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Determinants of Adoption of Improved Highland Forage Type: Evidence from Dendi District, West Shoa Zone, Ethiopia

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The main objective of this study was to investigate the major determinate factors of improved highland forages types in the study area and data were collected through survey by developing structured questionnaires for the total sampled households including household heads, members, key informants and subject matter specialists. The data were analysed by using simple descriptive stastics analysis mean, Percentage and Standard deviation. To this end, determinate factors of adoption for the improved highland forage type technologies has been outlined and major factors were all the demographic factor which constitute about 72% and it related with the ever increasing of population size at alarming rate which exacerbated the decline of land to labour ratio meaning shortage of land. 74% of the sampled household heads were cannot read and write. Similarly, this was also strongly correlated with low level of technology adoption (improved highland forage). Other factors of variables in the study were income of family which constitute 4%, educational status which constitute 80%, lack of information which constitute 12%, biophysical status of the land which constitute 66% and intuitional factors were part of the problem and all these are putted according to their order of importance and the overall finding of the study underlined the high

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importance of institutional support in improving the adoption and utilization of the technologies with their research recommended production package. Therefore, research centres, development agents and other concerned stakeholders should provide on farm extension training to fill knowledge and skill gaps in the adoption of improved Highland forage type.

Keywords: Adoption; livestock; highland forage; Dendi District.

1. INTRODUCTION

Forages can be described as any vegetative part of a plant that is eaten by animals, but they are further defined as those crops grown mainly for the feeding of livestock. Inside the mixed farming systems, involving forage production within the cropping cycles can increase the farm's sustainability [1]. Subdivided into groups, forages; include grasses, legumes, multipurpose fodder trees, and other browse species.

Livestock feed resources in Ethiopia are mainly natural grazing and browse, crop residues, improved pasture, forage crops and agro-industrial by-products and the natural pasture natural pasture comprises the largest feed resource, but estimates of the contribution of this feed resource vary greatly. Alemayehu [2] estimated that 80–85% of all feed comes from natural pasture while some estimates indicate the natural pasture provides 88–90%.

In Ethiopia, there are 179 browse species from 51 genera, which is not exhaustive, of which 51 species from 31 genera are recorded as promising browse species. Currently 185 accessions from 41 species and 18 genera are systematically collected and conserved by ILRI (IBCR/E, 2001) [3].

The International Livestock Research Institute ILRI (ex.ILCA 1998) [4] has done much to fill the gap by collecting grasses from different parts of Ethiopia and by acquiring access to world collections of forage grass Germeplasm.

In recent years the Forage and Pasture Genetic Resource Conservation and Research Department was established under the Institute of Biodiversity Conservation and Research/Ethiopia (IBCR/E) to carry out the conservation of pasture and forage genetic resources [5].

Feeding systems include communal or private natural grazing and browsing, cut-and-carry feeding, hay and crop residues. Informal surveys by ILCA in the Debre Birhan area of Ethiopia (about 2,800 m above sea level) suggest that farmer's trade in small stock (sheep in that area) both to increase cash incomes and to balance feed demands with available feed suppliesAt present, stock are fed almost entirely on natural pasture and crop residues. Grazing is on permanent grazing areas, fallow land and cropland after harvest. Forage availability and quality are not favourable year round and hence gains made in the wet season are totally or partially lost in the dry season [6].

In the study area different kind of cultivated highland forage technology has been disseminated in different time through the effort of different organizations including Holetta Agriculture Research centre, MOA and different local and international NGos; However, the promotion and utilization were very insignificant due to multiple variables mainly land shortage, knowledge gap, lack of adequate seed availability; labour shortages are play pivotal role to low adoption of the technology. Frequently when labor is required for forages development it is often already occupied by other fieldwork.

The other is Lack of knowledge as listed above is the other constraint identified by the farmers as a problem with forages adoption. Since, the problem is associated with limited know how a long with the technology packages. How to grow, manage, and utilized cultivated improved forages unlike the food crop one. For this reason after forages are given to them they do not know what is best to do with them or how to use them efficiently and effectively and Ahmed et al. [7] indicated that forage legumes were not the best option for solving dry season feeding because of the low yield and lack of persistence during the dry season but Persistence of forage and browse legumes can be improved by use of careful grazing management and moderated fertilizer inputs [8].

On the other hand, Due to the ever increasing of population size the marginal lands which were un productive lands so far are converged in to cultivation purpose and the encroachment of

cultivation land year to years have showed substantial increment in the study area which in turn down scale size of the natural free grazing lands and the future prospect of natural grazing land is under threat. Therefore, commonly land shortage. Is one of the major constraints to adoption in the Ethiopian farming system as mentioned above especially in the highlanders' areas? This study aimed to identify determinant factors of improved highland forage technology. This was conducted in West Shoa Zone in Dendi District in Borodo Watershed Area.

2. METHODOLOGY

2.1 The Study Site

The study was conducted in Dendi district of Borodo watershed. Dendi district covering 104, 680 ha of land is among the highly degraded areas of central highlands. Dendi is one of the 19 districts of West Shewa zone in Oromia Region. It is about 80 - 110 km west of Addis along the Addis-Ambo highway between 9° 02' N and 38° 07' E. The altitude of the district ranges from 1800 up to 2700. Dendi district is organized into 48 rural and 6 urban peasant associations. The population of Dendi is estimated at 236, 277. The climate is mild sub tropical weather with a daily temperature ranging from 15 to 23 C. The area experiences a bimodal rainfall pattern, the short rainy season falling during March to April while the long rainy season lasts from June to September. Up to 60% to 70 of the annual rainfall is received during the main rains that normally start in June, reaches peak it is in August and gradually ceases in September.

2.2 Sampling Technique

For the key informants interviews and field observation notes data were selected using both simple random sampling and systematic random sampling techniques and the data Boredo1st Peasant association and boredo 2nd Peasant association were purposively selected. The total sample selection of two peasant association were 50 in number (25 respondents from each PAs) then selected using randomization techniques and 3 developmental agent and 2 SMS (subject matter specialist) from Agricultural and rural development office were purposively selected who have a direct contact with animal agency and forage development of the district agricultural bureau office were interviewed.

2.3 Data Type, Source, Data Collection and Analysis Method

For this study, both primary and secondary data was used. Primary data were collected through structured questionnaire. Secondary sources materials were reviewed from published and unpublished materials. A + of 50 households were selected and interviewed from two peasant association administrations. Moreover, informal meetings were undertaken with a group of farmers in order to understand the general adoption of the technology and socio-economic situation of the population of the study area. In addition, informal meetings with key informants (farmers, elder people, women, experts and development agents) were held to gain in-depth knowledge about the area, the data were analysed through simple descriptive stastics mean, percentages and standard deviation, and the result is demonstrated using tables, pie chart and bar graph.

3. RESULTS AND DISCUSSION

3.1 Demographic Characteristics

Household size and characteristics are directly related to the supply and demand conditions for basic human needs, such as food, shelter, health and educational facilities, which in turn directly or indirectly influence the adoption of improved highland, forage technologies for a farming system. From the sample of 50 HH, the result indicates that 95% of the heads of household are male. These household heads include a wide range of people: village elders, decision makers (local administration), younger people, older people, poor farmers and rich farmers (Table 1).

Out of the total sample households in the study area, 5% of the household heads are women, who are single, widowed or divorced. No female household heads had adopted the livestock feed technology. During discussions with women headed households the main reasons why women headed households are not involved in the adoption of improved livestock feed technology development were that female heads have limited access to the information and that other socio-economic issues related to traditional social barriers limit women's resources. Women are also more involved in regular household activities than men are. In the area, a woman takes most of the household responsibilities (childcare, food processing and harvesting, weeding and fetching water from long distance).

3.2 Education Status of Household and Members

Five educational levels for household heads and education levels for family member groups were identified, which include: “illiterate” (meaning no formal education), “primary school started from “grade 1 - 4”, Junior school from” grade 5-8”, secondary school “grade 9-12” and college “diploma (grade 10+3 or 12+2)”, for house hold heads and for family members. From the survey result, about 80% of the household heads had no formal education, 16% have completed up to grade 1-5 (Table 2) and about 4% of the remaining household heads have completed up to grade 5 and above.

3.3 Educational Status of Family Members (not Counting Head of Household)

It has been found that 53% of household family members had no formal education, 29% were educated to a grade between 1 and 4, 15% have reached a grade between 5 and 8, 3% reached a high school grade 9 or 10 (or 12 in some schools), (Note that the 53% with no formal education includes infants and other young children). However, none of the family members have gone above the 4-year degree level (Table 3) Most of the farmer household heads in the area are not educated and thus have little access to information about newly introduced improved forage technologies and their practice.

From the survey results, better-educated households have more realistic perceptions about improved livestock feed development and possess more knowledge related to most improved technologies including forage and hence can more easily be involved in the establishment activities. From discussion with key informants, with respect to educational status of households in relation to their location within the study area, some farmers are better educated than other farmers of in the studied areas because those farmers who are participated in the integrated watershed management project Were highly benefited, where more NGOS and GOs were involved and give training concerning all improved agricultural technologies and improved forage management practice for the surrounding communities so they are relatively productive and beneficiary.

3.4 Age Status of Households Heads

Three age groups for head of household are identified: 56% are between 20-40 years, 36% are between 40-64 years, and 8% are over 64 years. Most of the HH heads (92%) are in the age from 20-64 years group (Table 4). Farmers in this age group are assumed to have a good understanding of problems of livestock feed due to access to information, and as a result, usually more interested in forage development and management practices. The proportion of elderly farmers is 8%, an age group in which labour shortage can be a hindrance to practicing forage development and management measures. However, these farmers usually implemented and accepted forage development and management practices because of having access to money for rented oxen as well as hired labour.

3.5 Age Distribution of Household Members

Three age groups of family members were identified: 60% were >25 and 37.5% were >25-64 and 2.5% were older than 64 years (Table 5). In most Ethiopian rural areas, the main sources of labour are the family members, including wife and children. The sample households are characterized by a high proportion of young population (>25 years) and a low number of old-age persons (> 64 years). Generally, there are more young people than older people are; because of poor health care people die at a relatively young age.

Table 1. Characteristics of farm plots, related to households and their heads

Description	No. of observation	Min.	Max.	Mean	Std. deviation
Age of HH heads	50	25	75	39.5	18.3
Family Size	50	2	7	3.6	2.1
Distance of plot from home (km)	50	1	6	2.6	1.8
Distance of home from market (km)	50	10	13	11.2	1.2
Livestock holding in TLU	50	4	20	13.4	5.7
Area per plot (ha)	50	1	15	4.5	5.4

Source: Own survey data, 2014

Table 2. Educational status of household head

Description	Educational level	%	No	Total HH heads
Over all HH heads 50	Illiterate	80	40	50
	Grade 1-4	16	8	
	Grade 5 and above	4	2	
	Grade 9-12	0	0	
	College diploma (10+3)	0	0	

Source: Own survey data, 2014

Table 3. Educational status of household members

Description	Educational level	%	No	Total HH heads
Over all HH 50 members	Illiterate	53	40	50
	Grade 1-4	29	8	
	Grade 5 -8	15	2	
	Grade 9-12	3	0	
	College diploma (10+2or 3)	0	0	
	Above college diploma	0	0	

Source: Own survey data, 2014

Table 4. Age distribution of household heads

Description	Age range	%	No	Total investigation
Number of 50 HH heads	20-40	56	26	50
	40-60	36	18	
	>64	8	4	

Source: Own survey data, 2014

4. LIVESTOCK PRODUCTION

The type and total number of livestock owned across all sample households is given in graph below Sample farmers' rear livestock for various purposes, including draught power, milk, meat, eggs, transport and other purposes. The main sources of feed for livestock in the study area include Teff straw, Pulses and wheat straw, Native grass hay, other improved forage crops (Oats vetch). The dominant livestock species in the study area including cattle, donkeys, poultry, shoats, horses mule and in the order of importance. Oxen are the main source of traction while horses and mules are pack animals. The number of oxen in the water shade is almost twice that cows of reflecting the crucial role oxen play in crop production in the study area (Fig. 1).

Mostly the livestock population is of indigenous breeds. Only four farmers have been reported owning crossbred cows. The lifetime productivity of the indigenous livestock breeds, however, is generally low. For instance, local cows give less than two litters milk of per day. Furthermore, local cows give birth to less than five calves in its lifetime. The gestation length of local cows is also low, less than 180 days. Despite their low productivity, however, farmers keep indigenous breeds mainly to produce replacement herd especially oxen, which are the major source of drought power.

Out of the total respondents, 14% do not have an ox and the others have one or more oxen. Most farmers reported that there is a shortage of feed for their animals, especially during the dry season and there is imbalances between the number of the animal and the available feed source this call for an intervention for curving their feed shortage problem.

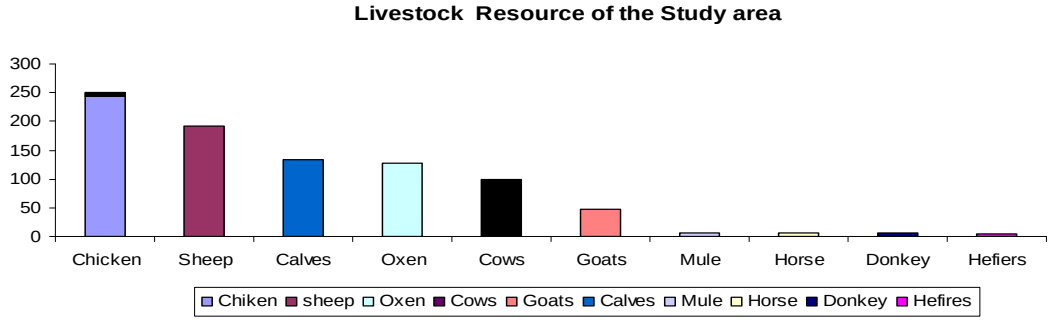

Fig. 1. Livestock resource of the study area
Source: Own survey data, 2014

Table 5. Age distribution of household members

Description	Age range	%	No	Total investigation
Number of 50	25	60	30	50
HH members	25-64	38	19	
	>64	2	1	

Source: Own survey data, 2014

4.1 Common Determinate of Adoption of Improved Highland Forage Type in the Study Area

In my study it has been found that shortage of land ,lack of information ,lack of seed availability and lack of capital specially to purchase input of production were the major contributors for the less adoption of the technology (cultivated highland forage) moreover; all the factors are ordered based of their level of importance as shown below the graph.

4.2 Households Characteristics of Economic Activities

In my study, it has been found that almost all farmers used their livelihood strategy entirely on agricultural production and 5% of farmers from the total sampled households are engaged in the off-farm income activities. Almost this portion of the population was female headed households and farmers who are left without land for agricultural production. The area is relatively potential in the crop production and they experienced in double cropping they sale some portion of their produced and it accounts 44% of their overall economic income, 38% derived from livestock production, Tree sale accounts around 12% and petty trade contributed 6%.

And their economic and social status directly related to the adoption of improved forage technologies through different features and study shows that high and middle class has showed fast reaction in the adoption and the lower class part of the population who are weak economically are less interested in the adoption of the technology because their economic weakness is more or less due to landless, therefore they do with nothing unless they have their own land.

4.3 Distances between Home and Farmland

It has been found that distance between the farmland and a homestead is an important factor in the adoption behaviour of improved livestock forage development. In the study area the average walking time from the homestead to the farmland is 1 ½ hours. The fragmented and far away fields are one of the factors that discourage farmers from adopting improved livestock forages and others. Because some activities requires to undertake during the evening that make it difficult to go to the fields that are located far from the home. Regarding ownership and sources land, the survey result showed that more than 56% of the plots are inherited from family. Almost 24% are shared and the remaining 20% is rented source.

4.4 Institutional Characteristics of the Area

Institutional factors are one of the critical aspects and has direct impact in the adoption of any technologies including the improved forage technologies and during my study I have tried to explore and got that farmers priority for the production of food crops this mainly due to

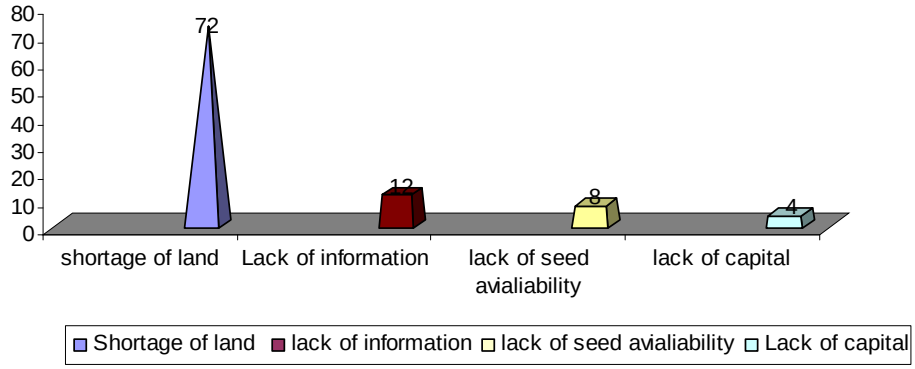

Fig. 2. Determinant factors of adoption of improved forages
Source: Own survey data, 2014

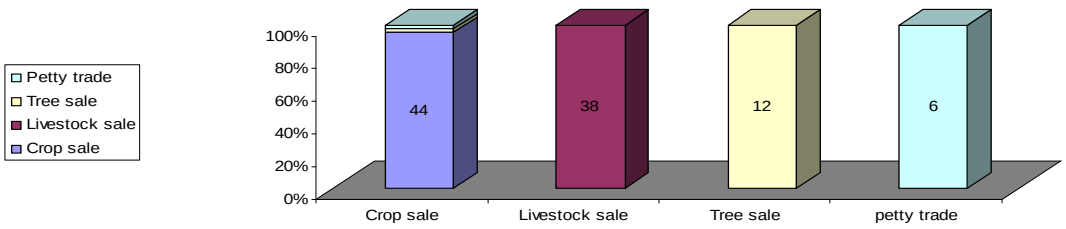

Fig. 3. Economic profile of the area
Source: own survey data, 2014

economic factor and lack of knowledge from my study it has been found the types of institution avail in my study area different GOs and NGos like AHI (African highland initiative) had been working with the society health extensions, agricultural experts, DAs with the help of FTS school which is built in the community area and few farmers got agricultural production knowledge's especially the best agronomic practices as per the recommendation of research centres, sharing best practice of others in collaboration with the district agricultural office and health extension also is delivering a significant service for the community by improving but the attention given by both from government body and policy makers are very minimal because of this the coverage of the technology development and sustainability is under critical condition in the community.

5. CONCLUSION AND RECOMMENDATION

The study has shown that educational qualification, marital status, income, and age contributed significantly to the farmers' use of agricultural information. Understanding of personal, socio-economic, institutional and biophysical factors would contribute to the design of appropriate strategies to achieve technical change in the adoption of improved forage process in the study area and other similar areas of the region. Based on the survey results and literature reviewed, the following points were made.

Land shortage is identified as a one factor affecting adoption of forages because of the large constituted land with food crop production [9]. Livestock sector development in Ethiopia is hampered by different factors, however land shortage were common in the case of all farmers in my study it constitute 72% of the total sampled population and feed shortage in turn is threatening factor in the overall sustainability of livestock production and productivity and Land shortage is a major cause of low adoption of improved forage technologies in Ethiopia. Ethiopia is hampered by high cost and low availability of seed for the recommended varieties. Farmers rarely collect or use seeds from their own farms or from their neighbors, as they still expect the forage/tree seedlings or seeds from projects, government and non-governmental organizations [10]. In addition, Access to credit for purchasing inputs plays a crucial role in the development and adoption of new technologies and improved feed resources especially in low-income households [11,12].

Gebremedhin et al. [13] Land tenure is another constraint to farmers wanting to adopt long-term technologies for pasture and livestock improvement in Ethiopia (Mapiye et al., 2006) and this warrants further investigation. In general Constraints on any of the factors of production: land, labor and capital can inhibit uptake of forage technologies. Such constraints are severe among the resource-poor smallholder farmers [14] for whom forage legume technologies are most needed.

Based on the result of this study, personal factors, socio-economic factors, institutional factors and demography of the HH, institutional factors, and biophysical factors thereby has direct or indirect significantly affect the probability of adopting improved forage technologies. Farmers' age, education level, income of HH head has both a positive and a negative impact on adoption of some improved forage and management practices. Older farmers have advantages of more experience and access to more farmlands, younger farmers possess a higher level of education as compared to old ones, they have good information about improved technologies, improved agronomic practice, and they are strong enough for the labour intensive nature of the technology.

The following recommendations are made based on the findings of the present study:

- There is urgent need to intensify adult literacy campaign among the rural dwellers. Literacy is capable of making people more conscious and receptive of innovations.
- There is a need to mould their mind set up .even though, land is scarce but possible solutions are there to establish improved forages through allotting of some portion of their farmland they can practice intensification. In addition, marginal lands would be another option to establish forage materials like on the cumber, terrace and bund areas.
- Use of intercropping techniques (integration approach like under sow, over sow methods) or on the other hand intensification of production system can solve the land shortage problem.
- Use of farmers' field day both on station and on farm would significantly enhance the uptake and sustainable use of the technology by all levels of farmers.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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