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Research paper

Determinants of the utilization of desho grass (*Pennisetum pedicellatum*) by farmers in Ethiopia

Factores determinantes para el uso del pasto desho (Pennisetum pedicellatum) *por productores en Etiopía*

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Abstract

A study was conducted to document how smallholder farmers in Ethiopia utilize desho grass (*Pennisetum pedicellatum*) and explain the determinants of alternative and competing uses of the grass. The study was conducted using a semi-structured questionnaire for 240 farmers in the districts of Burie Zuria and Doyogena, complemented with input from key informants and secondary data. The dependent variables tested were the use of desho grass as a feed, multipurpose uses of the grass and types of livestock fed. To test the effect of the explanatory variables on the dependent variables, separate univariate Probit models were used. Although the majority of respondents can read and write, about 23% of respondents were illiterate. The average desho grass-producing farmer in the sample owned 0.95 ha of farmland and 3.56 tropical livestock units; average household size was 6.5 people with a household head who was typically male (91% of households). Eighty percent of respondents in Burie Zuria and all respondents in Doyogena district depended solely on rain for desho grass production. Fifty-eight percent in Burie Zuria and 65% in Doyogena district applied either manure or artificial fertilizer to the grass. Weeding of desho grass was not practiced by any respondents in either district. Sixty percent of farmers used desho grass as a feed and 35% used it for more than a single purpose. Forty-two percent of farmers who fed desho grass did so to only lactating cattle, 3% fed it to small ruminants and 53% fed it to all livestock species. There were significant negative correlations ($P<0.01$) between both experience in production of desho grass and access to training in its production and utilization, and its utilization as a feed. Seventy percent of farmers in Burie Zuria and 13% in Doyogena have received training in desho grass production. To expand the utilization of the grass to as many farmers as possible, further training should be provided. A multi-faceted approach would be needed for the 23% of illiterate farmers over the 2 districts.

Keywords: Cut-and-carry, lactating animals, multipurpose, Probit models.

Resumen

En el estudio se analiza la utilización del pasto desho (*Pennisetum pedicellatum*) por pequeños agricultores en Etiopía y se explican los factores que determinan sus usos alternativos. El trabajo se realizó con la colaboración de 240 agricultores de los distritos de Burie Zuria y Doyogena mediante un cuestionario semi-estructurado, complementado con aportes de informantes clave y datos secundarios. Las variables dependientes analizadas fueron: uso del pasto como forraje; usos multipropósito; y tipo de animales que lo utilizan. Para probar el efecto de las variables explicativas

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sobre las variables dependientes, se utilizaron modelos Probit univariados en forma separada. Aunque la mayoría de los encuestados sabía leer y escribir, alrededor del 23% de los encuestados eran analfabetos. En la muestra, el productor promedio del pasto desho poseía 0.95 ha de tierra y 3.56 cabezas de ganado (TLU, tropical livestock unit) y la familia promedio consistía en 6.5 personas con una cabeza de familia típicamente masculina (91% de las familias). Para la producción del pasto, el 80% de los encuestados en Burie Zuria y todos los encuestados en el distrito de Doyogena dependían exclusivamente de las lluvias. El 58% en Burie Zuria y el 65% en el distrito de Doyogena fertilizaban el pasto con estiércol o con fertilizantes comerciales. En ambos distritos los productores en la encuesta no controlaban maleza en sus parcelas del pasto. El 60% de los agricultores utilizaba el pasto para alimentar sus animales y el 35% para más de un propósito. El 42% de los agricultores que lo usaban para alimentar su ganado lo suministraban solo a vacas lactantes, el 3% a pequeños rumiantes y el 53% a todo tipo de ganado. Se encontraron correlaciones negativas significativas ($P<0.01$) entre tanto la experiencia en la producción del pasto desho como el acceso a capacitación en producción y utilización, y su utilización como forraje. El 70% de los agricultores de Burie Zuria y el 13% en Doyogena habían recibido ese tipo de capacitación en producción del pasto. Para extender la utilización del pasto a un mayor número posible de agricultores, se sugiere intensificar las prácticas de capacitación. Para llegar a los agricultores analfabetos se requiere de un enfoque multifacético.

Palabras clave: Corte y acarreo, modelos Probit, multipropósito, vacas lactantes.

Introduction

Despite the large livestock population in Ethiopia (CSA 2015), its contribution to the national economy is below potential, owing to a range of factors including availability and quality of feed, poor genetic potential of animals for productive traits, poor health care and poor management practices (Mengistu 2006; Legesse 2008). Of these factors, the most limiting is low quantity and quality of feed (Shapiro et al. 2015). Among the recommended mitigation strategies of feed shortage in the country is the utilization of indigenous adaptable multi-purpose fodder species, e.g. desho grass (*Pennisetum pedicellatum*). This perennial grass is native to tropical Africa and widespread from West to East Africa (Leta et al. 2013). Though often considered to be a noxious weed (ISC 2015), in Ethiopia the grass was first used in Southern Nations Nationalities and Peoples' Region and is currently utilized for soil conservation practices and animal fodder in other regions of the country (Welle et al. 2006; Yakob et al. 2015). The grass has the ability to control water loss effectively and recovers rapidly after watering even under severe drought conditions (Noitsakis et al. 1996; Welle et al. 2006). Moreover, desho grass provides a small business opportunity for Ethiopian farmers (sale of cut forage and planting material) (Shiferaw et al. 2011). Desho grass can provide large amounts of fodder per unit area (30–109 t green herbage/ha/year; Heuzé and Hassoun 2015) and can be a year-round fodder for livestock (Leta et al. 2013). However, despite its abundance and expansion in different parts of the country, there is a lack of information on how farmers manage and utilize the grass.

The objective of this assessment was to document how smallholder farmers in Ethiopia utilize desho grass and explain the determinants of alternative and competing uses of the grass.

Materials and Methods

Description of study areas

The study was conducted in 2 districts purposely selected from Amhara and Southern Nations, Nationalities, and Peoples' (SNNP) Regional States of Ethiopia (Figure 1). Bure Zuria district (10°17'–10°49' N, 37°00'–37°11' E) is located in West Gojam Zone of Amhara region and covers 58,795 ha made up of 52% cropping, 6% grazing land, 25% forest and bushland, 9% wasteland, 7.5% construction and 0.5% water bodies (BZDoA 2014). The topography of the district is characterized by 76% plain, 10% mountainous, 7% undulating and 7% valleys. The district has 3 soil types: red (63%), blue (20%) and black (17%). The major portion of the district is Woinedaga/midland (77%) followed by Kola/lowland (22%) and Dega/highland (1%) with daily temperature range of 17–25 °C. The annual average rainfall is 1,000–1,500 mm. The major crops grown in the district are maize, finger millet, teff, wheat, barley, potato, pepper, onion, field pea and faba bean. The types of livestock reared in Burie Zuria district include cattle, sheep, goats, equines, chickens and bee colonies. The total area growing desho grass in the district reported for 2014 was 47.5 ha (BZDoA 2014).

Doyogena district (7°20' N, 37°50' E; 1,900–2,750 masl), located in Kembata-Tembaro zone of SNNPs

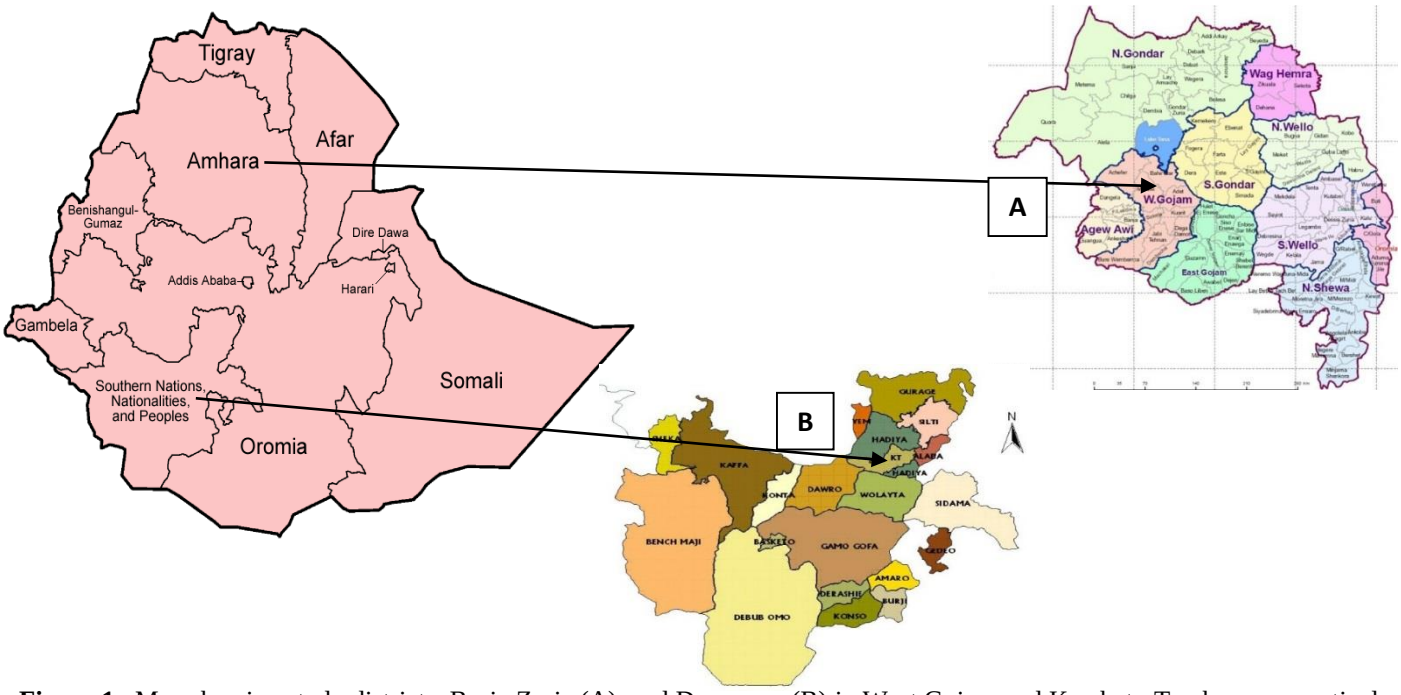

Figure 1. Map showing study districts: Burie Zuria (A), and Doyogena (B) in West Gojam and Kembata-Tembaro, respectively.

Regional State, 258 km southwest of Addis Ababa, covers a total area of 17,264 ha. About 86% of the area is used for cropping, 11.8% forest and bushes, 2% grazing land and 0.2% degraded land. The district has 2 major agro-ecologies, Dega/highland (70%) and Woyina dega/midland (30%). About 10% of the area is plain, while the remaining 90% is mountainous/hilly. It has minimum and maximum temperatures of 10 and 16 °C, respectively, and average annual rainfall of 1,400 mm (DDoA 2014). Major crops cultivated in the highlands are ensete, cabbage, potato, barley, wheat, faba bean and field pea. At low elevations, farmers also cultivate sugar cane and small areas of maize. The soil type is mostly black clay loam, rich in organic matter (InterAide 2014). Types of livestock in the district are cattle, sheep, goats, equines and poultry. The total area growing desho grass reported for 2014 was 2,790 ha (DDoA 2014).

Data collection and analysis

The study districts were selected based on desho grass production and utilization practice. From each district, 4 kebeles (kebele is the name for a local administration in Ethiopia) were selected, based on adoption of desho production and utilization. From each kebele, 30 farmers producing desho grass were randomly selected, making the total number of respondents 240. The survey was conducted using a semi-structured questionnaire completed as a personal interview with experienced and trained interviewers. A preliminary questionnaire was prepared, pretested with a group of farmers and modified before the actual data collection started. The data were complemented with information obtained from key informants, comprised of people from each kebele, including animal science and natural resource experts. Secondary data were obtained from the Office of Agriculture. Livestock holding per household was converted to standard units (Tropical Livestock Unit, i.e. 1 TLU = 250 kg) based on conversion factors set previously (ILCA 1990).

Descriptive statistics were used as a preliminary investigation procedure to gain an understanding of inherent significant socio-economic characteristics of the smallholder farmers. All data were systematically coded and analyzed using Statistical Analysis System (SAS 2007). To estimate the effect of socio-economic factors, agro-ecology and farmers' perceptions in desho grass-producing households were collected using a semi-structured questionnaire. The dependent variables tested were: the extent of use of desho grass as a feed (use as a feed, 1 = yes, 0 = no, if it is used for other purposes such as soil conservation or income sources); multipurpose aspect of desho grass (0 = single use, 1 = multiple uses as soil conservation and income sources); and preferred livestock for feeding (fed to lactating cattle, 0 = no, 1 = yes; fed to small ruminants, 0 = no, 1 = yes; fed to all livestock species, 0 = a single species, 2 = all livestock species). The dependent variables were binary in nature and independent. To accommodate this non-independence, a bivariate Probit model was used to simultaneously estimate the effect on the probability of multiple use of desho grass of the set of explanatory variables.

The model used for analysis can be expressed as:

$Y_i = x_i\beta + \varepsilon_i$ (Greene 2012)

where: Y_i is the decision vector, x_i is a vector of explanatory variables derived from household surveys, with β as the corresponding regression coefficient, and ε_i is the error term.

The factors tested (explanatory variables) were: household characteristics (head's age, education level, gender, experience in desho grass utilization, land holding, distance of the land from the homestead), agro-ecology and feed accessibility (midland vs. highlands), herd structure and access to training. The most common variables used in modeling technology adoption processes are: nature of the farming system, land tenure, resource endowment, social capital and social psychological factors (Rogers 1995; Namara et al. 2007; Salasya et al. 2007).

Results

Household characteristics of respondents

As shown in Table 1, most household heads were male (92.9%). The majority of respondents were at a mature stage of life (41–50 years, 49.4%), while the remainder were split fairly uniformly among remaining age groups. The overall educational level attained by the majority of respondents was elementary school (31.2%), while 15.9% had attended high school and a further 25.6% had no schooling but could read and write. Almost 23% were illiterate.

Table 1. Description of household heads of respondents.

Variables	No.	%
Gender		
Male	223	92.9
Female	17	7.1
Age (yr)		
18–30	26	10.8
31–40	49	20.4
41–50	115	47.9
51–60	33	13.8
>60	17	7.1
Education level		
Illiterate	58	24.2
Read and write	54	22.5
Elementary school	69	28.8
Junior	21	9.0
High school	38	15.8

Average family size was 6.29 people with 3.9 active labor units (Table 2). Each family owned on average 3.56 TLU, which were maintained on a farm size of 0.95 ha. Average experience with desho grass production was 3.05 years. The types of livestock species kept by respondents in both districts comprised cattle, sheep, goats, equines and chickens. In Burie Zuria district the mean TLU for cattle, sheep, goat, equine and poultry populations were 4.92, 0.32, 0. 27, 1.06 and 0.07 TLU, respectively, while the corresponding values for Doyogena district were 2.68, 0.28, 0.15, 0.72 and 0.04 TLU.

Table 2. Details of families, size of holding and livestock carried.

Parameter	Mean	SD
Family size (No.)	6.29	1.93
Active labor units in the family (No.)	3.90	1.80
Total livestock holding (TLU)	3.56	1.85
Experience with desho grass production (yr)	3.05	1.44
Landholding (ha)	0.95	0.69

TLU = Tropical Livestock Unit.

Feed shortage as a major livestock production constraint

Seasonal shortage of feed was the major problem raised by all respondents in both districts. In Burie Zuria district, 98.3% of respondents faced seasonal feed shortage, with 54.2% of these experiencing the problem only during the dry season, while the remaining 45.8% faced shortage in both dry and wet seasons. Similarly, in Doyogena district, 99.2% of respondents faced feed shortages, 86.3% of these in the dry season only and the remaining 13.7% in both wet and dry seasons. Feed shortage mitigation strategies employed in both districts were similar, with only the proportions differing between districts. In Burie Zuria district, strategies were: purchase feed plus use crop residues (54.2% of respondents); purchase feed only (35%); and use crop residues only (10.8%). Corresponding values in Doyogena district were 21, 44.6 and 34.4%, respectively. The graphical presentation of values for both districts is shown in Figure 2.

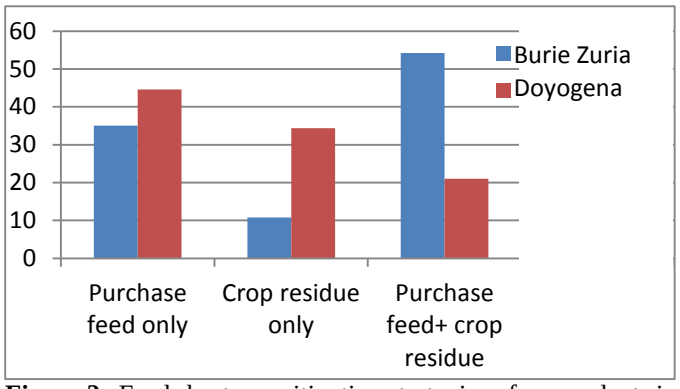

Figure 2. Feed shortage mitigation strategies of respondents in the two districts (%).

Desho grass production and management

The system of desho grass production in the study areas was determined mainly by rainfall. In Burie Zuria district 80% of respondents depended on rain for desho grass production, while 20% also had access to irrigation. In Doyogena district all respondents depended only on rain. Fertilizer application in the form of manure or artificial fertilizer is important for desho grass production (Leta et al. 2013). However, fertilizer usage was not uniform in either the application or form of fertilizer. In Burie Zuria district only 58.3% of respondents applied fertilizer to desho grass. Of the respondents using fertilizer, 75.8% applied manure, while 24.2% applied artificial fertilizer. In Doyogena district 64.5% of respondents applied fertilizers, 94.6% of them using manure and the remaining 5.4% using artificial fertilizer. In both districts weeding of desho grass was not practiced.

In both districts, the dominant form of desho grass production was as a backyard enterprise with 86.3% of respondents following this practice. This may be because the strategy is more convenient for the cut-and-carry feeding system, enabling intensive management and thus high yields in areas where land shortage is a problem. As far as harvesting of desho grass is concerned, in both districts all respondents harvested the grass at about 4 months after establishment. The frequency of cuts during the rainy season after the first harvest was: for Burie Zuria district respondents - every 2 weeks (44.7%), more than 2 weeks (20.3%) and depends on rain/moisture availability (35%); and for Doyogena - every 2 weeks (23.8%) and depends on rain/moisture availability (74.6%).

Utilization of desho grass for animal feed

Further investigation of the utilization of desho grass for animal feed (Table 3) was conducted because most respondents used it for animal feed only (60%) rather than for soil conservation and as source of income. In Burie Zuria district, use of desho grass for animal feed was much less common than in Doyogena. In Doyogena, where the grass is comparatively more utilized, the topography is mountainous and grazing is limited, so farmers would tend to cut-and-carry more. In this district, major crops are potatoes and ensete, which present fewer crop residues for livestock than in Burie Zuria (Table 3).

Table 3. Utilization of desho grass by farmers.

Parameter	No.	%
Desho grass used for 1 purpose (yes)	155	64.6
Desho grass used for 2 purposes (yes)	69	28.8
Desho grass used for multipurpose (yes)	16	6.7
Desho grass for feeding only (yes)	144	60
Desho grass for cattle (yes)	97	41.8
Desho grass for small ruminants (yes)	7	2.9
Desho grass for all animals (yes)	128	53.3
Both grazing and yard feeding (yes)	215	89.6
Feed conservation (yes)	183	81.3

The relationships between utilization of desho grass as feed and characteristics of household heads and farm parameters is indicated in Table 4. Age of the household head had no relationship ($P>0.05$) but there were significant negative correlations ($P<0.01$) between both experience in production of desho grass and training in its use, and its utilization as a feed. However, there was no significant correlation ($P>0.05$) between number of active laborers in a homestead and the utilization of the grass

Table 4. Relationships between utilization of desho grass as feed and characteristics of the household head and farm.

Explanatory variables	Estimate	SD	Sig. level
District	-1.34	0.40	***
Household head age (yr)			
18–30	-0.55	0.53	NS
31–40	-0.16	0.48	NS
41–50	-0.55	0.44	NS
51–60	-0.61	0.47	NS
Education level			
Illiterate	0.58	0.36	*
Read and write	0.86	0.39	*
Elementary school completed	-0.11	0.34	NS
High school graduate	-0.29	0.42	NS
Experience with desho grass (yr)	-0.20	0.08	**
Active laborers (No.)	-0.04	0.06	NS
Farm size (ha)	0.28	0.26	NS
Backyard desho production (yes)	0.29	0.32	NS
Access to training (yes)	-0.93	0.26	***
Total TLU (No.)	0.04	0.06	NS
Feeding system (grazing)	0.98	0.36	***
R^2	0.37		
No. of observations	240		

as a feed. There was no significant correlation (P>0.05) between farm size and distance of the desho grass plots from the homestead.

While there was no significant correlation (P>0.05) between livestock numbers in a farm and utilization of desho grass as a feed, the type of feeding system employed was positively and significantly correlated (P<0.01). There is a high tendency to supplement using desho grass when grazing is the main source of feed. During scarcity of desho grass (or other feed resources), farmers prefer to give the grass to lactating animals. The key informants indicated that, in comparison with other forage grasses used by them (oats, Rhodes and Napier), desho grass was the most important forage species because of its vigorous vegetative growth and high yields. All respondents from both districts had a positive impression of the feeding value of the grass as they indicated that it increases milk yield and improves growth and overall performance of animals when given fresh in the form of cut-and-carry. This elucidates that desho grass is playing a positive role in feeding of growing, fattening and lactating animals in the study district.

Number of roles of desho grass

Data for number of roles (single, dual and multiple roles) for desho grass are presented in Table 5. The non-feed roles of the grass are as soil conservation and income source by selling the grass to other farmers. While there was no significant correlation (P>0.05) between district, age and education level of household head, number of labor units in the family, size of farm and number of livestock and the number of uses for desho grass, there was a significant negative correlation (P<0.01) between experience in production of the grass and its use for only one purpose. In Burie Zuria district about 57.5% of respondents used desho grasses as a source of income by selling planting material (seedlings) to other farmers, while only 12.3% of respondents in Doyogena district earned income from selling seedlings and fresh grass, which was in line with other reports (IPMS 2010; Shiferaw et al. 2011). Desho grass was also used for land conservation purposes in both districts, as reported by other workers (Welle et al. 2006; Leta et al. 2013).

Preferred livestock to feed desho grass

The species of livestock fed desho grass are presented in Table 6. Based on respondents' information, the major species of livestock fed desho grass were used in the bivariate Probit model analysis. There was a significant correlation (P<0.01) between districts in desho grass use for lactating cattle, small ruminants and all livestock. Age of household head, educational level and number of active labor units had no significant relationship (P>0.05) with types of livestock fed desho grass. There was a significant negative correlation (P<0.01) between feed shortages and use of desho grass for lactating cattle, small ruminants and all livestock.

Table 5. Relationships between number of uses[1] of desho grass by the family and characteristics of the household head and the farm.

Explanatory variables	Single role		Dual role		Multi-role	
	Est.	SD	Est.	SD	Est.	SD
District	-0.94	0.34	0.64	0.42	0.68	0.76
Age of household head (yr)						
18–30	-0.44	0.49	0.59	0.58	0.04	0.78
31–40	-0.18	0.44	0.25	0.52	0.45	0.65
41–50	-0.36	0.40	0.73	0.49	0.03	0.57
51–60	0.24	0.44	0.68	0.52	-0.59	0.73
Education level						
Illiterate	0.34	0.35	-0.66	0.39*	0.34	0.58
Read and write only	0.24	0.37	0.35	0.40	-0.21	0.63
Elementary school completed	-0.07	0.33	0.21	0.35	-0.40	0.59
High school graduate	-0.23	0.41	0.38	0.43	-5.10	0
Experience with desho grass (yr)	-0.13	0.08*	0.09	0.09	0.19	0.15
Active laborers (No.)	-0.01	0.06	-0.03	0.06	0.08	0.11
Farm size (ha)	-0.01	0.24	0.11	0.27	0.14	0.46
Backyard desho production (yes)	0.17	0.30	-0.24	0.34	0.11	0.52
Total TLU (No.)	0.04	0.06	-0.11	0.06	0.02	0.11
R^2	0.12		0.29		0.70	
No. of observations	240		240		240	

[1]Uses of desho grass considered: livestock feed, soil stabilization and income source (sale of forage, sale of planting material).

Table 6. Relationship between livestock fed desho grass and household and farm parameters.

Explanatory variables	Lactating cattle		Small ruminants		All livestock	
	Est.	SD	Est.	SD	Est.	SD
District	0.64	0.39*	15.17	1.66***	-0.82	0.40**
Household head age (yr)						
18–30	-0.39	0.48	31.28	1.98	0.16	0.49
31–40	-0.28	0.44	32.37	3.51	0.32	0.44
41–50	-0.28	0.40	28.17	1.40	0.26	0.40
51–60	-0.76	0.44	25.79	2.53	0.59	0.44
Education level of household head						
Illiterate	0.43	0.37	7.38	1.81	-0.65	0.37
Read and write	0.57	0.38	6.91	1.66	-0.75	0.38
Elementary school	0.45	0.36	3.95	2.90	-0.55	0.36
High school graduate	-0.20	0.44	11.47	4.15	0.03	0.43
Active family labor (No.)	-0.03	0.06	-0.30	0.84	0.16	0.09
Feed shortage (yes)	5.85	0.33***	-0.93	0.26	-1.48	0.52***
Landholding (ha)	-0.12	0.25	-1.52	3.95	0.14	0.25
Total livestock (TLU)	-0.14	0.06**	-2.37	2.00	0.25	0.07*
Backyard desho production (yes)	-0.05	0.30	-1.80	2.42	0.00	0.30
R^2	0.24		0.993		0.31	
No. of observations	240		240		240	

Farm size had no significant correlation (P>0.05) with type of livestock species fed desho grass. There was a significant negative correlation (P<0.01) between the total livestock holding and desho grass utilization for lactating cattle and a significant positive correlation (P<0.05) between total livestock holding and desho grass utilization for all livestock. In addition to lactating cattle, desho grass was used for fattening cattle (14%) and equines (3.8%) in both districts.

Discussion

Household characteristics of respondents

The adoption of desho grass in the current study is below expectations, in comparison with findings of other studies (Mugisha et al. 2004; Salasya et al. 2007), which reported that education enhances the use of agricultural technologies because better educated farmers have more opportunity to acquire and process information as well as understand the technical aspects of new technologies. As the literacy level of respondents in the current study is better than the findings of various authors from different parts of Ethiopia (Eba 2012; Mekuriaw and Asmare 2014; Wondatir and Mekasha 2014), this kind of population should be more amenable to technology adoption.

Farm size is an important factor which normally determines the adoption of improved forages (Yami and Markel 2008). Desho grass is here considered as improved forage because it requires allocation of resources such as land, fertilizer and labor in addition to management practices. With regard to farmland, size of farm (0.95 ha) was comparable with the findings of Yayeh et al. (2014), who reported that rural land holding was 0.98 ha for Debre Markos District, Amhara National Regional State. However, farms were smaller than reported by Amare (2006) and Admasu (2008), where average farm sizes were 3.28 and 2.55 ha per household in Amhara and Southern Nationalities Regional States, respectively. Moreover, average farm size was much lower than the national average holding size of 1.6 ha reported by FAO (2008), which may in turn affect improved forage production in both districts. On small farms, a greater percentage of the available area may be required to provide food for the family, leaving less to grow forage for livestock.

With the small farm size, total TLU/household of Burie Zuria (5.46) was lower than the 9.87 (Solomon 2006) and 7.73 TLU (Yayeh et al. 2014) for Dejen and Debre Markos districts, respectively, Amhara National Regional State. The 3.37 TLU/household in Doyogena district was also smaller than the 5.45 TLU reported by Admasu (2008) for Alaba district with average farm size of 2.55 ha, Southern Nations, Nationalities, and Peoples' Regional State, Ethiopia.

Feed shortage as livestock production constraint

The fact that the major problem of livestock production in both districts was shortage of feed in both dry and wet seasons was not surprising as feed shortage is a common feature in many African countries. Both quality and

quantity of feed were insufficient as observed in previous studies by other workers in different parts of the country (Tolera 2007; Fetsum et al. 2009; Tegegne and Asefa 2010), a situation which is aggravated by expansion of crop production and increase in livestock numbers. Under these circumstances, planting of improved grasses to produce higher yields per hectare should reduce the feed deficit and improve the quality of available feed. Size of farm has a very important role in ensuring adequate supplies of feed for livestock, as the primary consideration must be providing food for the families on the farm.

Desho grass production and utilization

For maximum or optimal production, desho grass should be managed properly in terms of weeding, fertilizing, harvesting and utilization. It was gratifying to find that in both districts all respondents started harvesting desho grass when it was about 4 months of age, which is the recommended initial harvesting stage (Göhl 1981). However, 35% (Doyogena) and 42% (Burie Zuria) of farmers did not fertilize their grass, which raises the question of how these farmers utilize their livestock manure. The major difference in utilization of desho grass for fodder in the 2 districts may be related to the different crops grown. In Burie Zuria district crop production is a major activity, especially cereals, and crop residues are a high potential source of feed. However, in Doyogena, major crops are potatoes and ensete, which provide fewer crop residues for livestock. Therefore, desho grass is comparatively more utilized under a cut-and-carry system in Doyogena, as the topography is mountainous and grazing is limited.

The absence of correlation between age of household head and utilization of desho grass for animal feed indicates that all age groups appreciate the advantages of using the grass for this purpose. This contrasts to some degree with earlier reports by other workers (Adesina and Zinnah 1993; Fufa and Hassan 2006) that increasing age of a farmer reduces the probability of using new agricultural technologies.

The significant negative correlation ($P<0.01$) between experience in production of desho grass and its utilization as a feed indicates that growing desho grass for a longer time has provided the experience to utilize it for other purposes like soil stabilization. Similar results have been found by other workers (Welle et al. 2006). It is also significant that about 70% of respondents from Burie Zuria had received training in production and utilization of desho grass, while only 13% had received similar training in Doyogena. Both longer experience with the grass and access to training would have equipped the farmers in Burie Zuria with the knowledge to adopt a more flexible approach to its usage. This suggests that a concerted effort should be mounted, especially with farmers in Doyogena, to provide training and information on production and utilization of this grass. This would need to be a multi-faceted approach, as the illiterate farmers could not take advantage of printed material.

The absence of any significant correlation ($P>0.05$) between number of active laborers in a household and the utilization of desho grass as a feed suggests that the use of the grass is not necessarily labor-intensive or the areas on which desho grass is produced are limited, so usage for stock does not demand much labor input. Non-significant relationships ($P>0.05$) between livestock numbers in a household and utilization of desho grass as a feed may be due to the low livestock units per household in the 2 districts, which averages 3.56 TLU.

Number of roles for desho grass

The absence of any relationship between district, age of household head, and education level and the number of uses for desho grass might be due to the fact that the grass was produced on very small plots of land, which may be used for one or more purposes. This implies that within each district desho producers observed the production systems being used by others and largely adopted a similar approach. Desho grass production and utilization is a relatively new experience and most of the respondents have similar understanding about the roles of the grass. Where experience and training are minimal, the perception of farmers is low, they are not aware of the range of beneficial roles of desho grass, and use it largely for only one purpose.

Preferred livestock to feed desho grass

The non-significant ($P>0.05$) relationship between age of household head, educational level and number of active labor units and type of cattle fed desho grass suggests that the grass is used for the cattle with highest nutritional needs, i.e. lactating animals, regardless of other factors. Moreover, desho grass utilization does not need high literacy level or special knowledge, as all farmers would be aware from experience that these groups of animals need the best feed. This fact overrides all other considerations.

There was a significant negative correlation ($P<0.01$) between feed shortage and use of desho grass for lactating cattle, small ruminants and all livestock. This might be due to the use of other feeds such as crop residues to satisfy basal dietary requirements because desho grass was used to supplement the basal diet by all respondents. Lack

of significant correlation (P>0.05) between farm size and type of species fed desho grass could be associated with the fact that the grass was not planted on large areas of land as a trade-off with other forages or crops. Households in the highland areas tend to use desho grass to feed livestock more than those in the midland area. The higher the dependence on grazing, the greater the likelihood of the grass being used as a feed. The low accessibility to feeds in the highlands (possibly due to limitations of grazing), vulnerability of soil towards erosion and high density of livestock per household, create a higher potential for desho grass to be utilized as both fodder and for soil conservation in the highlands.

Conclusions

Provision of training on the use of desho grass is important to promote production and use of this grass as an avenue to generate income and for soil conservation in addition to animal fodder. This has the potential for capacity building, which would contribute to the sustainable use of desho grass in the future. Research on why multipurpose use is not more common in highland areas would clarify if this approach is necessary. To fully exploit the potential of desho grass, further research is needed on its agronomic characteristics, plus evaluation at the laboratory and animal production levels under a range of conditions.

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