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Farmer Innovation and Market-oriented Livestock Production in Ethiopia – Key to Sustainable Natural Resources Management

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Introduction

With shifts in climate changes and associated risks, animal production appears to be more resilient to rainfall induced stresses and thus contributes widely to the livelihood of the rural farmers in Ethiopia. Crop-livestock mixing farming in Atsbi district, Tigray Regional State, and a combination of pastoral, agro-pastoral and limited crop-livestock mixed systems in Mieso district of Oromia Regional State are commonly practiced to diversify household income sources. The livestock resources in these systems are commonly considered as capital assets for the rural households and are easy to convert in to cash (ASSEFA ABEGAZ. 2005). Atsbi highland sheep is particularly preferred for its peculiar tasty mutton, while goats and fattened cattle are major marketable commodities in Mieso. Farmers and pastoralists secure income through sale of animals to the domestic consumers and export abattoirs throughout the year. Animals are traditionally managed and the major feed resources are natural pasture, stubble grazing and crop residues. In Atsbi, increasing human population, however, large proportion of the traditional grazing lands shifted to croplands. Consequently, overgrazing intensified, vegetation cover reduced and runoff and removal of fertile topsoil due to erosion accelerated and infiltration rate reduced. Furthermore, the primary productivity of the bottomlands has been decreasing due to the burial by infertile soils eroded from the upper catchments. Aggregately, the landscape changed into bare lands where forages availability and quality cannot support the existing livestock flocks. In Mieso, shortage of feed is one of the most limiting factors in livestock production in all the three production systems. This is aggravated by reduced biomass productivity due to shortage of rainfall, shrinkage in grazing land, water problem and limited extension support. Over grazing and competition to grazing lands has also created social conflict. The purpose of this paper, therefore, is to share IPMS project lessons learnt in forage development approaches, scaling up strategies, opportunities and challenges in the process of farmer innovations and innovative interventions in the value-chain of market oriented livestock development in relation to sustainable use of natural resources in two districts in Ethiopia.

Materials and Methods

This action research is being undertaken in Atsbi district of Tigray Regional State, northeastern Ethiopia and Mieso district of the Oromia Regional State, southeastern Ethiopia. Data on biophysical attributes and livestock resources of the two districts are presented in Table 1. The IPMS project and its partners have been undertaking collaborative efforts into action to intensify community based forage developments and introduce innovative skills along the value chain of

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livestock production since 2005. Under the facilitation of IPMS and partners, farmers, extension service providers, community leaders, decision makers, researchers, and NGOs working in the district identified sheep (Atsbi) and cattle and goat (Mieso) as potential market oriented commodities (IPMS, 2004; IPMS, 2005). In subsequent meetings, potentials and limitations to advance market oriented livestock development were discussed and feed shortage was identified as one of the key limiting factors in both districts. This was further verified with decision makers and experts at regional levels and the response was similar to the grassroots level. Local innovations in coping with feed scarcity and possible interventions along the value chain of market oriented livestock production systems were also identified. Technical teams consisting of experts on forage production, animal production, forester, agronomist, district Office of Agriculture and Rural Development (OoARD) heads, Regional Bureau of Agriculture and Rural Development (BoARD) and IPMS staff were formed to facilitate forage development interventions. The team facilitated discussion among the community and community leaders and decision makers and searched for forage knowledge acquisition and possible sites for interactive knowledge. Local innovations in coping up with feed scarcity and IPMS interventions in feed resources development for market-oriented livestock production and its implication for natural resources management were assessed. Quantitative and qualitative data were collected and analyzed using Statistical Package for Social Sciences (SPSS, 2003).

Table 1. Biophysical attributes and livestock resources of Atsbi and Mieso districts, Ethiopia

Attributes	Atsbi	Mieso
Land area, Km^2	1,223	2,574
Altitude, masl	918-3069 (2212) – 75% >2600 m	1107-3106 (1813) – 75% <1700
Rainfall, mm	365-678 (537)	635-949 (760)
Temperature, ^oC	13-25 (17.8)	13-21 (18.5)
Human population	110,578	128,889
Livestock resources		
➢ Cattle	52,264	92,411
➢ Sheep	72,471	7,325
➢ Goats	10,427	41,869
➢ Camels	1,529	11,445
➢ Beehives	6,729	3,445

Figures in brackets indicate average values

Results and Discussion

Forage demonstration sites were identified around bottom and degraded slopes, irrigated and farmlands and back yards sites in Atsbi, while rangelands, slopes, backyards and integration of forages into cereal cropping system were identified in Mieso. Interventions strategies varied between land use types. In addition, capacity of farmers, pastoralists and extension services providers strengthened through short-and long-term training, exposure visit, sharing of ideas and experiences in the form of technology exhibitions or farmers festivals on livestock production management and marketing. Experience sharing visits were made to other locations where successful integration between feed resources development and market-oriented livestock production is being undertaken. To gain experience and skills actors also visited tannery, sheep and cattle fattening and breeding farmers and export abattoirs. Farmers and pastoralists were also provided with credit. Market information on livestock from the nearby towns has been posted biweekly in market places and all PAs and linkage with traders has been established.

In Atsbi district, natural forage grasses and legumes established very well in the bottomlands with average biomass yield of about 10 t (DM) ha^{-1}. In the degraded slopes, biomass yield ranged from about 3.0 to 5.0 t (DM) ha^{-1}. Substantial amount of green feeds was also collected from perennial grasses and legumes grown around backyards and irrigated sites. After the intervention in the bottomlands, about 45 different grass and legume species were recorded within the past 2-3 years. Some of the grass species included *Agrostis, Andropogon, Avena fatua , Cynodon, Cyperus, Eleusine, Eragrostis, Festuca, Harpachne, Heteropogon, Hyparrhenia , Pennisetum, Setaria spp,.* while the cover abundance of palatable legume species such as *Trifolium* spp., *Medicago* spp., *Lolium* spp., *Indigofera spp., Lotus spp., and Vicia spp.* were significantly improved. Legumes covered about 25-30% of the standing herbage biomass. Farmers harvest green forage three times per year. Forage from the slopes also has similar composition but forage harvest is limited to once a year. Forage groundcover improved to about 70-100% depending on the season and rainfall after intervention compared to 20-30% before intervention. In the slopes, the forage groundcover was about 60-90% in the rainy season after the intervention compared to 5-10% before intervention. In the dry season, forage groundcover was about 50-60% after intervention compared to less than 5% before intervention.

The presence of year round forage groundcover protects the soil by canopy cover (more than 5 cm above the soil surface) and contact cover (up to 5 cm above the soil surface). The forage groundcover also protects the soil by slowing runoff and improving water infiltration and the soil deposits any dislodged silts around forage plants. Furthermore, it helps to enrich groundwater and springs developments in down streams. Gullies in the intervened forage sites were stabilized and transformed into productive lands. The stabilization of gullies attributed to the soil and water conservation in the upper catchments and growing of *in situ* forages plants. Improved forage groundcover reduces runoff and evaporation, and increase infiltration. Groundwater was also substantially enriched with the appearance of some swampy sites along with spring water development down stream which is being used for human and livestock consumption and for high value crops such as irrigated vegetables production. About 65% of the total grazing bottomlands (8802 ha) and most of the grazing lands in the slopes adapted cut and carry feeding system. In some PAs, farmers introduced improved forage species and enriched the bottomlands and slopes to increase biomass production. Similar scaling up and out efforts outside the district indicated that six districts in Tigray have adopted the lessons in forage development.

In Mieso district, there are some interesting innovative fodder production and utilization and coping mechanisms in the different production systems. In the pastoral systems, innovative fodder production and utilization and coping mechanism include enclosure and resting of rangeland, use of tree leaves and pods, supplementation of mineral soil, herd splitting, halting milking, plowing for feed/share cropping, de-stocking, passing animals to friends for plowing in exchange for feed, temporary gifts to fellow highlanders, spot areas reach in local mineral soils, fatten male goats as a value addition strategy, preparation of water troughs to animals nearby water points and keeping kids near mobile home to avoid predators' attacks. In the agro-pastoral system, fodder utilization and coping mechanisms include enclosure, use-rest-reuse-rest, sweet potato and maize cultivation, use of mineral soil de-stoking, manipulating breeding season, supplementation of various home grown high energy feeds, targeted feeding, passing animals to friends for plowing in exchange for feed, cyclical goat fattening and sale schemes, supplementing roasted maize grain to young male goats targeted for sale. In the integrated crop livestock system, coping mechanism include sweet sorghum cultivation (thin out, fresh stalks and leaves, early stage heads, mature stalks and leaves), stover collection and conservation, tillers/ratoons collection, sweet potato, mineral soil supplementation, de-stocking, cut and carry feeding, supplementation of dough stage maize, sorghum and haricot beans for fattening oxen, targeted feeding of different classes of animals (eg. oxen, fattening cattle and lactating cows), passing

animals (bullocks and bulls) to friends for plowing in exchange for feed, proper harvest and conservation of feed resources, social networks for feed and plow (provision of stover or hay for plowing), renting enclosure to graze animals for specified period, specific times of supplementary feeding such as feed at night when the temperature gets cooler.

In Mieso district, a total of 285 ha (187 ha in pastoralist and 98 ha in agro-pastoralist) of pasture and range land has been rehabilitated through community mobilization for dairy and goat production and cattle fattening. In addition, 14 ha of pasture land in 5 PAs has been enclosed and sown with Rhodes grass, tree legumes and stylosanthes, while cowpea and pigeon pea have been introduced for intercropping with cereal crops, mainly with sorghum and maize.

Conclusion and Outlook

The main reasons of forage development are to match animals' requirements with forage availability, protect the soil from rainwater run-off and to encourage water infiltration into soil. This is a key element to enhanced market oriented livestock production and sustainable use of natural resources. Furthermore, with improved forage development livestock production and fattening emerged as key business oriented commodities with significant changes in the income of farmers and pastoralists, particularly for landless youth and female headed households. With cut and carry feeding system, selective breeding and disease control has become effective. In conclusion value chain based livestock production interventions revealed that market oriented development helps sustainable conservation of natural resources because communities can secure income and improve their livelihoods.

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