Title: Small Scale Irrigation Users Agro-Pastoralist Access to Improved Forage Technologies for Sustainable Livestock Development in Afar and Oromia Regional State of Ethiopia

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Abstract

In Ethiopia, forage productions seed mainly supplied to farmers by government and non-government organizations (NGOs) in unsustainable manner. As an alternative option to this, the Werer Agricultural Research Center in collaboration with Woredas Agricultural Office undertook participatory community based forage production study using scaling out approach for two year (2013 main growing season) in Amibara, Awash Fentale and Fentale districts. Generally, 300 agro-pastorals were involved in the project and the main forage species used were Lablab, Napier grass, Alfalfa and Cowpea. It was learned that Agro-pastorals are capable of producing forage and used the forage for their milking cows, goats and camels which contributed substantially to their families consumption and nutritional addition to the household. It recommend that agro-pastorals better organize themselves in a form of research groups which can help them to support each other in technical efficiency forage that can be supplied to the market and involve in seed production for larger dissemination among the farming and fattening community, this has a dual purpose in forage production (increased livestock productivity and income generation).

1. Introduction

Agro-pastoral of Ethiopia situated primarily in arid and semi-arid areas, as a rule of thumb, the lower the average annual rainfall, the higher and the variability of rainfall and forage availability. Pastoralists in semi-arid areas therefore cannot plan with a fixed stocking rate and a long-term grazing plan. They have to adapt to the highly variable climatic and forage conditions. No doubt, that climate change is affecting dry lands and pastoral livelihoods in Ethiopia. As a result, these Areas were tending to become drier, and existing water shortages is worsen. In addition, climate change is likely to bring about even more erratic and unpredictable rainfalls and more extreme weather conditions such as longer and more frequent droughts. Where this happens, the delicate balance on which pastoral systems depend is undermined.

Letting Agro-pastorals to produce the most valuable forage crops at the irrigated field as well as at backyards can help the achievement of development efforts for the social stability and healthy livestock production system in pastoral and agro-pastoral districts.

In addition, Agro-pastorals benefited from the available proven forage technologies and it was help them to cope with the environmental variability and reduce unnecessary long travel in search of grazing lands for their animals. In turn, it contributes for the peace and stability of the community by producing forage permanently in their own land and backyards as many of the conflicts in pastoral areas caused by scares feed resources like pasture and range land.

General objective

Promote different improved forage technologies in small-scale irrigation user agro-pastoral communities.

Specific objectives

Increasing Agro-pastorals community awareness on improved forage production

1.1.Agro-pastoral development strategy

There is a clear historic trend towards considering pastoralists' settlement as a solution to their problem, promoted by government and those concerned with the question of rational use of resources and promoting development of rural areas.

Poverty reduction and agricultural development are objectives that are high on the political agenda of Ethiopia. For instance, improving crop production and productivity thereby to ensure food security, increase input supply for local industries and improve foreign currency earnings have given due attention in the five years Growth and Transformation Plan (GTP) of the country (MoFED, 2012). Moreover, the GTP explicitly recognizes voluntary resettlement program as a key instrument to improve food security and welfare of rural communities in arid and semi-arid areas. Hence, public research and extension institutions expected to strengthen existing technology transfer efforts to realize these expectations particularly in pastoral settlement areas.

1.2. Scaling out of Agricultural technology for enhanced livelihood

Future agricultural growth will depend vitally on raising productivity, through better yields and moving toward higher-value products. As most of the poor continue to depend on agriculture for their livelihood, technological improvements, and access to it, are also an essential ingredient of any poverty reduction strategy. It documented that the only means of dramatically increasing productivity is to improve the farmer's technological capabilities (Rhoades, 1987).

Picture 1: agro-pastoral on farm training at WARC

Agricultural research institutions have key role in technology development and improving productivity. However, research is only one element in a complex of processes that lead to innovation and the adoption of new technology (FAO, 2010). Hence, it is critically important to facilitate the forging of collaborative partnerships among and between researchers, extension service providers, rural farmers and producer organizations. This can reduce transaction costs of knowledge and information dissemination also make for greater relevancy in technology generation (FAO, 2006).

1.3. The need for stakeholders' partnership and coordination

Therefore, stakeholders' collaboration and linkage is a key for success. This is because there are different institutions operating in pastoral areas particularly government institutions, and they directly interact with rural communities. However, there is little interaction among these institutions, even though they have similar objectives (Carley, 1992). The establishment of task-oriented networks and taskforces often considered the most effective way to tackle such complex issues with many different stakeholders (Alders, 1993).

Partnership is an agreement to do something together and it will benefit all the involved parties, bring results that could not achieved by a single partner operating alone, and reduce duplication of efforts. A successful partnership enhances the impact and effectiveness of action through combined and more efficient use of resources. Hence, facilitating linkages in scaling up/out initiatives and soliciting the full and genuine participation of actors is, therefore, vitally important in enhancing agricultural technology generation, development, transfer and utilization as well as in accelerating agricultural and rural transformation (Kaimowitz *et al*., 1990). Similarly, networking significantly contributes agricultural research and extension activities to be more impact oriented.

This project is, therefore, designed to enhance settled agro-pastoralists' access to improved agricultural technologies and management practices through partnership mainly in settlement areas of Amibara, Awash Fentale and Fentale districts. Proven agricultural technologies that are crucial to increase production and productivity and bring meaningful impact on the livelihoods of the settled agro-pastoralists disseminated with a direct involvement of concerned stakeholders. Above all, the project was providing support for the current pastoral settlement.

2. Methodology

The research strategy comprises the following main activities:

(i) ***Description of the production system*****:** Rapid rural appraisal (RRA) and production monitoring methods assisted by participatory research tools, to characterize and better understand the attributes, production and socioeconomic aspects.

(ii) ***Definition of scaling out goals***: Building on information obtained from production systems characterization and local knowledge, input of community member was capture using participatory approach.

(iii) ***Assess the existing traditional institutions and policies:*** with the aim of building on to enhance or strengthening them to better support improved

forage varieties and general resource management and marketing strategies, at community level.

(iv) ***Development and implementation of a community-managed scaling out strategy*****:** strategies varying in complexity considered in accordance with institutional arrangements, opinions of the community and the baseline performance data on the production and productivities in question.

(v) ***Joint evaluation of rapid survey results and development of guidelines for setting up community-based Agro-pastoral Research Group programs*****:** Comparisons of available community-based scaling out plans conducted in identical premises and variety of conditions will enable identification of key factors that contribute to the successful adoption of forage scaling out plans.

(vi) ***Impact assessment*****:** Baseline information considering key indicators of success compiled for further assessments of the performance and potential sustainability of the strategy, one year after completion.

(vii) ***Impact of technologies change at individual and systems level:*** To assess the relationship between male headed and women headed household in adopting the technologies and in livelihood improvement and resulting productivity changes, at the individual level.

2.1. Types and Methods of Data Collection

A pilot survey conducted in Amibara, Awah Fentale and Fentale woreda. The pilot surveys then used to develop an agro-pastoral adoption of technologies for scaling out of forage.

2.2. Analysis of Data

Two types of methods employed. Simple analytical tools such as percentages, averages etc formulate descriptive analyses for much of the data. Paired t-tests used

to determine if there is a significant mean difference between early adopters and non-early adopters for success in scaling out of the technologies.

2.3. Sample size

From all woredas (districts), 100 household of agro-pastorals were selected with total land coverage of 20.2 ha.

Table 1: Sample sites

No.	Woreda	Sample site	Technology	Beneficiaries	Area in ha
1	Amibara	Waidulele, Bodahamo, Ambash and Angelelea	Forage	30	7.2
2	Awash Fentale	Sabure and Deho	Forage	20	5
3	Fentale	Illala, Dreasedi and Gorbo (It might increase)	Forage	50	10
Total				**100**	**20.2**

Source: own data of 2013

3. Results and Discussions

In order to improve the linkage among research, extension and farmers, and thereby help them function synergistically with an aim to bring significant change in the livelihoods of resource poor agro-pastoral, there is a need to promote scaling out of forage technologies. Accordingly, in the first year, 100 households were formed beneficiaries of different forage varieties from Amibara, Awash Fentale and Fentale districts using small-scale irrigation and dairy beneficiary that were willing to participate were purposely selected. In the second year, 100 agro-pastorals were involved for pre-scaling out production.

Forage Production

Lablab is a vigorous annuls or short-lived perennial legume with very vigorous seedlings, which best promoted as a dual propose species. It grows up to 2400m altitude and requires more than 400mm annual rainfall. Lablab suite to a wide range of soils but will not tolerate salinity or water logging. Being large seeded; it establishes easily on a rough seeded bed with seeding rates of 18-20kg/ha four pure stands under irrigated middle Awash condition. Successful establishment requires the seed covered before germination. Lablab should cut or grazed regularly and lightly. Should not, be cut below 25-30cm. It has moderate palatability and cattle may require several days to become acquainted with it.

Lablab yield more seeds in Amibara area than the rest of the districts. This is because of good management practice and availability of irrigated water throughout the production process that enabled the plant to have a more herbage yield (dry matter per ha) whereas in Awash Fentale there was miss management of practices by households and irrigation water shortage at the time seedlings. The establishment of Alfalfa was possible in both districts during the season.

Alfalfa is a long –lived perennial legume producing large quantities of high quality forage under good management. It develops a deep taproot, which enables the plant to withstand drought once established. It produced good yields with more than 600mm of rainfall and suited for irrigation production. Alfalfa is suited to a wide range of well-drained soils but best production is on neutral to slightly alkaline soils

Nevertheless, in the second year, one agro-pastoral at Amibara was able to produce two kg of Alfalfa. Similarly, a higher herbage yield was recorded in Amibar district because of the high availability of irrigated water. Concerning the growth of elephant grass the growth noticed to slow in Amibara. In all of the species selected and established in both districts, a lower seed yield and herbage was recorded as compared to the findings in literatures (Alemayehu, 1997).This could

be absence of good management application before the establishment to support its emergency and its subsequent growth.

Picture 2: Forage seed that was ready for distribution

Table 2:

Parameter	Variety type			
	Lablab	Napier grass	Alfalfa	Cowpea
Seed used per ha	13kg	cutting	8kg	14kg
Average land coverage	5.2	3.5	5.5	6
Spacing applied	10cm	50cm	**	10cm
Soil type				
Average yield per ha	40 ton biomass		50 ton biomass	36 ton biomass

Source: own data of 2013

Note: ** no spacing applied between plants but 40cm spacing between rows applied

Feeding improvement and economic impact implication

The land allocation for the aforementioned forage species ranges from 0.20 to 0.25 of a hectare where on average in each sample districts. This indicated that for the annual species (lablab), it was possible to obtain lablab residue of 30 ton for agro-

pastoral in Amibara and 22 ton of biomass in Awash Fentale, respectively. This can support 645 TLU (Tropical livestock unit) for a farmer in Amibar and 352 TLU in Awash Fentale district. Whereas for Alfalfa it can support 912 TLU and 748 TLU in Amibara and Awash Fentale districts, respectively (where the cutting frequencies were two times in a month and once in a month for respective districts). The Scaling out Agro-pastoral engaged in the community based forage production by feeding their cows with green feed (alfalfa) and the residue the milk yield of their cows increased by 1-2 liters /head.

4. Recommendations

Lessons Learnt

- Additional efforts are required to organize Agro-pastoral in one form as the sale of forage seed or grass does not have a regular market place as food crops

- The start of forage production should have different utilities not only seed or grass production for sale. But, increased quantity and quality of livestock feed need emphasis particularly for those who have dairy cows.

- Doing research with participation of Agro-pastoral at all stages, different stakeholders, policy makers, etc are key indicators for successfulness and sustainability of certain technology.

- Agro-pastorals who have been trained for other activity, observed the forage demonstration site and impressed much and repeatedly asked to do as the centre does and they were unfortunately selected as one of agro-pastoral forage grass producers and are eventually found performing better.

Picture 3: Field day of experience sharing

Cut and carry

Cutting forage for hand feeding to livestock is the recommended method of using forage in most areas of Ethiopia; especially Harrarighe farmers use this system. The cut and carry system allows farmer to completely control the use of his forage.

Benefits of cut and carry

- It increases livestock performance through higher forage production and higher rates of utilization.
- It avoids wastage of forage by animal feces on pastures.
- It reduces internal parasite problems, especially in wet areas.
- It avoids distraction of the pasture by overgrazing and helps to control soil erosion.

The main problem with cut and carry is that it demands more labor than grazing. However, even if labor on the farm is scarce, it may be possible to use cut and carry at times when other activities on the farm are limited.

Another problem with cut and carry is that soil fertility can rapidly decrease, no dung, urine or forage left on the pasture, as is the case with grazing. Therefore, the development agents should encourage farmers to tether and feed their animals as close as possible to where the forage is growing. This has two advantages:-

1. It reduces the labor requirement for carrying the forage
2. It allows the animals manure to be spread easily on to the forage area

When to cut the forage

Forage is at its best when it is young and green. It is more palatable and nutritious than older and drier forage. The development agents should advise the agro-pastorals to cut and use their forage while it is still fresh and green. Grasses decline in feeding value much more quickly than legumes so they should cut frequently. Example: Rhodes ever 45 days under irrigated condition. Tree legumes should generally cut to a height of about 1meter. Cutting should carry out ever 6 to 8 weeks. This increases the proportion of leaves on the tree legumes and as a result, the feeding value is increased. Longer cutting intervals may use where there is a need for fuel wood. The portion of legume should generally be 20-30% of the ration, but even 10% will result in marked improvement in livestock production. Forage not always needed for feeding when it is at its best. Forage conservation is, therefore, necessary and advisable in many cases.

Table 3: Forage Crops Recommended for Middle Awash Irrigated Area

No	Species	Dry matter t/ha/year	Number harvest per year	Seed yield (kg/ha/year)	Irrigation frequency	Seed rate (kg/ha)	Spacing (b/n rows and within row)
	GRASS						
1	Chloris gayana (Rhodes grass) cv.Masaba	42	6	639	15	6-10	40X0cm
2	Cenchrus ciliaris(Buffle grass) cv. Bilola	40	8	810.4	15	8-13	40X0cm
3	Panicum maximum (green panic)	45	7	700	15	5	40X0cm
4	Panicum antidotale(blue panic)	65	7	2234.4	15	4-5	40X0cm
5	Sorghum sudanse (Sudan grass)	49	4	3668	15	6	40X25cm
6	*Pennisetum purpureum (Elephant grass)	48	4	-	15	cutting	100X50cm
7	*Pennisetum Spp.	45	4	-	15	cutting	40X20cm
	Species	Dry matter t/ha/year	Number harvest per year	Seed yield (kg/ha/year)	Irrigation frequency	Seed rate (kg/ha)	Spacing (b/n rows and within row)
	LEGUMES						
1	Medicago Sativa (Alfalfa) Hairy Peruvian	55	8	2368	15	6-8	40X0Cm
2	Macroptilum atrpurpureum (siratro)	36	7	3500	15	6	40X0cm
3	Lab- lab purpureus (Dolicos)	45	3	2568	15	18-20	40X10cm
4	Vigna unguiculata (Cowpea)	8.3	1				40X10cm
	FODDER TREES						
1	Leucaena leucocephala cv.Cumighum	65	4		15		100X25cm
2	Sesbania sesban	40	4		15		100X25cm
3	Gliricidia sepium	35	3		15	cutting	