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Assessment on Farmers' Willingness to Adopt Improved Forage Production in South Tigray, Ethiopia

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Abstract
This paper was planned to analyze farmers' willingness to adopt improved forage production that mainly aimed at identifying the social, institutional, economic and physical factors that affect the adoption and intensity of adoption for forage production; identifying farmers' evaluation criteria for improved forage distribution and assessing alternative methods and strategies to enhance the use of improved forage varieties to improve the livestock feeding system. The data used for the empirical analysis was obtained from a survey of 56 household farmers in southern zone of Tigray. Kebeles and household farmers were selected using systematic random sampling and proportional sampling techniques and data was analyzed using a logistic regression model. The results of this study show that variables related to age, education level, land tenure, farm size and level of income do not significantly affect the degree to which improved forage production is adopted. Other empirical studies also show that age, education level, the salinity level of water and membership in a farmers' association do not significantly influence the degree to which salt-tolerant forage production is adopted (Ali Chebil, etal.,2009). On the other hand, labor constraint, membership in a farmers' organization and the rate of extension advises significantly affect forage crop production. These variables have significant and positive relationship with forage adoption. This indicates that farmers' that were members of any local organization and those had the access for frequent extension advice in addition to own labor resources have better adopted. So, agricultural extension services should ensure that farmers' participation in various local organizations and frequent extension advises has to be strengthened to encourage them to adopt forage production and pass on their knowledge to other farmers.
Keywords: Adoption, feed, improved forage production, south Tigray

1.Introduction

Agricultural development will be conditioned by Government policies, by the prevailing economic, social, institutional and infrastructural conditions. It is too simplistic to visualize a problem and a purely agronomic solution. We live in complex societies where many factors are interrelated, and so it is at farm level. Farming systems are often characterized by activities related to crop and animal production, family and household consumption, production, labour and leisure time usage, and off-farm household tasks (Swanson, 1984). Technology development and transfer activities that do not consider these complexities might attempt to extend inappropriate technology which will not be accepted by the farmer e.g. new high yielding crops may be rejected because they need attention during seasons where off-farm labor demands are high.

Forage and browse legumes play an important role in sustaining livelihoods of small- and medium-scale farmers in the tropics, mainly as a result of their contribution to economic and environmental sustainability (C Mapiye et al., in Peters and Lascano 2003). Legumes play a vital role in the improvement of tropical pastures, largely due to their ability to fix atmospheric nitrogen. Apart from the direct contribution to livestock production, particularly in intensive systems such as dairy, through the provision of protein-rich fodder, legumes can improve the productivity of rangelands by increasing the amount of nitrogen available for uptake by associated grasses (Giller 2001). Major limitations to the adoption of forage legume based technologies include the scarcity and high cost of seed and inoculants; poor identification of entry points and target groups; difficulties associated with establishment and maintenance of legumes; limited exploitation of the multipurpose nature of many types of forage legumes; isolated efforts in feed and soil improvement; and often difficult socio-economic environments (Mapiye et al 2006; Kumwenda and Ngwira 2003; Mupangwa 1994).

Forage legumes offer a lower-cost alternative to nitrogen fertilisers and purchased protein supplements for improving dairy cattle feed resources in the tropics (Mapiye et al 2006).

Crop residues account for over 90% of all available feed in the Ethiopian highlands (de Leeuw, 1997). Such feed resources are high in fiber, with low to moderate digestibility and low levels of nitrogen and minerals (Preston, 1995). Such low quality feeds are associated with a low voluntary intake, thus resulting in insufficient nutrient supply, low productivity and even weight loss (Hindrichsen et al. 2001).

Hence, the use of cereal straw for ruminant feeding is essentially constrained by its low digestibility and voluntary intake, so that energy requirements for maintenance are not satisfied when it is given as the only feed to animals (Castrillo et al. 1991). Moreover Berhanu et al. (2009) reported that wheat bran is the major agro-industrial by product supplied in Tigray, while oilseed cakes are uncommon. As compare with other feed

types, there is a sharp increase in oil seed cake prices recently due to increase in fattening activities. Berhanu et. al (2009) indicted that 680 ton of wheat bran and cotton seed cakes were exported to Djibouti. Due to this reason the price of oil seed cake in Ethiopia, particularly in Tigray rising and erratic availability. Even though use of chemical treatments such as oxidizing agents, alkali-based agents and urea were attractive methods to solve protein source problems but due to cost implications and their difficulty to apply were no recommended (McDonald et al. 1995).

Effective methods through which utilization of low quality roughages could be improved include supplementation with energy and nitrogen sources, chemical or physical treatment, and selection and breeding of crops, each of which ultimately depends on the economic benefits and applicability (McDonald et al. 2002). The most economical and feasible method of improving utilization of low quality crop residues is by supplementation with high nitrogen multipurpose tree legumes and some of the high protein agro-industrial by-products (Reed et al. 1990).

Forage and browse legumes supplementation have been found to be effective in improving the utilization of crop residues (Richard et al. 1994b). Osuji et al. (1993) have suggested that forage legumes may be better nitrogen supplement than most of the conventional protein sources due to low cost of producing them by small holder farmers . although Forage and browse legumes are most economical and feasible method of improving utilization of low quality crop residues but their adoption is not still sufficient. So this study is aimed to identify the determinants of the technology adoption to point out a new way of forage technology development strategy.

2.Objectives

The main objective of this study is to identify and analyze farmers' problem on the adoption rate of forage development and set a solution based on the results found in the study.

2.1. Specific objectives

- To identify social, institutional, economic and physical factors that affect the adoption and intensity of improved forage development in the area
- To identify farmers' evaluation criteria of improved forage distributed in the Study area.
- To identify alternative methods and strategies to enhance the use of improved forage varieties for farmers.

3. Methodology

3.1 Sampling technique

The study was including both improved feeds delivered by agricultural research center and agricultural development bureau. To cover the whole southern zone of Tigray, systematic random sampling was used to select four representative tabias hosted forage development practice from four woreda. Proportional sampling was used to select farmers from each tabias.

3.2 Method of data collection

The study was conducted in two districts of lowland and two districts from the highlands of southern Tigray region. To produce full information for the subject matter Primary data was collected through key informant interview, informal discussion with farmers and development agents.

3.3 Data analysis

The data was coded and entered into Statistical Package for Social Science (SPSS) version 16.0 computer program for analysis. The different analytical techniques such as descriptive statistics (such as percentages, frequencies, mean and standard deviations) and Mean comparison methods (independent sample t-test and $\chi 2$) and Pearson chi-square used to test potential power of the continuous and discrete variables that influence the adoption of improved feed varieties in the study area, logistic regression model was employed to determine the factors affecting the adoption of improved forage varieties.

4.Result and discussion

This section presents results of the study and discusses the results by giving due emphasis on purpose of the research objectives. For the sake of clarity and ease of understanding the descriptive results and analytical findings pertaining to forage adoption will be discussed using different statically tools. First to get general livestock and feed image of the study areas this section will discuss livestock production system and feed availability as well as feed composition in general. Secondly socio-economic and physical characteristics of sample households in reference to adoption of forage will be discussed. Then it presents a brief description of the forage development practices commonly used in the study area. The last section presents and discusses farmers' forage adoption determinants.

4.1. Breed and feed composition of sample farmers

4.1.1. Livestock production systems

The proportion of households that keep sheep, local and improved dairy cows were 8.3 %, 3 % and 2.5 % respectively. Poultry village (12%), sheep (8.3%), goats (7.3%), camels (7%) and traditional beekeeping (5%) were the major animals reared in the study areas where as improved bulls or castrated male cattle, improved dairy cows (lactating and non-lactating), improved dairy heifers, improved dairy calves, modern beekeeping and horse are reared in small number and most of the households in the study areas did not give priority to these animals in their animal production practices. The relative importance of sheep rearing (8.3%) over improved dairy cows and improved bull or castrated male cattle and buffalo (1%) is highly significant. All households in the study area dominantly keep chickens.

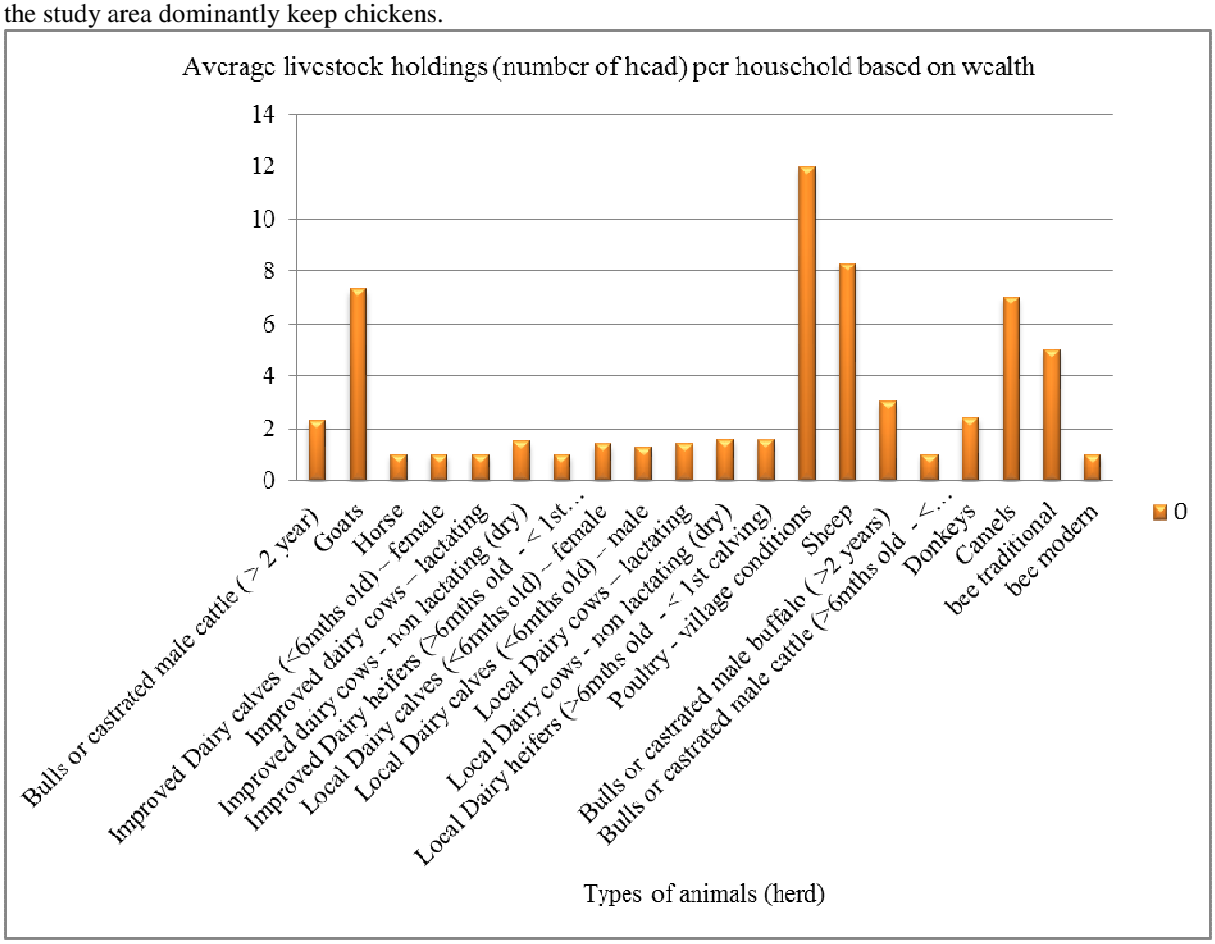

Figure 1. Livestock production system

4.1.2. Feed resources: Availability, quality, seasonality

The feed resources in study areas include grazing, cereal and legume crop residues, hay, green fodders (mainly weeds) and planted fodder. These feeds were either obtained from communal lands (grazing) and private lands (crop residues and weeds), produced (planted fodder and hay) or were purchased (crop residues, hay and green fodder accounting for 26% and 4% of the feed purchased). Overall feed availability and quality was low because communal grazing lands are degraded and only few farmers produce cultivated fodder on small pieces of land. The major feed sources are naturally occurring feeds either collected (hay and weeds) or used *in situ* (grazing lands). The relative contributions of the different feed sources to the total dry matter (DM), metabolizable energy (ME) and crude protein (CP) contents of the total diet are shown in Figures 4.6. There is a seasonal variation in the contribution of these feeds as depicted in grape 3. Generally feed availability is high during the rainy and wet seasons (July- September) and crop harvesting period (October - January) which are the major contributors for grazing, green forages and crop residues/hay respectively. However, commercial concentrates (wheat bran) account for 0.42% of the feeds purchased.

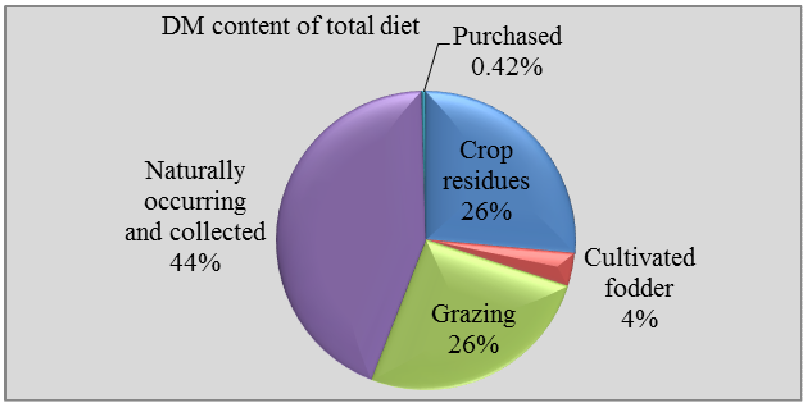

Figure 2. Percentage composition of feed availability

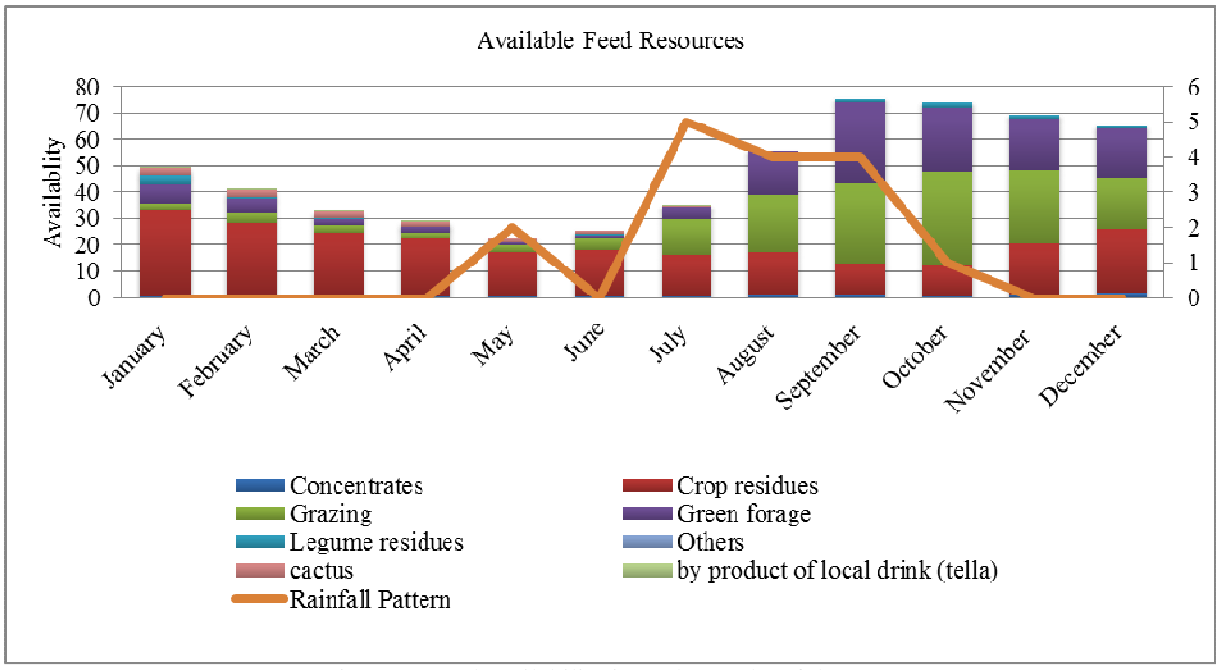

Figure 3. Feed availability in each months of the year

4.2. Socioeconomic and physical factors

Examining the socioeconomic and institutional characteristics of the sample households is of paramount importance because they are directly related to the supply and demand conditions for basic human necessities. To this effect, this section presented some of the major socioeconomic characteristics of sample households' and their relation with the adoption of forage development practice.

4.2.1. Age of the household head

Table 1: Distribution of sample households by age 2005 (N= 56)

Forage	N	Mean	Std. Deviation	T-v	Sig. (2-tailed
Non-adopters	27	42.6296	10.83139	-0.041	0.968
Adopters	29	42.7586	12.66507		
Levene's Test (sig 0.209)		(equal variance)			

It is a well-established fact that farming experience is an important factor for success or failure in the farming business; towards this end, analyzing the age of household head with respect to adoption seems important. The mean age of the household head was 42.6 years for adopters, while that of non-adopters was 42.8. Age of the household head was one of the demographic characteristics hypothesized to influence adoption. The survey result showed that, the difference in mean age between adopters and non-adopters is not statistically significant at less than 10% probability level. Obviously we can see from (**figure.**) that the mean age between adopters and non-adopters is almost similar.

4.2.2. Education status of sample household heads'

In fact, educational level of farmers is assumed to increase the ability to obtain process and use agriculture related information and use technologies in a better way. In the study area, the education level of farming community is relatively low similar to the national literacy level. The levels of education of the sample household heads with respect to adoption of forage are as presented in Table 2. From the total sample household heads, about 39% of them were illiterate while about 55% were able to attend elementary school; only 3.6% and 1.8% were attended secondary and college education respectively (table2).

Table 2. Educational level of sample households (N= 27)

Level of education	Non-adopters		Adopters	
	Frequency	Percent	Frequency	Percent
Valid	11	40.7	11	37.9
0	1	3.7	1	3.4
2	3	11.1	1	3.4
3	4	14.8	2	6.9
4	2	7.4	5	17.2
5	3	11.1	4	13.8
6	1	3.7	4	13.8
8	1	3.7	1	3.4
10	1	3.7	0	0
10+3	0	0	0	0
Total	27	100.0	29	100.0

T-v (-0.399)
Asymp. Sig. (2-sided) 0.692 (NS)
Levene's Test (sig 0.833 (equal variance)

Among the total of 29 farmers who adopted forage, about 37.9% were illiterate, 58.7 % had attended primary school and the rest 3.4% of the total adopters had attended secondary school education levels. On the other hand, about 40.7% of the total forage non-adopters (27) were illiterate, 48.1% were attended primary school, 3.7% were attended secondary school, and the rest 3.7% were attended college level education. The survey result showed that, the difference in education level between adopters and non-adopters is not statistically significant at less than 10% probability level.

4.2.3 Land holding of sampled households

Land variable was hypothesized to influence adoption of forage. As shown in Table 3, the average cultivated land holding of forage adopters was 3.2 hectare where as that of non-adopters was 2.5 hectares. An independent sample test was conducted to compare the mean difference between adopters and non-adopters of forage with respect to land holding size. However, this difference is found to be statistically significant at 10% probability level (t=1.936). Probably this could be due to reason that farmers in the highland with minimum land holding were good in adopting forage than farmers in the low land with larger land holding.

Table 3**.** Land holding of the sample households (N=56)

Forage	**N**	**Mean**	**Std. Deviation**	**T-v**	**Sig. (2-tailed**
Non-adopters	27	3.2222	1.73944	1.936	0.06
adopters	29	2.5000	.88641		
Levene's Test (sig 0.02)	(unequal variance)				

4.2.4. Labor availability

In the study area, of the total sample households 59.3% of non-adopters of forage development practice have labor constraint while it was about 34.5 % for the adopters. Pearson chi-square test was conducted to compare the percentage scores of adopters and non-adopter groups with respect to labor constraint. The chi-square analysis showed that, there was statistical significant difference between the two groups of the sample households' head with respect to labor constraint. This is to mean that having labor availability indicate that there is a higher probability to adopt forage development practice. This could be because of the fact that, forage development practice requires extra labor forces.

Table 4. Labor availability of the sample households (N=56)

Labor constraint		Adopters		Non-adopters	
		Frequency	Percent	Frequency	Percent
Valid	adopters	10	34.5	16	59.3
	Non-adopters	19	65.5	11	40.7
	Total	29	100.0	27	100.0

Pearson Chi-Square
Asymp. Sig. (2-sided) 0.063

4.2.5 Participation in local organization

In the study area, of the total sample households who do not participate in local organization were 77.8% of non-adopters and 55.2% of adopters of forage development practice. Pearson chi-square test was conducted to compare the percentage scores of adopters and non-adopter groups with respect participation in local organization. The chi-square analysis showed that, there was statistical significant difference between the adopters and non-adopters of forage development practice of the sample households' head with respect to participation in local organization. This is to mean that participation in local organization indicate higher probability to adopt forage development practice. This could be because of the fact that, local organization could create favorable condition for organized follow up and enforcement of forage development practice. As it can be indicated in Table 5, participation in local organization show systematic association with adoption of forage development practices.

Table 5. Participation in local organization (N=56)

		adopters		Non adopters	
		Frequency	Percent	Frequency	Percent
Valid	no participation	16	55.2	21	77.8
	youth association	2	6.9	3	11.1
	cooperative	6	20.7	2	7.4
	local administration	4	13.8	1	3.7
	local saving and loan institution	1	3.4	-	-
	Total	29	100.0	27	100.0

T-v (-2.399)
Asymp. Sig. (2-sided) 0.065

4.2.6. Access to and rate of extension service

In the survey area, all adopters (100%) were able to get access for extension service regarding to forage development practices, while it was about 96.3% for the non-adopters. The chi-square analysis disclosed that, there is no significant difference between adopters and non-adopters of forage emerged from difference in access to extension services. This is to mean having access for extension services do not add up on the probability of forage adoption. Beside to this rate of extension service, essential factor to look at according to the survey 75.9% of adopters has extension service at least once in a week. But only 37.0% of non-adopters of forage development practice have extension service at least once a week. The chi-square analysis disclosed that, there is significant difference between adopters and non-adopters of forage emerged from difference in rate of access to extension services. This is to mean having access for extension services do not add up on the probability of forage adoption according to the result below in table 5 what matters is actual and frequent follow up experts on forage developing farmers is essential.

Table 6. Advise to extension services (N=56)

	Adopters		Non-adopters			
advise	Frequency	Percent	Frequency	Percent	T-v	Asymp. Sig. (2-sided)
yes	29	100.0	26	96.3	1	0.296
no	-	-	1	3.7		
Total	29	100.0	27	100.0		
How often						
no advise	-	-	1	3.7	2.92	0.017
once a week	22	75.9	10	37.0		
once a month	6	20.7	7	25.9		
quarterly	-	-	3	11.1		
some times	1	3.4	6	22.2		
Total	29	100.0	27	100.0		

4.3. Forage development practice in the area

In order to gets deep insight concerning forage production in the area it's essential to have a look into forage development in the study areas. All farmers included in this study were familiar with forage production and the only the difference among them is on keeping doing what we call adoption which was our main concern of this study. So it's important to see at some factors associated with forage development practice which seems to determine forage adoption. These are the level of forage production at the start of starting, purpose of forage production; fencing forage production area, type of animal to which the forage is feed, form of feeding, and access of forage seed and source of water for forage production. According to the result from survey, at their start, about 69.0% of adopters and 62.5% of non-adopters had high forage production. Obviously the chi-square analysis disclosed that, there is no significant difference between adopters and non-adopters from fencing. Although the result points that there were some farmers took forage for the purpose of soil and water conservation beside to animal feed but most of the farmers, adopters (93.1%) and non-adopters (81.2%) took forage for only animal feed purpose. Chi-square analysis disclosed that, there is no significant difference between adopters from production purpose of forage production they took. On the other hand, fencing the forage planted area as a factor expected to determine forage adoption. According to result from survey, about 87.5% of the adopters and 62.1% of the non-adopters fence their forage production area. Chi-square analysis showed that, there is significant difference between adopters and non-adopters from production level of forages they took. The others factor expected to determine forage adoption was type of animal they feed the forage. According to the result from survey, most of the respondent farmer (51.7% of adopters and 56.2% of non-adopters) feed their forage to dairy cows. The chi-square analysis indicated that, there is no significant difference between adopters and non-adopters to which animal they should feed their forage as both of them focused on the same animal type. On the other hand, form of feeding and access to seed was expected to determine forage adoption. According to the result, similar trends revealed on the form they feed on both the adopters and non-adopters, that is about 96.6% of adopters and 93.8% of non-adopters feed their animal by cutting and caring method. Although seed access was better in the case of adopters, significant proportion of farmers had good access to forage seed that is 51.7% of adopters and 37.5% of non-adopters had access to forage seed. The chi-square analysis disclosed that, there is no significant difference between adopters and non-adopters due to form of feed and seed access difference.

Table 7. Forage production practices of the sample households (N=56)

Forage production	Adopters		Non-adopters		Asymp. Sig.(2sided)
	Frequency	Percent	Frequency	Percent	
High	20	69.0	10	62.5	0.728
Medium	8	27.6	5	31.2	8
Low	1	3.4	-	-	
Total	29	100.0	15	93.8	
Purpose of production					
Animal feed	27	93.1	13	81.2	0.481
Animal feed and soil and water Conservation	2	6.9	2	12.5	
Total	29	100.0	15	93.8	
fence					
Yes	18	87.5	14	62.1	0.086
No	10	34.5	1	6.2	
Total	29	100.0	15	93.8	
Type of animal					
Dairy cow	15	51.7	9	56.2	0.408
Fattening cattle	1	3.4	-	-	
Ploughing	-	-	1	6.2	
To all	13	44.8	5	31.2	
Total	29	100.0	15	93.8	
Form feed					
Cut and caring system	28	96.6	15	93.8	0.467
Silage making	1	3.4	-	-	
Total	29	100.0	15	93.8	
Forage seed shortage					
Yes	15	51.7	6	37.5	0.46
No	14	48.3	9	56.2	
Total	29	100.0	15	93.8	
Place of planting					
Irrigation land	29	100.0	15	93.8	-

4.4. Analysis of Determinants forage development activities

In this section, a binary logit model was employed to show results of the analyses of determinants of adoption of introduced forage development practices in the study area. It discussed the important socio-economic, institutional and physical factors which significantly influencing farmers' adoption decisions with regard to forage adoption and it used to discuss some of the promising non-significant variables to explain why they are not significant. The chi-square test for the goodness- of-fit was also tested. The result of logistic regression models are as presented in Table 8a, Table 15b and Table 15c.The Maximum likelihood estimate of the logistic regression models are significant at less than 5% probability level. The Hosmer and Lemeshow goodness of fit test (chi-square test for goodness- of-fit) compares observed and predicted values of 10 significant exploratory variables.

Table 8a. Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	.992	2	.609
2	.822	4	.936
3	8.862	7	.263

Table 8b. Variables in the Equation

Explanatory variables		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Participation in local organization	.876	.364	5.797	1	.016	2.402
	Constant	.724	.413	3.073	1	.080	.485
Step 2[b]	Labor constraint	2.960	1.241	5.692	1	.017	19.297
	Participation in local organization	1.261	.473	7.093	1	.008	3.529
	Constant	5.791	2.357	6.039	1	.014	.003
Step 3[c]	Labor constraint	2.949	1.229	5.764	1	.016	19.095
	Participation in local organization	1.589	.702	5.127	1	.024	4.898
	Rate of extension	1.015	.542	3.501	1	.061	.363
	Constant	4.024	2.370	2.883	1	.090	.018

4.4.1. Determinants of forage development activities

4.4.1.1. Availably economically active labor forces of the household

As expected, the availability of sufficient labor in the household is found to be positive and statistically significant at less than 5% probability level for adoption of forage. This could be attributed to the fact that forage development practice requires relatively more labor. All other factors being kept constant, having sufficient labor increases the probability of adopting forage by a factor of 19.09

4.4.1.2. Frequency of household contact with extension agent

The coefficient of this variable practices is consistent and similar to our prior expectation. As expected the likelihood of adopting forage increased significantly at less than 5 percent probability level. A frequent contact with development agent increased the probability of adopting forage by a factor of 4.898.

4.4.1.3. Participation of the household head in local organization

Similar to our expectation, this variable has a positive coefficient for forage and was also statistically significant at less than 10 percent probability level. Participation of farmers in local organization increased the probability of adopting forage by a factor of 0.363. Perhaps, the possible explanation is that those who participate in local organization might have been easy to enforce and follow up. Farmers in local organization have commitments, and given maximum attention to farming technologies because they are easily accessed for new technology and strict follow.

4.4.2 Expected non-significant determinants of forage development practices

Some of the variable which was expected to determine forage development practice but not significantly affect forage adoption were discussed in this section. One of these coefficients is sex of household head which is non-significant to affect forage adoption. The justification behind this fact might be due to all the farmers and non-adopter of forage are male headed it is because culturally conditioned to involve in other alternative farming activity that required intensive male labor forces rather they restricted to in-home activities. Educational level of the household head was other variable expected to be positively correlated with the adoption of forage development practices but non-significant. Our explanation for non-significance of education lies in the generally low literacy level in the study area.

Land holding was also another variable that positively correlated with the adoption of forage development practices but non-significant. An independent sample test was conducted to compare the mean difference between adopters and non-adopters. In this case there was a significant difference for land holding between adopters and non- adopters. However, logit model reveals that land holding is not significantly affecting forage adoption at 10% probability level but it's 0.040 significant at 20% probability. Sometimes this is acceptable in social science studies. Probably this could be due to the minimum variation in land holding size between the two categories to affect adoption decision. Beside to this, the way farmers got their land was expected to significantly affect forage adoption. But it was non-significant to affect forage adoption probably this is because similarity of land acquisition between adopters and non- adopters that means most of farmers in the sample got their land from government.

Table 9. Variables not in the Equation

	Explanatory Variables	Score	df	Sig.
Step 3	age	.371	1	.543
	Education level	6.649	8	.575
	Marital status	.167	1	.683
	Number of plots	.204	1	.652
	Land holding	2.480	1	.115
	Land acquirement	.000	1	1.000
	Land tenure	.087	1	.768
	Change in land tenure	.110	1	.740
	Level of income	.186	1	.666
	saving	1.999	1	.157
	Model farmer	.349	1	.555
	demonstration	.177	1	.674
	Overall Statistics	26.300	19	.122

Chi-Square Tests

	Value	DF	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided
Pearson Chi-Square	.529[a]	1	.467	1.000	.659
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.846	1	.358		
Fisher's Exact Test	.517	1	.472		
Linear-by-Linear Association					
N of Valid Cases[b]	44				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is .34.
b. Computed only for a 2x2 table

5.Conclusion and recommendation

5.1 Conclusion

- Improved forage varieties were introduced through different GO and NGO in frequent times.
- But the adoption of farmers to these improved forage varieties is still low.
- So, this paper is aimed at identifying factors that affect farmers' willingness to adopt improved forage varieties.
- The empirical results show that land holding, educational level, age, change in land tenure, level of income, marital status, plot number, land acquirement and saving do not significantly affect famers' willingness to adopt improved forage crop production.
- Local organization, labor constraint, extension services and rate of extension services were found to significantly affect farmers' willingness to adopt.
- Extension services on forage is not strong specially follow-up which resulted in low adoption of forage crops by farmers.
- Other empirical studies also shows that age, educational level, salinity level of water, farm size (land holding) and membership in a farmers' association do not significantly influence willingness to adopt salt-tolerant forage production (Ali Chebil etal.).
- But membership in a farmers' association significantly affect farmers' willingness to adopt improved forage production due to its impact to work cooperatively and in an organized manner.

5.2 Recommendation

- Agricultural development agents and experts should focus on improved forage technologies which are not labor intensive and it should be in an organized manner.
- Development agents and agricultural experts should provide intensive extension services and continuous follow-up on improved forage production so that farmers' willingness to adopt forage production can be enhanced.
- Therefore, farmers' who are members of different famers associations should also attain extension services and a continuous advice on forage production so that their adoption can be enhanced.

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