

Livestock production and utilization of sweet potato vines as source of feed in two districts of southern Ethiopia

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Abstract

A diagnostic survey was carried out in Badawacho and Sodo Zuria districts of Southern Nations, Nationalities and Peoples Regional State (SNNPRS) of Ethiopia. The districts were characterized by mixed crop-livestock production system. The average land holding per household is 1.29 ha in the Badawacho district and 0.58 ha in Sodo Zuria district. Livestock have multiple roles. Households keep cattle mainly as a source of draft power in Sodo Zuria and as source of milk in Badawacho districts. The main purpose of keeping small ruminant was as a source of cash income. The average livestock holding per household was 2.60 and 1.97 TLU in Badawacho and Sodo Zuria districts, respectively. The survey indicated that the main dry season feed resources are crop residues, whereas natural pasture is the main source of feed in the wet season. According to the respondents, feed shortage is the major livestock production constraint in both Badawacho and Sodo Zuria districts. Feeding sweet potato vine to livestock is commonly practiced in both districts, mainly as fresh and also after curing. The bulk of sweet potato vine is obtained during harvesting of sweet potato tubers. Households use a smaller portion of the vine for propagation. But the larger proportion of the residue that is left aside is available for feeding to livestock.

Keywords: *feed resources; sweet potato vine; livestock production constraints; Ethiopia*

Introduction

Livestock productivity in most production systems is mainly constrained by feed inadequacy in terms of quantity and quality (Getnet et al., 2003). Grazing and browsing on natural pastures and poor quality crop residues are the main sources of feed in most parts of east Africa (Owen, 1994). Currently, with the rapid increase of human population and expansion of arable land and with the steady decrease in grazing land, the use of crop residues is increasing. However, cereal straws and stovers, which form the bulk of crop residues, are characterized by their low digestibilities (<50%), low metabolizable energy content (<7.5 MJ/Kg DM), low intake (10-15 g DM/Kg live weight), and low content of available minerals and vitamins (Owen, 1985).

Other agricultural by products such as sweet potato vines, cassava leaves, banana leaves and peels, sugar cane leaves and enset (*Ensete ventricosum*) leaves could also serve as important sources of supplementary feed during the dry season. Sweet potato

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is traditionally grown to provide tubers for human consumption and vines can be used as useful supplementary feed for livestock in areas where the crop is grown (Tolera et al., 2000). This study is designed to assess the utilization of sweet potato vine for animal feeding in parts of southern Ethiopia.

Materials and Methods

The study area

A diagnostic survey was conducted in July and August 2005 to describe livestock production system and assess the utilization of sweet potato vines as animal feed in Sodo Zuria and Badawacho districts in Southern Nations, Nationalities and Peoples Regional State (SNNPRS), southern Ethiopia. Sodo Zuria district is located at 6°49'N and 39°47' E and lies approximately 400 km southwest of Addis Ababa. The district covers an area of 481 km² and has an altitude range of 1700-3000 m.a.s.l (Mohammed Saleem, 1995; Irvin, 2000). Rainfall averages 1100 mm per year and is bimodal, with the short rains from February or March - April and the long rains from June - September or October (Tolera and Said, 1992). The area has an annual mean temperature of 18°C. Badawacho district is located at 7° 4'N and 38° 00'E and it lies approximately 328 km south west of Addis Ababa (EMA, 1988). The area has an annual mean temperature of 18°C, and receives an annual rainfall of 900 to 1200 mm (Badawacho district Office of Agricultural and Rural Development, Unpublished).

Sampling technique

Sodo Zuria and Badawacho districts were purposively selected because they are among the areas known to have high potential for sweet potato production. From a total of 50 Peasant Associations (PAs) in Badawacho district three (Weyira Mazoria, Weyira Gere, and Lalo Gerbe) and from a total of 31 PAs in Sodo Zuria districts three (Ziga Borkoshe, Gilo Bisare and Sore Meshido), a total of six representative PAs and 30 households from each PA were randomly selected. Accordingly, a total of 180 households were selected for the interview purpose.

Data collection

Data collection was carried out using a pre-tested questionnaire and information related to household land holding (grazing and cultivated land), land-use patterns, main means of income, herd size, livestock species composition, the purpose of livestock keeping, available feed resources, seasonal availability, livestock production constraints and utilization of sweet potato vine as animal feed in the study areas were collected. Extension personnel who work in agricultural and rural development offices of the districts collected the primary data under the supervision of the researcher. Secondary information was also gathered from district Bureau of Agriculture.

Data management and statistical analysis

Descriptive statistics was employed to describe the various variables in the livestock production systems including household size, herd size, land holding and land use pattern and available feeds. The data was analyzed statistically using SPSS software, version 10.0 (SPSS, 1999).

Results and Discussion

Household characteristics

The mean household size in Sodo Zuria was higher than that of Badawacho district. The average family size was 6.7 persons with a range of 2-13 persons in Badawacho district. Similarly average family size in Sodo Zuria district was 7.9 persons with a range of 2-13 persons per household. The proportion of adults (age class of 15-64 years) per household in Badawacho district was 49.4 % and children (age<15 years) make up 45.5 %, while the proportion of older people (>64 years) in the household was 5.0 %. In Sodo Zuria district 43.2 %, 51.9 % and 4.94 % of household members fall in the age class of (<15 years), (15-64 years) and (>64 years), respectively.

The number of children per household varies from 1-11 in both districts with a mean of 4.9 and 6.0 in Badawacho and Sodo Zuria district, respectively, which indicate that the two districts are among the densely populated areas in the country.

Out of the household heads interviewed in Badawacho district, about 42.2% and 12.2% had educational level of primary and secondary schools, respectively, while the remaining 45.6 % did not have any formal education. About 61.1% of household heads had educational background of primary and secondary schools in Sodo Zuria district, while the rest 38.9% did not have any formal education. The result of the two districts showed that more proportion of the household heads were literate (54.4% and 61.1% in Badawacho and Sodo Zuria districts, respectively). Educated manpower is a social capital that could facilitate generation as well as adoption of new technologies.

Landholding of Households

Average land holding was 1.29 ha per household in Badawacho district and 0.58 ha per household in Sodo Zuria district. This included cultivated land, natural pasture as well as area of homestead. As compared to previous studies, which reported a land holding of 0.96 ha (Tolera, 1990), the landholding has diminished over time in Sodo Zuria. The mean cultivated area was 1.09 ha or (84.5%) in Badawacho district and about 0.42 ha (72.4%) of the farm size in Sodo Zuria district. This result is greater than the privately owned cultivated land (57% of the total land holding) that was reported in Wolayita

Sodo (Irvin, 2000). This implies that there is an increasing competition for land between livestock and crop production.

The average privately owned grazing land was 0.15 ha (11.3%) in Badawacho district and 0.14 ha (24%) of the farm size in Sodo Zuria district. The latter value is by far less than the privately owned grazing land (0.23 ha/household) reported earlier for Wolayita Sodo (Tolera and Said, 1992). This is possibly due to high human population growth in the district, which led to the conversion of private grazing lands into crop land. The relatively higher grazing land allotted by households in Sodo district is due to lack of communal grazing land as compared to Badawacho. It indicated that, more land will be needed to produce food crops, thereby reducing the land available for pasture and fodder. As a result, crop residues will assume greater importance as livestock feed than natural pasture through time.

Crop production

The dominant crops in both districts are maize, sweet potato, haricot beans, teff (*Eragrostis tef*) and enset (*Ensete ventricosum*). Maize is the leading crop in both districts. Area of land used for maize production was 0.43 ha and 0.28 ha in Badawacho and Sodo Zuria districts, respectively (Table 1). The reason for this may be because of higher productivity of the crop as compared to others, and price advantage in relation to sweet potato in the districts. In area coverage, sweet potato was the second leading crop in both districts, it accounts for 0.26 ha and 0.22 ha in Sodo Zuria and Badawacho districts, respectively.

Table 1. Area of land (ha) allocated for production of different crops in Badawacho and Sodo Zuria districts (mean ± SE)

Crop type	Badawacho	Sodo Zuria
Maize	0.43±0.12	0.14±0.07
Sweet potato	0.22±0.05	0.13±0.04
Teff	0.21±0.08	0.02±0.02
Haricot bean	0.14±0.05	0.04±0.02
Wheat	0.03±0.02	0.03±0.03
Potato	0.02±0.02	0.01±0.01
Enset	0.02±0.01	0.04±0.02
Barley	0.02±0.01	0.01±0.01

Many farmers also grow minor crops, which were not ranked; these include pumpkin, sugar cane, cabbage, coffee and Khat (*Catha edulis*). The priority of the farmers is to meet their subsistence requirements. Of the crops, teff, sugar cane, coffee and the stimulant crop Khat are grown primarily for income generation. Of the major crops, both maize and sweet potato are the major staple diets in Badawacho and Sodo Zuria districts. According to the respondents, maize is the major staple diet followed by sweet potato

and teff in Badawacho district (Table 2). This corroborates with the area coverage of the crops in the district (Table 1). On the other hand sweet potato followed by maize and enset are the three major staple diets in Sodo Zuria district. In similar way, Tolera and Said (1992) reported maize, sweet potato and enset as the major food crops in Wolayita Sodo.

Table 2. Percent farmers reporting the different crops as major staple food in Badawacho and Sodo Zuria districts

Crop Type	Badawacho (N=90)	Sodo Zuria (N=90)
Maize	76.4	35.6
Sweet Potato	21.1	53.3
Enset	1.4	7.8
Wheat	-	2.2
Haricot bean	-	1.1
Teff	1.1	-
Total	100.0	100.0

Livestock species composition

According to the respondents, farm animals raised in the two districts include: cattle, goats, sheep, poultry and equine (donkey). The average livestock holding per household in Tropical Livestock Unit (TLU) during the study period was 2.60 and 1.97 in Badawacho and Sodo Zuria district, respectively (Table 3). Bigger herd size per household in Badawacho district is probably due to larger grazing land per household than in Sodo Zuria district.

Table 3. Livestock holding per household and herd/flock structure in Badawacho and Sodo Zuria districts

Location		Badawacho		Sodo Zuria		
Heads of animal species	Mean ± SE	Percent	Mean (TLU)	Mean ± SE	Percent	Mean (TLU)
Total livestock	5.14		2.60	4.00		1.97
Cattle	3.51±0.07	100	2.33	2.70±0.06	100	1.79
Cows	1.38±0.08	39.38		0.90±0.07	33.33	
Oxen	0.62±0.06	17.66		0.57±0.07	20.98	
Bulls	0.32±0.08	9.12		0.21±0.05	7.82	
Heifers	0.57±0.07	16.24		0.50±0.07	18.52	
Calves	0.62±0.06	17.60		0.52±0.06	19.34	
Sheep	1.14±0.07	100	0.12	1.00±0.05	100	0.10
Lambs	0.55±0.08	48.25		0.34±0.07	34.44	
Ewes	0.50±0.07	43.86		0.53±0.06	53.34	
Rams	0.09±0.04	7.89		0.12±0.04	12.22	

Location	Badawacho			Sodo Zuria		
	Mean ± SE	Percent	Mean (TLU)	Mean ± SE	Percent	Mean (TLU)
Heads of animal species						
Goats	0.22±0.03	100	0.02	0.18±0.03	100	0.02
Kids	0.07±0.03	31.82		0.07±0.03	37.51	
Does	0.14±0.05	63.64		0.10±0.03	56.24	
Bucks	0.01±0.01	4.54		0.01±0.01	6.25	
Donkeys	0.25±0.05	100	0.13	0.12±0.04	100	0.06

Oxen comprised 17.7 percent of the cattle herd in Badawacho and 20.9 percent in Sodo Zuria district (Table 3). Given the need for use of oxen as source of draft power for crop production, the result is logical. Moreover, in Sodo Zuria district oxen may also be kept for fattening purpose to generate cash income. However, the proportion of cows, accounted for 39.4 percent of cattle herd, is higher in Badawacho than that of Sodo Zuria district, which accounts for only 33.3 percent. Moreover, proportion of young animals (heifers and calves) in the cattle herd was 16.2 percent and 17.6 percent in Badawacho and 18.5 percent and 19.3 percent in Sodo Zuria, respectively.

Among small ruminant, the average goat holding per household was 0.02 TLU both in Badawacho and Sodo Zuria districts (Table 3). This is smaller than the number (0.25 TLU) reported by Tolera and Said (1992). The proportion of does, accounting for 64.8% of goat flock, is higher in Badawacho than in Sodo Zuria district, which is 56.2%. However, the proportion of kids in the goat flock was 37.5% and 30.2% in Sodo Zuria and in Badawacho districts, respectively. Average sheep holding per household in TLU was more or less similar in both districts (0.11 and 0.10 in Badawacho and Sodo Zuria, respectively). Donkey population was higher in Badawacho than in Sodo Zuria district.

According to the respondents in both districts, the population of livestock shows a decreasing trend over the last five years. This could be due to high human population density, increased cultivated land and concomitant decrease in communal and private grazing lands. The result implies a need for alternative feed sources in the area, and a declining condition of livestock to household nutrition and income generation.

Source of income

Livestock make a substantial contribution to the economy of smallholder farmer in Ethiopia (Gryseels, 1988). Mixed farming is the dominant system in both districts. But in most farms cropping is the main activity while livestock stands second. In Badawacho district, sale of crop products was the main source of income followed by sale of livestock and livestock products (Table 4). Sale of crops followed by animal products and animal sales were the important sources of income in Sodo Zuria district (Table 4). The minimal income from livestock could be due to inadequate livestock services (Irvin, 2000) to enhance the productivity of the livestock sector.

Table 4. Percentage of responses reported on income generating activities in Badawacho and Sodo Zuria districts

Activities	Badawacho (N=90)	Sodo Zuria (N=90)
Crop sale	87.8	63.3
Livestock sale	11.1	10.0
Sale of animal products	1.1	16.7
Total	100	100

Purpose of keeping livestock

In both districts, livestock are reared for multiple purposes. They serve as a source of food, cash income, draft power (land preparation and threshing of wheat, barley and teff), manure and hide and skin. In Sodo Zuria district, the first objective of cattle rearing is for draft power (Table 5). This is because crop production was the main farming activity at the moment in the district. Only 15.6% of the respondents ranked milk production as a major role of cattle rearing. The role of livestock for saving and income generation through sale of live animal is given lesser priority. On the contrary, more than 75% of the households rear cattle primarily for milk production followed by the role as a source of draft power and saving of money in Badawacho district.

Table 5. Percent respondents reporting the purpose of keeping cattle and small ruminants in Badawacho and Sodo Zuria districts

Purpose of cattle keeping	Badawacho (N=90)	Sodo Zuria (N=90)
Milk	77.7	15.6
Draft	18.9	71.1
Saving	2.2	8.9
Cash income	1.2	4.4
Total	100.0	100.0
Purpose of keeping small ruminants		
Income	73.3	69.1
Saving	15.1	20.1
Meat	5.4	2.0
Skin	4.0	2.6
Manure	2.8	5.2

The main purpose of rearing small ruminant in both districts was for income generation through sale of live animals (Table 5). In Badawacho district about 15.1% of the respondents ranked sheep and goats as a means of cash reserve. Small ruminants are also used as a source of skin and manure.

Available feed resources

The principal feed resources available to livestock in the study areas include natural pasture, crop residues and fodder trees (Table 6). Generally, residues from cereals (maize, wheat and barley), were found to contribute more to the feed resource base than those from other crops. Getnet and Ledin (2000) reported that in the highlands of Ethiopia, livestock are mainly dependent on crop residues and natural pasture for their feeds. Also Tolera and Said (1992) indicated that enset and sweet potato vines are used as a dry season feed resources in Welayita Sodo. The magnitude of availability of each type of feed resources varied between the two districts. The difference could be attributed to the variation in land use system and the average size of land holding in the two districts.

Table 6. Percent respondents reporting the feed resources available in Badawacho and Sodo Zuria districts during the wet and dry seasons (N=90)

Feed resources	Wet season		Dry season	
	Badawacho	Sodo Zuria	Badawacho	Sodo Zuria
Natural pasture	78.8	68.9	2.2	24.4
Crop residue	17.8	3.3	56.7	37.4
Hay	1.2	22.2	38.9	17.6
Industrial by-products			1.1	0.5
Fodder trees	2.2	2.2	1.1	17.8

Different studies indicate that crop residues are the most important dry season livestock feed in most countries, as availability of natural pasture is the main limiting factor during the dry season (Preston and Leng, 1984). As human population density rises, the importance of crop-residues feeding increases relative to uncultivated forage. This is reaffirmed by the present survey that more than 55 percent of the Badawacho district respondent reported crop residue followed by hay and natural pasture to be the main feed resource in the dry season. Most of the crop residues are used as livestock feed, but their supply is seasonal. In Sodo Zuria 37.4% of the respondents indicated crop residue as the main feed resource in dry season followed by feed from natural pasture and fodder trees (Table 6). Crop residue is more important as a source of feed in Badawacho than in Sodo Zuria district, this may be due to the availability of large cropping land in Badawacho than in Sodo Zuria district.

In the wet season, available natural pasture was higher in Badawacho than in Sodo Zuria. This may be due to the fact that the land available for natural grazing and browsing is rapidly decreasing due to the increasing human population and increasing demand for cropping land, to cope with the high and increasing human population pressure in Sodo Zuria district. As the report by Tolera and Said (1992) showed, the use of concentrate

feeds is very minimal. Agro-industrial by-products such as oilseed cakes and flour mill by-products are not available in the area. Acute shortage of land and inadequate feed supply constrain animal output in Wolayita Sodo.

Utilization of sweet potato vine as animal feed

Majority of the respondents (98.9%) in Badawacho and (87.8%) in Sodo Zuria districts indicated that sweet potato vine was used as animal feed (Table 7). Similarly Tolera and Said (1992) reported that sweet potato vines as well as *enset* and cassava leaves are used as dry season feeds in Wolayita Sodo. In Badawacho district 51.1% of the respondents use sweet potato vine as fresh, 45.6% use in cured form and the remaining rest 2.2% used in both fresh and cured form (Table 7). On the other hand, 45.6% of the respondents in Sodo Zuria used as fresh and 35.6% in cured form and only 4.4% used both in fresh and cured form of the vine as animal feed.

Table 7. Percent respondents reporting utilization of sweet potato vine in Badawacho and Sodo Zuria districts

Responses on use	Form of use	Badawacho (N=90)	Sodo Zuria (N=90)
Yes	Fresh	51.1	47.8
	Cured	45.6	35.6
	Both	2.2	4.4
	Total	98.9	87.8
No		1.1	12.2

In terms of animal species, cows followed by calves, sheep and oxen were reported to be the main animals fed sweet potato vine in Badawacho district. Also cows followed by oxen, calves, sheep and goat are the animals fed sweet potato vine in Sodo Zuria district. In both districts, cows were given preference to feed sweet potato vine, this may be related with milk production. In both districts the respondents indicated that goats have less preference for sweet potatoes vines than cattle and sheep. In the presence of alternative feeds sources and given the behavior of goats as selective feeders, goats may tend to prefer other shrubs as the major diet. However, previous studies conducted elsewhere (Branckaert, 1993) and on-station experiment conducted at Hawassa University after this survey (Netsanet et al Unpublished) showed that goats can readily consume and devour sweet potato vines.

Livestock production constraints

The respondents in both districts mentioned a number of problems affecting livestock production, but shortage of feed was indicated as the main constraint for livestock keepers (Table 8). In another study, Tolera and Said (1992) reported shortage of grazing

land and inadequate feed supply as the major problems facing livestock producers in the area. Farmers face very high feed shortage especially in the dry season (December- May).

Table 8. Percent respondent reporting livestock production constraints in Badawacho and Sodo Zuria districts

Constraints	Cattle production		Small ruminant production	
	Badawacho (N=90)	Sodo Zuria (N=90)	Badawacho (N=90)	Sodo Zuria (N=90)
Feed shortage	90.0	85.6	62.2	68.9
Land shortage	7.8	6.5	14.5	13.8
Disease problem	2.2	7.9	21.3	9.6
Predator			2.0	7.7
Total	100.0	100.0	100.0	100.0

According to Irvin (2000) weight loss, reduction in milk production, reduction in draft power and deaths of young and adult livestock occur during the dry season. During that time the farmers always need other supplemental feed resources for their livestock (Table 9). As Irvin (2000) reported, some measures taken by farmers to combat these feed shortages are feeding livestock with feeds normally intended for human beings such as sweet potato tubers, maize grain and *gefetano enset*, which is normally reserved for sick animals. The harvesting time of sweet potato overlaps with this time of feed shortage (Table 10). This is also one advantage to overcome these feed shortage by providing the vine while human beings use the tubers. As Tolera et al (2000) indicated, sweet potato is traditionally grown to provide tubers for human consumption and the vines can be used as supplementary feed for livestock. Crops having food and feed value such as sweet potato are gaining more acceptances in systems where land is limited and maximum output from a given area is required.

Table 9. Percent respondents reporting the need of supplemental feed in Badawacho and Sodo Zuria districts

Time of the year when supplements needed	Badawacho (N=90)	Sodo Zuria (N=90)
December-May	81.2	79.7
Always	18.8	20.3
Total	100	100

The other constraints of livestock production indicated by the respondents in the study area include land shortage and disease problem (Table 8). The same holds true to the constraints of small ruminant production in both districts, but the weight given to

the constraints is different. In addition to cattle production problems, predator is one additional problem to the production of small ruminants in both districts.

Table 10. Percent respondents reporting different sweet potato harvesting time in Badawacho and Sodo Zuria districts

Time of harvest	Badawacho (One harvest per year)	Time of harvest	Sodo Zuria (Two harvest per year)
February-April	41.1	January and May	45.6
February-March	32.2	October and February	24.4
May-July	26.7	October and May	20.0
		November and March	10.0
Total	100.0	Total	100.0

The survey showed the importance of sweet potato in the study areas. The fact that sweet potato vine and tuber can be grown and harvested during the dry season, when acute feed shortage occurs, makes it a strategic food/feed crop.

Conclusions

In both districts, shortage of feed was identified as the main constraint affecting livestock production, particularly during the dry season. As human population density rises, the importance of crop-residues feeding increases relative to natural pasture. The culture of feeding sweet potato vine exists in Badawacho and Sodo Zuria districts of Southern Ethiopia. The bulk of sweet potato vine is obtained during harvesting of sweet potato tubers. The harvesting time of sweet potato overlaps with the time of critical feed shortage. This helps to alleviate the problem of livestock feed shortage by providing the vine while human beings use the tuber.

Acknowledgement

The research work was financed by the Norwegian Center for International Cooperation for Higher Education (NUFU) as part of a collaborative project between Hawassa University and Norwegian University of Life Sciences through a project entitled “Enhancing Food Production and Nature Management, Pro 16/2002”. We thank the interviewed farmers for their time and willingness to share their knowledge of their farm and farming system.

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