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Farmer's Perception Towards Agricultural Lime Technology in the Case of Ejere District, West Shewa, Zone of Oromia Region, Ethiopia

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Abstract: The purpose of the study is to find out how farmers perceive about agricultural lime technologies in some chosen kebeles within the districts of Ejere. This study examines farmers' opinions about lime technology were measured using a scale with items developed for the purpose of this study. A multistage sampling procedure was employed to draw 145 sample households from one woreda and three kebeles. Using a Likert type scale, sample respondents' responses to the perception were examined. According to the degree of agreement, the outcome showed that the perception on the statement lime treat (amend) soil acidity, improve crop yield, improve crop yield for consecutive years, reduce crop disease showed positive perception from the respondent Whereas, perception on the statement lime needs additional labor and time, technological availability and soil acidity testing service shows the lowest degree of agreement in relation to the other level of agreement parameters taken into consideration. Despite the fact that the study area's households benefit more from technology, It is discouraged for certain farmers to use the lime technology due to unavailability of the technology (lime shortage), unawareness about lime technology, transportation problem, labor shortage and a problem of soil acidity testing service were some of the elements influencing the study area's adoption of lime technology. Therefore, the government, nongovernmental organizations, and other stakeholders focused more on making better access to agricultural lime timely and needed to put in place infrastructural and policy support at different levels for technical interventions to address the problem of acid soils in general and in the study area in particular.

Keywords: Lime, Likert Scale, Perception, Smallholder Farmers, Technology

1. Introduction

Perception is the process by which our senses are organized and interpreted to provide meaning for the environment [1]. It is a person's summation of acts taken to raise awareness and evaluate environmental information. Based on their prior experiences, the individual interprets the inputs into something meaningful. However, how a person understands or perceives something might not match reality. The farmers' perception of a new technology is necessary foundation for acceptance [2].

Technology adoption is a complicated and dynamic process that depends on a variety of variables, including perceived technological characteristics and farmer situations and conditions. According to the adopter perception model, adoption behavior is influenced by how innovations are viewed [3]. Therefore, people's perceptions of the technologies useful to them determine its adoption. A Variety of factors, some personal and others based on the effectiveness and utility of the technology, influence users' opinions. Users' acceptance or rejection of technologies may be a reflection of the technologies' capacity for reasoned decision-making. Users are likely to reject technology that does not meet their demands, is inappropriate for their workplace, or could potentially interfere with other activities that they deem vital. Adoption decisions of technology have been found to be highly influenced by these subjective technology features. [4].

The possibility of successful and long-term scaling-up of agricultural technology rises when farmers are able to adopt new technologies in their local contexts first and have the

chance to modify them [5, 6]. The attitudes and beliefs of the community are key factors in determining how agricultural technologies are adopted [7]. The limited applicability of farmers' preferences in economists' adoption studies and contends that farmers' perceptions have a significant influence on their adoption decisions [8]. This indicates that in order to improve the traditional economic analysis of farmers' decision-making, it is imperative to comprehend and take into account the importance of elements connected to farmer behavior and perceptions in adoption studies.

Effective adoption and scaling-up of sustainable Agricultural technologies has great potential to develop the agricultural sector in rural areas and ensure food security [9]; Farmer stated that technology is useful to farmers. Farmers employ technology because it produces high yield with good efficiency, fewer pests, and extra advantages. However, technical and socioeconomic factors interact to affect how farmers view particular technologies [10]. Different Agricultural technologies face different constraints for adoption and scaling-up, which vary by region because adoption processes are Sustainability highly localized [11]. Furthermore, several authors have shown that farmers' perceptions influence their adoption and scaling-up decisions. In Tanzania the scaling-up of Agricultural technology is based on the initial resource requirements for adoption [12].

A number of factors were taken into consideration when choosing the improved agricultural technology, including the product's ability to produce food and cash, people's perceptions of its qualities, the innovation's complexity and performance, its availability and that of complementary inputs, the relative profitability of its adoption when compared to alternative technologies, the time it takes for an investment to pay for itself, local adoption patterns of the technology, the technology's susceptibility to environmental hazards, etc were used to choose the most advanced agricultural technologies [13].

Farmers' perception of technology is a decisive factor in whether a given technology is adopted or not. Researchers do not criticize farmers if their views deviate from theirs as farmers have their meaning about technologies (i.e. perception of farmers). Farmers' adoption behavior is influenced by their subjective opinions of new technology in the context of the current socioeconomic atmosphere. Adopter perception is currently a notion featured in a variety of agricultural economics publications [14].

The decision to use of technology is dependent on how farmers perceive of technology. Perception acts as filter through which new observations are interpreted. [15], perception is the process by which we received information or stimuli from our environment and transform it into psychological awareness.

Before releasing improved varieties onto the market, the intended end users thoroughly assess and approve the production and consumption qualities of enhanced seeds [16]. Evidence and experience from sub-Saharan African nations suggest that agricultural technology improvement could yield very large and long-lasting returns. Assets, money, institutions, vulnerability, awareness, labor, and inventiveness among smallholder farmers are the elements influencing the use of technology [17].

Farmers' perceptions of new technology have been taken into account in quantitative research that considered farmers' opinions in relation to adoption choices. It is believed that farmers possess personal tendencies towards certain traits present in new technology or advances. The adoption of technology is thought to be significantly influenced by these preferences. Farmers' adoption of technologies is an example of rational decision-making based on their assessments of the suitability of the technology's attributes.

It is crucial to examine farmers' opinions regarding each aspect of a particular area of expertise in order to gain insight into their decisions about the adoption of new technologies. Thus, it is necessary to understand the evaluative criteria used by the farmers who responded in terms of expertise qualities. The study area, Ejere woreda, is one of the sites affected severely by soil acidity problem and where low adoption of lime technology is recorded. Having implemented many interventions, as a result, this study was conducted with the objective of examining smallholder farmer's perception towards lime technology in the research area.

2. Methodology of the Study

2.1. Description of the Study Area

The capital of the Ejere district, which is 50 kilometers west of Addis Ababa, is found in the West Shewa Zone of Oromia Regional State. With an estimated 592.19 square kilometers, it is bounded by the Southwest Shewa Zone to the south, the Dendi district to the west, the Jeldu district to the northwest, the Meta Robi district to the north, the Adda Berga district to the northeast, and the Walmera district to the east.

There are 29 kebeles in the district altogether, of which 26 are administration areas for kebeles situated in rural regions and 3 are town kebeles. An estimated 114,714 people live in the district overall, with 56,444 women and 58,265 men. Rural agricultural households make up 88.36% of all households [18]. The district is situated between 2,060 and 3,185 meters above sea level. It has an annual temperature range of 90°C to 180°C and receives 900–1,200 mm of rainfall. Two agro-ecologies are found in the district: Dega (45%) and Weina Dega (55%) implying highland and midland regions, respectively [19].

The district's soil types are mostly mixed (10%), black (32%), and red (58%). The district is known for its mixed-subsistence farming, where raising cattle and crops is a typical source of income. The district is thought to have a total area of 56,918 hectares, of which 40,985 ha are used for cultivation, 4,446 ha for grazing, 4,456 ha for forest and 7,031 ha for other uses.

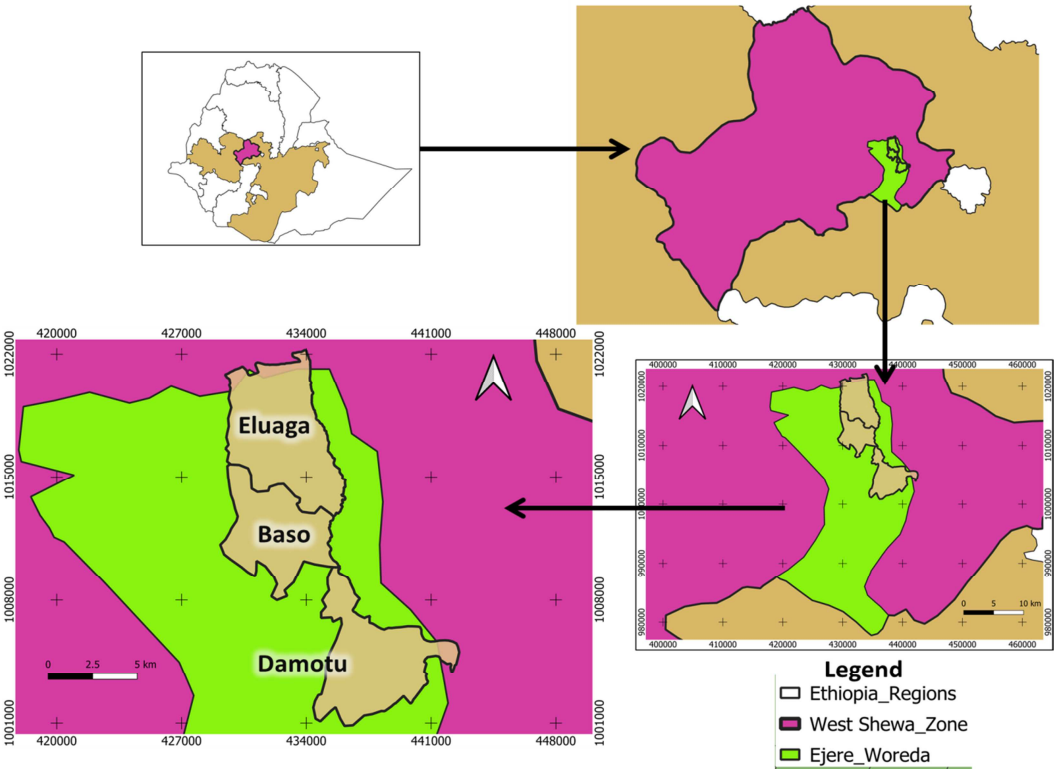

Figure 1. *Location of the study area.*

2.2. Data Types and Sources of Data

The study used primary and secondary data sources with both quantitative and qualitative data kinds. Key informant interviews, focus groups, personal observation, and household surveys were used to gather primary data. The agricultural office of the Ejere district provided secondary data, which was gathered by looking through both published and unpublished papers as well as online sources.

2.3. Sampling Procedure and Sample Size Determination

For the analysis, a combination of purposive sampling technique and simple random sampling method was employed. First, Ejere woreda was purposively selected based on the intensity of lime technology intervention. In the second, kebeles were identified as lime adopters (users) in collaboration with the District Agricultural Office. And three kebeles were randomly chosen. These sample Kebeles had been Damotu, Eluaga and Beso. Lastly, simple random sampling was used to select sample households (adopters and non-adopters) from each selected Kebeles. A total of 145 samples were chosen, 61 of which were adopters and 84 farm households that were not adopters took part in the entire process. The study employed Yamane's (1967) formula to determine the sample size.

$$n = \frac{N}{1+N(e)2}$$

$$=2037/1+2037(0.08)^2$$

$$= 145$$

Where; n is a sample size, N is the population size (total number of households in three *kebeles*), e is allowable margin of error (level of precision) 8% (0.08 adapted by reviewing various literature); 1 designates the probability of the event occurring.

Therefore; The Total sample size was 145, and the technique of probability sampling was utilized to produce the intended sample size for the study sites.

Table 1. *Probability distribution of sample respondents according to size as determined by Kebeles.*

S/N	Kebeles Name	Total HH at each Kebele	Total sample size
1.	Damotu	767	55
2.	Eluaga	719	51
3.	Baso	551	39
	Total	2037	145

Source: Computed based on data obtained from Ejere woreda administration.

2.4. Method of Data Collection

Both primary and secondary data were used in this study in order to meet its goals. The study's primary data source was a field survey, which concentrated on information about the respondents' socioeconomic, institutional, demographic, and psychological traits as well as other pertinent details that were crucial to the study.

Secondary data was gathered from the agricultural office of the Ejere district, reviewing both published and unpublished materials, such as books, journals, office records, scientific research projects, and online resources. Primary data was collected through Household survey questionnaires,

focus group discussions key informant interviews and Personal observation was done by using respondent and development agents.

Focus group discussion: 8-12 participants were selected for a group FGD which involves encouraging a group of people with related problems and experience to participate. Two FGDs were held in each kebele, the non-adopter's and the adopter's respective ones. The researcher gave the participants a range of open-ended questions to share their opinions and thoughts about the adoption and perceptions of lime technology as well as other relevant issues.

2.5. Method of Data Analysis

Descriptive analysis:

Farmers perception towards lime technology is described and measured based on the agreement level of the respondents perceived during the data collection. Perception was measured using a scale with items developed for the purpose of this study. The responses of respondents regarding lime technology in the study area were measured using a 5-point Likert-type scale; for every statement or item, respondents were required to choose one of the available possibilities. Since the Likert scale was measured on a scale of 1 to 5, with 1 representing strongly disagree, 5 representing strongly agree, and 3 representing undecided/neutral, the responses of the sample households were then analyzed using frequency, percentage, and mean.

3. Result and Discussion

3.1. Adoption Status of Lime Technologies

According to this study, smallholder farmers who apply lime input are considered adopters of lime. As a result, among the 145 participants in total, 61 (42.07%) were determined to be adopters of lime technology in Ejere woreda, while the rest 84 (57.93%) were found to be non-adopters.

3.2. Results of Focus Group Discussion

Participants in the focus group discussions (FGDs) from the three kebeles of the woreda reported that the adoption status and rate of lime technology is rising year by year, but more slowly. The low level of lime input use is attributed to the low availability of lime, labor requirement of the application of lime and poor access to credit to buy the lime.

According to the farmers, lime technology is introduced to the woreda for the first time by the Holetta Agricultural Research Center. The farmers indicated that the center tested their soil and distributed the lime to them. In the beginning, the farmers refused to accept the lime technology. However, through training and awareness creation, they started to use the technology. Currently, the farmers recognized the importance of lime technology in enhancing the productivity of the soil. Thus, they will continue to use the technology if there is an adequate supply.

Figure 2. *Pictures of FGD in Damotu kebele.*

According to this specific study, the degree of lime technology usage shows that from the total 299.61 hectares of farmland only 58.25 hectares of land treated by lime implies that 19.41% of the farmland treated by lime, between none of the adopter households (0.0 ha to 1.5 hectares) treated their acidic plots in this specific study area, for this 58.25 hectare of land around 30 tons of lime per annum is currently being applied; the survey result showed that the adoption of recommended and required amount of lime inputs application in the study area was low due to different factors, Limited availability /access/of lime, lack of awareness and the technology required labor is some barrier to the broader application of lime technologies.

Table 2. *Adoption intensity of lime in Ejere Woreda.*

Woreda Ejere	Households Average land holding size		average area (ha) of land treated by lime		
	n	Total sample average (ha)	n	sample (ha)	% of area treated by lime
	145	2.06	61	0.31	15.04

Source: Computed from own survey (2023)

3.3. Perception of Farmer's Towards Adoption of Lime Technology Related Analysis Results

The farmer thought that technology was useful for farmers because technologies offer good efficiency in terms of high output, fewer pests, and farmers trust them [13], claim that factors such as the product's capacity to produce food and money, how people perceive its characteristics, how well the innovation performs, and other similar aspects were taken into consideration when choosing an improved agricultural technology.

The study reveals a farmer's viewpoint on the adoption of lime technology. Seven statements (Table 3) about different lime technology adoptions were assessed. A 5-point Likert-type scale was employed to evaluate respondents' opinions on lime technology adoption in the study area.

For every statement or item, respondents were required to choose one of the available possibilities. Since the Likert scale was measured on a scale of 1 to 5, with 1 representing strongly disagree, 5 representing strongly agree, and 3 representing undecided/neutral, the responses of the sample households were then analyzed using frequency, percentage, and mean.

Table 3. *Respondent's perception on the adoption of lime technology.*

Statements	Respondent distribution according to their reaction						
	SA (5)	AG (4)	*N* (3)	DA (2)	SDA(1)	Mean	STD
uses of lime treat (amend) soil acidity	64 (44.4)	63 (43.4)	18 (12.4)			1.689	0.702
Lime adoption improve crop yield	70 (48.2)	65 (44.8)	10 (6.8)			1.586	0.618
lime use is improve crop yield for consecutive years	33 (22.7)	58 (40)	50 (34.4)	4 (2.7)		2.234	0.849
Needs additional labor and time	65 (44.8)	73 (50.3)	7 (4.82)			2.806	1.062
Reduce crop disease	13 (8.9)	52 (38.8)	37 (25.1)	36 (24.8)	7 (4.8)	2.806	1.062
Availability of lime is a problem in the area	82 (66.1)	42 (28.9)	20 (13.7)	1 (0.6)		1.586	0.750
soil acidity testing service is a problem in the area	73 (50.3)	52 (35.8)	18 (12.4)	2 (1.3)		1.648	.7502

The numbers without ( ) frequency and the numbers with ( ) percentages, AG (agree), N (neutral), DA (disagree), and SDA (strongly disagree) and SA (strongly agree). Source: own survey data, 2023.

1) *Perception of the respondents about lime technology in Strongly Agreed and Agreed Categories.* The majority of the respondents strongly agreed and agreed on the study area based on the given statement, some disagreed and strongly disagreed, and some were neutral with their clear mean perception.
2) *Perception of the Respondent about lime technology in the Neutral/Undecided Category.* Some respondents answered in the neutral or undecided category because they were unsure or did not perceive whether the adoption of lime technology for their acidic soils amendment, and they were not aware of lime technologies relation to all statements mentioned above (table 3).

In the statement, uses of lime treat (amend) soil acidity, Perception of the total sample of respondents were strongly agreed (44.4%), agreed (43.4%), and were undecided (12.4%), According to this result, the majority of the respondents strongly agreed lime use treat soil acidity.

In the statement lime adoption improve crop yield, perception of the total sample respondent (48.2%) were strongly agreed, (44.8%) were agreed and the rest (6.8%) were neutral or undecided. This result revealed that lime technology is important to increase productivity in acidic soil areas. Furthermore, lime use is improving crop yield for consecutive years, with this statement (22.7%) strongly agreed (40%) were agreed, (34.4 %) were neutral and the rest (2.7 %) disagreed.

According to this result, the majority of the respondents agreed and stated that once lime is applied in their acidic plots its effect is seen for consecutive years for more than 2-3 years. FGD finding on adopters groups also confirmed this perception during the discussion.

The majority of the respondents agreed with lime use needed additional labor and time (50.3%) and (44.8%) were strongly agreed and the rest (4.8%) were undecided, with this result lime application in their acidic plots were need additional labor.

Some respondents disagree (24.8) and a few respondents (4.8%) strongly disagree with the statement lime use reduces crop disease, the majority of (50.3%) agreed and (8.9%) were strongly agreed with this statement the rest (25%) respondent were undecided with this point.

With the statement Availability of lime is a problem in the area, the majority of the sample respondents strongly agree (66.1%), and (28.9) were agreed the rest (13.7) were undecided and only (0.6%) of respondents disagree this statement. The result reveled that lime availability is major problem in the study area, similarly with the statement of soil acidity testing service is a problem in the area, from the total sample house hold (50.3%)were strongly agree,(35.8%)were agree and (12.4%)were undecided and the rest (1.3%) were disagree with this statement. As the result indicated soil testing service is another problem in the study area.

4. Conclusion and Policy Recommendation

The study's findings lead to the following conclusions. The majority of responders agreed and thought that adopting lime technologies; However household 'Unavailability of the technology (lime shortage), unawareness about lime technology, transportation problem, labor shortage and a problem of soil acidity testing service were some of factors that influenced the adoption of lime technology in the study area.

Generally farmers would need to include lime as an additional required input; thus emphasis needs to be given to increasing the adoption of lime technology. The government, nongovernmental organizations, and other stakeholders should focused more on making better access to agricultural lime timely and needed to put in place infrastructural and policy support at different levels for technical interventions to address the problem of acid soils in general and in the study area in particular.

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