except for its early maturing nature of the variety that exposes the variety to serious bird attack, even good yield can be obtained as compared to the commercial varieties (commonly known as Local varieties) at the hands of the farmers'. Also, this variety inherits beautiful traits; such as grain color important traits for marketability that cannot hinder it as the best option from disseminating to a large number of farmers and a wider area. Therefore; since the farmers evaluated, ranked, and selected the Chawaka variety first with its distinct traits inherited the variety will be disseminated in a large area and for a greater number of farmers where the activity carried out and others similar agroecologies. But also, as a quality supply of this variety; Chawaka, is scarce as compared with the high demand from many end users we shall encourage and recommend even the standard check; NERICA-1 as the best option over using commercial (local) varieties.

4. Conclusions and Recommendations

This pre-extension demonstration of improved rice technologies was carried out in one selected district of Ilu-Harar of the then Ilu-Ababora zone of Western Oromia. One newly released rice variety; Chawaka, was planted along with standard check; NERICA-1, on 10m*10m adjacent plots of land and a total of 4 hosting farmers in the district.

At the maturity stage, participatory variety evaluation and selection was arranged and held to evaluate, rank, and select the best-suiting variety/according to their real situation. Accordingly; the Chawaka variety was selected first in all of the traits and then by NERICA-1 one after the other. Chawaka variety suits the farmers' selection criteria and is ranked as a high yielder and other traits listed. Even the standard check; NERICA-1 can be an option as it can give a higher yield than varieties the farmers have been using. To this end; the demonstrated improved variety was much better in yield performances than the standard released check used and varieties on the hands of the farmers.

Moreover; the Chawaka variety demonstrated was far better in financial profitability, yield advantage of about 45.59 %, and suiting farmers' needs. Further; statistical analysis of mean yield performance comparison between the varieties (t-test) and ANOVA table results of the varieties on yield showed that there exists a highly significant difference at ($p<0.05$). Eventually; farmers evaluated, preferred, and selected Chawaka first and then the NERICA-1 variety second, but as farmers evaluated low yielder as compared to Chawaka and secondly selected; the NERICA-1 variety, can excel in yield than commercial varieties the farmers have been using. Therefore; this entails scaling up/out activity will be the next activity to be carried out for the coming years for Chawaka variety as a prior and even the standard check; NERICA-1 as a best option, on a greater number of farmers and on wider areas where the activity was carried out and other similar agro-ecologies.

Acknowledgments

In the first place, we want to acknowledge the almighty Lord for giving us everything and life. Secondly; all our colleagues in the center especially biological researchers in the cereal team for their collaboration in delivering us different improved seeds. Last but not least appreciation will go to the center for its cooperation in providing all the physical and financial resources.

Conflicts of Interest

We have no conflicts of interest to disclose**.**

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