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*Research Article*

# Production Constraints, Farmers Preferences and Participatory on Farm Evaluation of Improved Forage Technologies in Selected Districts of Southern Ethiopia

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**ABSTRACT**

**Assessments of Desmodiumintortum (Desmodium),Rhodes grass and Alfalfas was carried out on 54 farmers fields in Bolososore, Soddo and Kedidagamila districts of Wolayita and Kembata-tembaro zones of Southern Ethiopia during 2010/2011 cropping season. The objectives of the study was to test the adaptability and acceptability of grass and legume forages, create awareness to the farmers and evaluate the yield performance of the forage species by farmers' evaluation criteria. The range and mean performance of annual grass and legume forages showed considerable amount of variability among the traits in all tested locations. For instance, fresh biomass and dry matter yields of Desmodium was varied from 55.3-83.2 t/ha and 20.01-46.75 t/ha, in Boloso, 41.7-79.3 t/ha in Soddo and 33.8-76.4 t/ha and 13.9-34.2 t/ha in Kedidagamila districts respectively. Moreover, the fresh biomass yields of Rhodes grass varied from 31.9-98.0 t/ha and 27.8-39.3 t/ha for Soddo and Kedidagamila districts, respectively. Besides, the fresh biomass and dry matter yields of alfalfa is varied from 21.9-44.1 t/ha and 22.1-34.30 t/ha and 8.26-23.26 t/ha and 10.6-17.6 t/ha for Sddo and Kedidagamila districts, respectively. Based on farmers' evaluation, the performance of Desmodium wasthe second place after Rhodes grass in all tested districts. In all tested farmers' field, both desmodium and Rhodes grass were the most vigorous, persistent and highly adapted species, and thus can be safely suggested for all tested districts. Based on the overall mean evaluation criteria, 33.05%, 49.34% and 17.73% of tested farmers were select desmodium, Rhodes grass and alfalfa respectively.**

## 1 INTRODUCTION

Ethiopia stands first in Africa and tenth in the world in its livestock population (CSA, 2006). However, the production and productivity in this sector is low due to many biotic and abiotic factors. Feed scarcity in both quantitative and qualitative dimensions is one of the major constraints for the promotion of the livestock sub-sector in Ethiopia (Alemu, 1997; Tesema and Halima, 1998). In many areas of the country, animals are kept on poor quality natural pasture that commonly occur on permanent grasslands, roadsides, pathways and spaces between cropped plots. Moreover, the available grazing lands are decreasing in size and quality particularly in the highlands due to high population pressure and encroachment of cropping on to communal grasslands (Nandi and Haque, 1988). Increased livestock population and the subsequent rise in feed demand are expected to occur largely in the country, where livestock feed production is already insufficient (Lulseged, 1995). This situation warrants the use of appropriate technologies that can optimize utilization of available feed resources and alternative technologies to replace traditional practices (Nandi and Haque, 1986).

Although reliable statistical information on production and distribution of feed in Ethiopia is lacking, moreover, the production of improved forage technologies are not yet adopted and developed by the farming community due to lack of improved forage technologies, inadequate knowledge on production of feed and poor extension service (Othill, 1986). On the contrary, the adoption of improved forage technologies in a sustainable manner at the household level is expected to assume a pivotal role in increasing animal production. Therefore, this study has been designed to test adaptability and demonstrate improved forage technologies*;* to test adaptability and create awareness on *Desmodium intortum*, *Medicago sativa* and *Chloris gayana* in farmers' fields and to evaluate the yield performance of these technologies by farmers' evaluation criteria in bolososore, soddo and kedidagamila districts of Southern Ethiopia.

## 2. MATERIALS AND METHODS

### 2.1 Description of the Study Area

This study was conducted at Bolososore, Soddo and Kedidagamila districts of Wolayta and Kambata-tembaro zones of southern Ethiopia. The environmental conditions of all districts are favorable for production of desmodium, (*Desmodium intortum),* alfalfa (*Medicago sativa*) and rhodes grass (*Chloris gayana*). All tested districts have diverse agro-ecologies with an altitude range of 1675-2500 m.a.s.l, representing one of the major grass and legume forage growing areas of the country.

### 2.2 Selection of Participating Households

Fifty four households eighteen from each district was selected by giving equal chances based on consultation with agricultural experts and key informants knowledgeable about the crops. The selection focused different social groups (Young, Men, Women and wealth status) from six kebeles/groups. Three farmers considered as a group from each district. This process was repeated for all possible groups until six possible groups have been made for each district. An aggregation was then realized on the scores for each group over the farmers participating in the exercise represents the district score. The ranking of these scores provides the position of the varieties in the district. The same process was applied in the remaining districts.

### 2.3 Participatory evaluation with farmers

Eighteen households (from different social groups) each from Bolososore, Soddo and Kedidagamila districts were used to evaluate desmodium, alfalfa and rhodes grass technologies. Selection of individual farmer was made on meeting with key informants that are familiar with the three crops to determine the adaptability and growth performance throughout the entire growing period. Interviews and discussions with different households were also used based on semistructured questioner. The interviews were later extended to group participatory discussions of selected farmers in six clusters from each district. Group discussions were to carefully build on and critically examine, the information derived from individual farmers of different households. It was also intended to clear conflicting ideas on issue like adaptability and growth performance of the technologies. The group discussions focused on i) Preference and selection of forage technologies ii) availability of feed during the dry season iii) growth performance of the technologies iv) types of utilization options and seed set v) earliness and easiness to harvest vi) storability and biomass yield of each crop and other related parameters.

Focus group interviews and key informants were used to understand the underlying factors influencing farmers' decisions to conserve and sustainable utilization of improved technologies on farmers' field. Information obtained from the interviews (individual households and group discussion) and key informants was used to obtain a broad understanding of the technologies in the study districts.

### 2.4 Plantation, Data collection and Statistical Analysis

The seed of desmodium, alfalfa and rhodes grass were sown as broadcast over the entire plots of each farmer (10m x10m of each crop). All plots received a recommended seed rate of 10 kg/ha, 15kg/ha and 10 kg/ha for desmodium, rhodes grass and alfalfa respectively. The recommended fertilizer rates for all

plots are 18/46 N/P2O5 kg/ha were used at planting. Seed viability was determined by germinating scarified seed on moist filter paper in petri-dishes. In this study, approximately 85%, 87% and 89% of desmodium, rhodes grass and alfalfa seeds were germinated and the seeding rates were adjusted to give similar numbers of viable seeds per plots before sowing.

The plantation of all materials was in completely randomized block design with 18 replications in each district. All the plants from the plots were harvested at 5 cm above ground level. Yield was expressed as tone of dry matter per hectare. Dry matter content of the plants was measured after oven-drying at 60℃, for 24 hours. Fifty plants were randomly selected from each plot to collect mean quantitative data. Finally the analysis of yield and other yield related traits were performed using SAS computer software packages (SAS, 2001).

## 3 RESULTS AND DISCUSSION

### 3.1 Survey Results

#### 3.1.1 Boloso sore district

The result of farmers' evaluation revealed that, farmers in the area possess considerable knowledge about all crops and it's persistent. Some of the criteria that are considered by farmers for evaluation are fresh biomass yield, ease of harvesting, avail during the dry season, frequency of harvesting during a year, storability and marketing value of the crops as a whole. From the household interviews, almost 51.85%, 37.03% and 11.12% of the farmers' preferred desmodium, rhodes and alfalfa respectively based on fresh biomass yield, available during the dry season and frequency of harvesting and 74.07%, 20.37% and 5.55% of the farmers selected rhodes grass, alfalfa and desmodium for storability and easiness to harvest because desmodium has high nitrogen and moisture in their leaves and permits spoiled and decompose easily after harvest. Based on growth performance, both desmodium and rhodes grass have the same performance and 55.55%, 38.89% and 5.55% of boloso famers selected desmodium, rhodes grass and alfalfa respectively, however, based on market value farmers' selected desmodium this might be due to the fact that desmodium is not known by the farmers in this area.

#### 3.1.2 Soddo District

The result of farmers' evaluation obtained from Soddo district indicated that there were many important practices carried out by farmers' concerning selection and utilization options of grass, legume and other local forage cultivars. The results of the household interviews showed that 55.56% of farmers of the respondents reported that they select and collect forage materials from their own gardens and the remaining 44.4% reported that they gather planting material from the market and grazing lands due to lack of improved forage technologies in the area.

All the farmers communicated to evaluate performance of the improved forage technologies (dismodium, alfalfa and rhodes grass) based on their own criteria. About 88% of the respondents said to have preferred the improved forage technologies and the remaining 12% reported that they selected both local and improved forages. The general indication is that farmers preferred both local and improved technologies to solve their seasonal feed shortage during the dry season in the Soddo district when other crops are not in the field. The improved forage technologies especially dismodium and rhodes grass seems to be used to fill seasonal feed gap in the area. Based on growth performance, biomass yield and growth habit of the crop, about 46 (85.17%) of the respondents reported to have a good interest in dismodium and rhodes grass technologies, which might be attributed to the fact that farmers in the area have high feed shortage and thus the improved technologies produces high fresh bio mass yield, had high tillering capacity and have good performance as compared to their alfalfa. Farmers in the area have a good trend of using alfalfa leaves as poultry feed. This taken in to consideration 35(64.81%) of the total farmers were selecting alfalfa.

Harvesting of forage is a labour-intensive operation that involves standing, bending and sometimes sitting on the ground depending on the length and twisting of vine to each other. This is taken in to consideration by the farmers, 48 (88.89%) of the farmers selected rhodes grass and alfalfa rather than desmodium for ease of harvesting.

Farmers who live in soddo district follow the same interest on seed set, avail in the dry season and frequency of harvest. There was no disease and insect pests observed during the entire growing period of the three crops, as a result of which the farmers did not evaluate the susceptibility and resistance of the technologies to diseases and insect pests as a whole. In general, farmers' preference or selection criteria were found to be highly dependent on the needs of individual farmers, available land and the accessibility of planting materials.

#### 3.1.3 Kedidagamila District

The results of the survey conducted in the kedidagamila district showed that almost all the farmers approached have the same knowledge about the utilization of grass and legume forages which provides a good setting to study, selection and evaluation of improved forages in traditional agriculture within the farmers. The results of the preliminary observation made within the farming population of the study area suggested that the technologies have distinct strengths and weaknesses and the farmers use their own criteria's to select the technologies found in the fields.

About 67% of the respondents reported that they collect and utilize forage materials from crop by products

and forage trees whereas the remaining 33% said that they collect planting material from district bureau of agriculture and rural development office. The results of the survey clearly indicated that there are many selection and utilization options of local and improved forage cultivars at the household level . The results of the interview made with the households indicated that most of the farmers 45 (83.33%) were selecting rhodes grass and dismodium based on biomass yields, growth performance and seed set at maturity.

Like to boloso farmers, farmers who live in kedidagamila have the same interest on most of the criteria that was used. The results of the survey conducted in the kedidagamila district showed that farmers enforced to feed poultry from their crop by products and prefer alfalfa over grass forages as poultry feed Legume forages have high nitrogen content, but easily spoil during long time storage which inturn results in decrease in nutritive quality. Thus, most of the respondents reported to prefer rhodes grass over alfalfa for conservation as feed of dry period. On the other side, all the farmers communicated said to have preferred both alfalfa and rhodes grass over local cultivars based on ease of harvesting. Generally, the selected forage crops are high yielder and have better quality compared to natural pasture and local forage cultivars.

### 3.2 Results of Field Plantations

#### 3.2.1 Bolososore district

According to the result of the experiment, the mean fresh biomass (80.53t/ha) and dry matter yield (32.6t/ha) of *D. intortum* grown at bolososore district is higher than that of average national yield (Table 1). The performance of desmodium (*Desmodium intortum)* is very good in all tested farmers' fields of bolos sore district**.** It gave the highest mean biomass and dry matter yield (Table 1). The same observation was done under natural pastures in the area. The legume had spread over large areas where it was not abundant before. The legume modulates profusely without any intervention, especially under the shade of the trees. The legume is naturally prostrate and this makes it better adapted to grazing conditions. Under natural conditions, *Desmodium intortum* mainly produce high yield (Fresh and dry matter) without suffering from competition with any weed spp. Therefore, management of *Desmodium intortum* has a great impact on soil conservation and sustainable animal feed (Lal,, 1986 and Minale, 1997).

Besides, the mean performance of rhodes grass in boloso (56.03t/ha) is higher than soddo (54.75t/ha) and kedidagamila (33.36 t/ha) (Table 1). This is due to high adaptability of the crop in tropical environment (Habtamu and Teshale. 1996). The average dry matter yields did not exceed 20t/ha in tropical region but in this study the result is much greater than (28.04t/ha) the average dry matter yield (20t/ha) of tropical region. The performance of alfalfa in boloso is low and produced least amount of (9.03t/ha).

#### 3.2.2 Soddo District

The results of the field plantations in soddo showed that the growth performance of both crops is good and are strongly persistent in most of the farmers fields (Table 1). Both the short season desmodium and rhodes grass had high tillering capacity, resistance to insect and disease and good in seed and flower production as a result of which the majority of the farmers in the study area showed a good interest in the technologies.

The mean fresh and dry matter yield of desmodium and rhodes grass planted in this district was 64.6t/ha and 54.75t/ha. respectively (Table 1), with the corresponding range of 41.7-79 t/ha and 31.9-98.0 t/ha for fresh yield and 19.7-39 t/ha and 13.19-61.27t/ha dry matter yield. Rhodes grass was found to be very persistent and vigorous with high tillering capacity (11.30/plant), in all farmers plot. On the other side, the mean fresh and dry matter yield of alfalfa planted in the same study area was 30.20 t/ha and 13.95 t/ha respectively (Table 1) with a corresponding range of 21.9- 44.1 t/ha for fresh yield and 8.26-23.26 t/ha for dry matter yield indicating that alfalfa also performed very well on farm condition in soddo district. This result showed that Soddo district is very suitable and favorable for the production of alfalfa. Thus, it could safely and economically be suggested that both alfalfa and rhodes grass are highly productive under household farming system of soddo district.

**Table 1: Means, standard deviation and ranges of four quantitative traits of Dismodium, Rhodes grass and Alfalfa grown on 54 farmers' fields of Bolososore, Soddo and Kedidagamila districts of Southern Ethiopia, 2010/2011 cropping season**

| Characters | Forage types | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dismodium | | | | | | Rhodes grass | | | | | | Alfalfa | | | | | |
| | Bolososore | | Soddo | | K.gamila | | Bolososore | | Soddo | | K.gamila | | Bolososore | | Soddo | | K.gamila | |
| | Mean | Range | Mean | Range | Mean | Range | Mean | Range | Mean | Range | Mean | Range | Mean | Range | Mean | Range | Mean | Range |
| NBR/l | - | - | - | - | - | - | 10.8 | 5-14 | 11.30 | 4.0-16 | 12.41 | 7-16 | 8.6 | 2-9 | 9.08 | 3-17 | 10.25 | 4-17 |
| PH | 137.66 | 103-171 | 123.2 | 91-152 | 97 | 83-135 | 152.1 | 134-182 | 148.6 | 129-173 | 119.7 | 111-129.5 | 102 | 91-121 | 127.2 | 121.3 - 138.9 | 83.7 | 73.7-92.3 |
| FBY | 80.53 | 55.3-83.2 | 64.6 | 41.7-79 | 51 | 33.8-76.4 | 56.03 | 35-101 | 54.75 | 32-98 | 33.36 | 27.8-39.3 | 22.7 | 16.3-31.2 | 30.2 | 21.9-44.1 | 26.22 | 22.1-34. |
| DMY | 32.60 | 20-46.75 | 27.33 | 19.7-39 | 21.8 | 13.9-34.2 | 28.04 | 19.3-71.2 | 25.83 | 13.19 - 61.27 | 15.06 | 10.08 - 20.33 | 9.03 | 4.8-16.7 | 13.95 | 8.26-23.26 | 12.38 | 10.6-17.6 |

NBr/pl =Number of branches/plant, PH=Plant height (cm), FBY=Fresh biomass yield (t/ha) and DMY=Dry matter yield (t/ha).

**Table 2**: **Summery of major farmers evaluation criteria of Desmodium, Alfalfa, and Rhodes grass at Boloso sore, Soddo and Kedidagamila districts of Southern Ethiopia and their rankings (n= 54 farmers)**

| Characters | Boloso sore | | | | | | Soddo | | | | | | Kedida-gamila | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dismodium | | Rhodes grass | | Alfalfa | | Dismodium | | Rhodes grass | | Alfalfa | | Dismodium | | Rhodes grass | | Alfalfa | |
| | No. farmers | % | No. famers | % | No. farmers | % | No. farmers | % | No. farmers | % | No. farmers | % | No farmers | % | No.farmers | % | No.farmers | % |
| Bio mass yield | 28 | 51.85 | 20 | 37.03 | 6 | 11.12 | 26 | 48.14 | 20 | 37.03 | 8 | 14.81 | 23 | 42.59 | 22 | 40.74 | 9 | 16.67 |
| Selection of forage | 30 | 55.55 | 21 | 38.89 | 3 | 5.55 | 21 | 38.89 | 21 | 38.89 | 12 | 22.22 | 24 | 44.44 | 22 | 40.74 | 8 | 14.81 |
| Growth performance | 26 | 48.14 | 25 | 46.29 | 3 | 5.55 | 26 | 48.14 | 23 | 42.59 | 5 | 9.25 | 23 | 42.59 | 22 | 40.74 | 9 | 16.67 |
| Avail the dry season | 28 | 51.85 | 20 | 37.03 | 6 | 11.12 | 26 | 48.14 | 21 | 38.89 | 7 | 12.96 | 27 | 50.00 | 21 | 38.89 | 6 | 11.12 |
| Type of utilization | 12 | 22.22 | 14 | 25.92 | 28 | 51.85 | 3 | 5.55 | 16 | 29.63 | 35 | 64.81 | 6 | 11.12 | 18 | 33.33 | 30 | 55.55 |
| Frequency of harvest | 28 | 51.85 | 20 | 37.03 | 6 | 11.12 | 25 | 46.30 | 29 | 53.70 | 0 | 0.00 | 25 | 46.30 | 29 | 53.70 | 0 | 0.00 |
| Seed set | 28 | 51.85 | 23 | 42.59 | 3 | 5.55 | 28 | 51.85 | 38 | 70.37 | 12 | 22.22 | 23 | 42.59 | 22 | 40.74 | 9 | 16.67 |
| Earliness to harvest | 28 | 51.85 | 22 | 40.74 | 4 | 7.40 | 22 | 40.74 | 26 | 48.14 | 6 | 11.12 | 24 | 44.44 | 26 | 48.14 | 4 | 7.40 |
| Easiness to harvest | 3 | 5.55 | 40 | 74.07 | 11 | 20.37 | 4 | 7.4 | 26 | 48.14 | 22 | 40.74 | 6 | 11.12 | 25 | 46.29 | 23 | 42.59 |
| Storability | 3 | 5.55 | 40 | 74.07 | 11 | 20.37 | 6 | 11.12 | 40 | 74.07 | 8 | 14.81 | 7 | 12.96 | 40 | 74.07 | 7 | 12.96 |
| Market value | 0 | 0.00 | 52 | 96.30 | 2 | 3.70 | 0 | 0.00 | 50 | 92.59 | 4 | 7.40 | 0 | 0.00 | 45 | 83.33 | 9 | 16.67 |
| **Overall mean** | | **36.02** | | **49.72** | | **13.97** | | **31.48** | | **52.18** | | **20.03** | | **31.65** | | **46.12** | | **19.19** |
| **Overall rank** | | **2** | | **1** | | **3** | | **2** | | **1** | | **3** | | **2** | | **1** | | **3** |

Rank: 1= Best; 2= fair; 3= worst. The scoring represents farmer's evaluation criteria of desmodium, rhodes grass and alfalfa. This scoring reveals the degree of satisfaction provided by each variety in considering each criteria (n=54). Only farmers who held evolutional knowledge on each given technology were requited to assess it.

### 3.2.3 Kedidagamila District

The results of the field plantations of desmodium, alfalfa and rhodes grass initiated in kedidagamila district are shown in Table 1. The results obtained showed that both grass and legume forages performed well in the kedidagamila district. Perennial, rhodes grass had densely fine stems, high degree of resistance to disease and insect pests, good seed set and an excellent seedling regenerative capacity. The mean fresh biomass and dry matter yield ranged from 27.8-39.3 t/ha and 10.08-20.33 t/ha respectively (Table 1) with the corresponding mean value of 33.36 t/ha for fresh yield and 15.06 t/ha for dry matter yield. Moreover, it is well established in all tested farmers fields and had got good impression of farmers.

According to the data given in Table 1 alfalfa, was found to be more strongly persistent and highly resistant to disease and insect pests. A mean fresh and dry matter yield of 26.22 t/ha and 12.38 t/ha was recorded from alfalfa planted on farmers field respectively. In some farmers' fields, the performance of alfalfa was quite low, with poor seedling, regenerative capacity, and poor establishment and growth performance as compared to soddo district (Table 1), which might be attributed to poor cultural practices was done during the life span of the crop. Based on the over all results of these on farm experiments both rhodes grass and desmodium could safely be recommended in the kedidagamila district.

## 4 DISCUSSIONS

This study, basically focus on: test adaptability and create awareness on grass and legume forages in boloso, soddo and kedidagamila districts of southern Ethiopia. Toward this effort, desmodium (*Desmodium intortum),* alfalfa (*Medicago sativa*) and rhodes grass (*Chloris gayana*) were used for assessment. The range and mean performance of annual grass and legume forages have showed considerable amount of variability among the traits. For instance, fresh biomass and dry matter yields of desmodium was varied from 55.3-83.2 and 20.01-46.75 t/ha, in boloso, 41.7-79.3 in soddo and 33.8-76.4 and 13.9-34.2 in kedidagamila districts respectively. Moreover, the fresh biomass yield of rhodes grass varied from 31.9-98.0 and 27.8-39.3 tones/ha for soddo and kedidagamila districts respectively. The height of desmodium also varied from 102.8-170.7, 128.9-172.9 and 110.8-129.5 cm for boloso, soddo and kedidagamila districts respectively. Furthermore, the fresh biomass yield and dry matter yields of alfalfa is varied from 16.3-31.2, 21.9-44.1 and 22.1-34.30 t/ha and dry matter 4.8-16.7, 8.26-23.26 and 10.6-17.6 t/ha for boloso, soddo and kedidagamila districts respectively. As compared to desmodium and rhodes grass, the mean yield of alfalfa, is poor in all locations; it probably resulted from unfavorable climatic conditions. The result of farmers' evaluation criteria revealed that, farmers in the study areas possess considerable knowledge about grass and legume forages and the attributes of each crop. Based on the overall mean evaluation criteria, 33.05%, 49.34% and 17.73% of tested farmers selected desmodium, rhodes grass and alfalfa respectively.

## 5 CONCLUSIONS AND RECOMMENDATION

Our present data are not yet conclusive and since there is little information on these important grass and legume forages, therefore, there is a need to investigate further other indices of evaluation.

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