The Characteristics of Hay Production in Dmanisi, Tetritskaro and Tsalka Municipalities

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For more information please go to www.allianceskk.ge

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EXECUTIVE SUMMARY

Hay in winter months and pasture in summer months make up the predominant form of nutrition for livestock in Georgia The importance of hay and of maximizing the efficiency of hay production for livestock producers was highlighted in 2012 by rocketing prices, the highest in the last 30 years, caused by a scarcity of availability due to a dry early spring which resulted in yields half that of the previous year.

In the summer of 2011 the Alliances programmes commissioned a remote sensing survey[1] of the rangeland in Kvemo Kartli and Samstkhe Javakheti which highlighted several key factors relating to pasture management and hay production: principally that there is a shorter production season when hay of good nutritional value may be made, which starts earlier especially in dry years , and that the need to take advantage of this window in spring/early summer for hay production when grasses are at their most productive, may become more pressing if the trend to a warmer and drier climate continues. The subsequent research and results detailed in this report, was undertaken by the SDC project the Mercy Georgia implemented *Alliances KK Programme (www.allianceskk.ge)*, in order to triangulate and build on the findings of the remote sensing report mentioned above and to provide the data which will be used to design and underpin successful interventions in this critical area of livestock production.

The research was conducted in four parts: a literature review of all existing research pertaining to hay and pasture land in Georgia, a random sample survey of small scale livestock producers with statistically significant results, key informant interview surveys with other farmers, machinery service providers and government representatives and an economic survey looking at simple profit and loss calculations related to the production and provision of hay for livestock for small, medium and large farmers and machinery service providers.

The research has provided information on patterns of farmers' land management, hay making practices and constraints, a comprehensive picture of the feeding practices of farmers related to cattle, portraits of the operations of machinery service providers, access to inputs and infrastructure and the economics of hay making including costs, purchase and sale. Specific questions on access to hay land were not included in this study, although the option to provide open answers on reasons for constraints to production was available and the literature review touches on the subject. The 2011 *Alliances KK Focus Group Survey* contains a comprehensive section on Access to Pasture and Hay Land[2] and a complementary piece of research focussed on clarifying the legislative history to date of the privatisation of land in Georgia[3] was carried out at the same time as this research which would provide a solid basis for further research pertaining to pasture and hay land access if a need for further research becomes necessary.

Farmers confirmed that hay is the main source of animal nutrition and the role of all other feeds is relatively minor in comparison. However the research confirmed the use of other feeds for milking and fattening by all types of farmer. In general, hay meadows and pastures are described as being of medium level productivity in the region, i.e.: neither farmers nor service providers regard local lands to be very fertile generally describing hay land as being of medium productivity and the area of hay land extant is not fully exploited. Hay production has overall increased over the last 3 years by one – two tonnes per household, however the level of hay production of small and medium livestock producers has decreased

[1] *Remote Sensing Research carried out to Assess the Condition of Rangelands in Kvemo Kartli and Samstkhe-Javakheti Regions of Georgia.* Environment Systems, UK, November 2012. Go to www.allianceskk.ge and to the '*downloads*' page for the full and summary versions of this report.

[2] Please see on http://www.allianceskk.ge/index.php/ en/downloads.html p21to p28 .

[3] *Land Ownership and the Development of the Land Market in Georgia 2012* available in full and summary versions.

from nine to seven tonnes.[4] There is clear potential for these lands to have a higher level of productivity e.g. through over seeding, the use of fertilizer, crop rotation as well as improved pasture management e.g. rotational grazing. Hay is predominantly made by hand and is costly in time and money with a significant proportion of draught animal power being used. Some of this is related to hay land being located on difficult terrain inaccessible to machinery, but in general the main drawback for fully exploiting the land potential was very clearly revealed to be the lack of access to machinery, machinery services or the finances to purchase or rent them. In addition, it is worth mentioning that, all respondents give absolute priority to the need for small and medium sized machinery/implements for hay making[5] rather than large tractors or larger implements.

Machinery service providers struggle with old machinery with high running costs and low efficiency and in a cash poor environment accept non cash payments and barter exchange in order to keep their business operational.[6] As the main feed resource for livestock in the programme area, the production, transport and purchase of hay has the major impact on farmer's outgoing income. Of course where a farmer can produce a surplus for sale it can have a major impact on incoming income. Good management practices related to hay production, the availability of good quality and appropriate machinery services that allow for cost effective and timely hay operations will help to defray the impact of bad years and maximize the positive impact of good years. A sufficient amount and upgraded quality of hay over winter can play a determining role in the development of the small scale livestock producer in the expansion of the number of milking cows or in improved feeding for better productivity.

Note: In 2011 the Alliances KK programme conducted an extensive focus group survey in Kvemo Kartli which allowed for the definition of small, medium and large farmers according to the number of milking/breeding cows they possessed. These definitions are used throughout the report in reference to the farmers. The definitions are:

Small farmers: - owning 5 or fewer milking cows
Medium farmers – owning 6 to 13 milking cows
Large farmers – owning 14 and more milking cows

The report is divided into the following sections:

1. Introduction
2. Literature Review
3. Farmers Survey: Summary Results
4. Machinery Service Providers and Government Representatives: Key Informant Interview Surveys: Summary Results
5. An Economic Profile of Hay Production and Provision for Farmers and Machinery Service Providers
6. References and Bibliography
7. Annex 1: Research Methodology
8. Annex 2: Survey Results in Full

[4] Large and medium scale farmers have increased production from 10-13 tonnes per household. Please see page 13 for the pertinent survey results.
[5] This includes balers.
[6] The programme gathered in depth information concerning the Informal Economy in the programme area in the 2012 survey: *Beyond Statistics the Non Cash Economy in Rural Georgia* it can be found on www.allianceskk.ge downloads page.

1. INTRODUCTION

The aim of this research was determine the characteristics of hay production in the hay lands of the programme area in Dmanisi, Tetritskaro and Tsalka. Hay in winter months and pasture in summer months make up the predominant form of nutrition for livestock in Georgia. In order to successfully plan nutrition interventions it is imperative to form a complete picture of the production, use and economy of hay in the programme area as well as finding out whether any supplementary cultivation, purchase or feeding of alternative fodder crops or feeds is occurring to supplement the grass/hay fed diet. In light of the 2011, *Remote Sensing Research carried out to Assess the Condition of Rangelands in Kvemo Kartli and Samstkhe-Javakheti Regions of Georgia*[7] the programme has concrete research recommendations and data with which to bolster the research into hay production, not least the definition in the report of the location and extent of rangelands and hay land and their location. The report findings concluded that:

- There is pronounced seasonal change in rangeland condition, largely linked to climate and rainfall. This becomes apparent in the timing of the main growth season for grass and the time of its burn off. The effect of seasonal change is more pronounced on lower land which includes hay land.
- That supported by hydro-meteorological data[8] and stakeholder feedback, the climate seems to be becoming warmer and drier overall. In dry years this means less grass available for grazing from mid to late summer.

With regard to hay making the effects of this are:

- There is a shorter production season which starts earlier especially in dry years, when the window for cutting hay of good nutritional quality may be made.
- The need to take advantage of this window in spring/early summer for hay production when grasses are at their most productive may become more pressing if the trend to a warmer and drier climate continues.

It was considered important to both the programme and SDC that the remote sensing research be triangulated and used as a basis for more in depth research at the land user level. Therefore the research comprises a literature review which gives an overview of existing research on hay and pasture land in Georgia, a survey with a statistically significant sample of Small Scale Livestock Producers and farmers in the programme area, a key informant survey of Service Provider and Government representatives and an economic profile of hay making and hay provision for small, medium and large farmers and machinery service providers. Key research points around which the surveys were built were:

- An assessment of hay and hay land quality including accessibility, usage and productivity.
- Hay/Pasture improvement practices
- Availability of hay making services and infrastructure
- A review of existing hay making practices including purchase and sale in the programme area:
- Hay making by hand, machine and draught animals
- Hay usage for feed and any supplementary feed inputs
- Constraints to optimal production
- Potential for improvement

[7] *Remote Sensing Research carried out to Assess the Condition of Rangelands in Kvemo Kartli and Samstkhe-Javakheti Regions of Georgia*. Environment Systems, UK, November 2011. A report commissioned by SDC project Mercy Corps Georgia implemented Alliances Programmes.

[8] The report clearly stated however that the meteorological data was less than optimal.

2. A LITERATURE REVIEW REGARDING HAY AND PASTURE LAND IN GEORGIA

Introduction

This literature review was compiled as part of a larger research initiative, the results of which are included in this report, being carried out by Alliances KK on the characteristics of hay production as part of its nutrition component and DRR component under which was carried out in 2011 a remote sensing survey to ascertain the rangeland condition in Kvemo Kartli and Samstkhe Javakheti. The literature review does not contain the findings of this report, as it was intended to provide an overview of existing research on hay and pasture land in Georgia and as such to form part of the foundation for the analyses and interpretation of the results of the hay survey. This literature review was prepared on the basis of desk research of the pertinent and available publications concerning hay and pasture land in Georgia, and more specifically if material was available, of research relating to the Alliances Kvemo Kartli programme area[9].

The cited publications listed at the end of the report are divided into two sections, the first section, T*he References*, are cited directly in the text, the second, *The Bibliography*, have formed part of the background reading of the study and are summarized in this introduction. The two sections were compiled in an attempt to consolidate and provide a directory of the relevant material available on the subject.

Available research concerning the evaluation of hay lands and hay production can be divided into three periods:

- Research conducted before 1990
- Research conducted between 1990-2002
- Research conducted after 2002

Note: Generally for the period 1990-2002 the quality of the research outputs were compromised due to the disruption caused by the collapse of the Soviet Union and the effects of civil war[10].

Literature from the first period (before 1990) is focused on hay making through collective farming (the *Kolkhoz*) and is tailored to the requirements of the collective farm. The research includes: definitions and characteristics of hay land, the geographical distribution of hay land, a description of the agricultural systems in which hay production takes place and notes concerning the management of hay lands including measures to increase the productivity of hay land and the nutritional composition and effect on livestock of hay. Studies concerning hay making as a commercial enterprise, the environmental context surrounding hay lands and hay making with the farmer as a participant of a wider market system are not found in the literature of this period.

Literature of the second period (between 1990-2002) was produced under the framework of the Students' Studying Programme 3[11]. Authors published papers on the subjects of; cenosis in hay and pasture lands, the influence of mineral fertilizers on the composition of amino acids in grass, the economic efficiency of fertilizers and the influence of surface improvement on productivity. The authors had begun working on these research topics 20 years previously however the publishing of the materials took place after 1996.

[9] Dmanisi, Tetritskaro and Tsalka municipalities.
[10] According to an Academician of the National Scientific Academy as well members of the Livestock and Nutrition Production Institute, research during this period was often incomplete.
[11] A University Programme.

The literature of the third period commences from 2002 to the present and is notable for the growing emphasis on the environment. The research of this period carried out by scientists of the agricultural institutes[12] focuses on technical aspects of hay production and pasture management such as the impact and characterization of weeds, poisonous and noxious plants in pasture. Wide ranging surveys were commissioned by the government during the period, largely connected with protection of the environment and surveys carried out by international NGO's were conducted related to the assessment of pasture condition and measures to improve grazing management within the context of local management, environmental degradation and climate change. Research placing hay production within the farming economy is largely absent in research to date as is further analysis from a farmer or local stakeholder perspective into key constraints to hay production and grazing within the local market and the farming economy as it currently stands.

Hay Lands and Pastureland in Georgia

There are 6 land zones in Georgia (Department of Statistics, 2009).

I Zone: up to 250 m above sea level – West Georgian sub-tropical plants including citrus cultivation.
II Zone: 250-500 m above sea level – Market-gardening, viticulture and intensive field-crop cultivation (mostly maize)
III Zone: 500-1000 m above sea level – Mostly cereals, pasture lands, cattle-breeding;
IV Zone: 1000-1500 m. above sea level – Hay-lands and pastures, weakly developed field-crop cultivation;
V Zone: 1500-2000 m above sea level – Hay-lands and pastures;
VI Zone: 2000 m and higher – No agricultural activities apparent beyond extensive grazing.

The program area includes 4 vertical zones (from 400 to 2000m above sea level) where grass fed dependent livestock farming is practiced (Ibid, 2009). According to (Abbot, 2010) the amount of permanent pasture and the meadowland declined in 2008, falling from 287,000 ha in 2006 to 277, 000 in 2007 and 264,000 in 2008. Kakheti experienced the biggest reduction in 2008 (30,000 ha) which was however offset by increases of 5,000 and 14 000 ha respectively in other regions and Samstskhe-Javakheti. The reasons for these reductions are not clear; but are possibly the result of the reclassification of pasture and meadow land as 'arable' when resown with grass (Ibid, 2010).

According to Kavtaradze (2011) up to 500, 000 ha of the total area of pastures and hay lands in Georgia have been eroded; large parts of them damaged by landslides and other natural disasters mostly in highland areas. According to *The National Program of the Activities Directed Towards the Protection of the Environment of Georgia* 2011-2015 (2010) , 60% of the agricultural lands of Georgia are characterized as low productivity areas, which encompasses the hay and pasturelands.

Mineral fertilizers, concentrated or additional[13] animal feeds and farming machinery are generally in short supply or rarely utilized in the extensive livestock management and grazing generally practiced on the hay and pasture lands of Georgia . Animal production is therefore primarily limited by the natural productivity and carrying capacity of the environment (*Remote Sensing Study into Rangeland Condition in Kvemo Kartli and Samtskhe-Javakheti Regions*, 2011).

Conservation of grass, fodder root crops or crop residues for the winter period is necessary for all parts of Georgia. Most small farms (which make up more than 99% of all farms) have too little income or limited

[12] National Academy of Science of Georgia, the Academy of Agriculture Science of Georgia, Agriculture University and Scientific Research Institute of Food Production and Livestock.
[13] Additional to grass and hay

access to feed suppliers to support the purchase of compound feed. Forage conservation at the smallholder farmer level is limited to haymaking and the storage of crop residues. The quality of the crop at harvest is often less than optimum and habitually deteriorates further due to the uncovered storage in winter. Furthermore, official data from 2005 shows that, there has been a significant and apparently long-term reduction in areas sown by fodder crops, perennial and annual grasses. (Abbott, H, 2010).

Environmental Degradation and Climate Change and its effect on Hay and Pastureland

The degradation of grazing and hay lands was noted in the report of the Government's *National Programme of Activities Against Desertification* (2003) with soil erosion as the main indicator denoting the worsening condition of pastures and hay lands. In this and other surveys the environmental degradation of hay and pastureland is considered to have been exacerbated or caused by climate related factors, poor management and overgrazing due to the decline in traditional management systems following the transition from the *Kolkhoz* system to the subsequent privatization of land in Georgia, a process which is ongoing.

In2003 the perils of desertification were detailed in the Georgian context (Ibid, 2003). The last decade of the 20th century (1991-2000) was the warmest period of the second millennium (Ibid, 2003). In this context, a decline in precipitation was seen as an indication of the initial stage of desertification a process which will further deepen and accelerate as a consequence of an increase in man-induced negative impacts including deforestation. Desertification represents not only an environmental, social and economic problem, but also a climatic one. Global warming is seen as posing a serious threat to the Caucasus glaciers, as it causes melting due to the higher temperatures, relatively low humidity and a fall in solid atmospheric precipitation (Ibid, 2003). The effects of this will be far reaching and hard to counter as the complicated mountainous relief, climate characteristics and predisposition to serious disaster events make Georgia one of the most complicated environmental regions of the world (Green Alternative, 2008). In addition two mountain research initiatives; The Mountain Research Initiative (MRI) and the Global Mountain Biodiversity Assessment (GMBA) acknowledge that the rangeland biodiversity in Georgia is under threat as a result of both human impacts and global climate change (Mountain Forum Bulletin, 2009).

In the *Remote Sensing Study into Rangeland Condition in Kvemo Kartli and Samtskhe-Javakheti Regions,* (2011) some evidence was found based on field observations, and stakeholder consultation, supported by meteorological data, that the climate in the study area is becoming warmer and drier. Currently rangelands in Kvemo Kartli and Samstkhe Javakheti generally have in early summer, good or moderate vegetation cover with a good diversity of grass and forb species. This condition is related to altitude, higher ground being in better condition as the summer progresses due to a later snow melt[14]. In terms of soil erosion there was a suggestion of its occurrence on some steeper slopes and valley sides probably due to heavy rain falling on dry ground. The study found no evidence of widespread overgrazing except locally along transhumance routes or around local communities and summer encampments. However a widespread seasonal change in rangeland condition was observed and if the trend to a drier and warmer climate continues then the productive grazing and hay making seasons are likely to start earlier and end earlier possibly becoming shorter in dry years with a longer period of seasonal grass burn off and die back and a higher risk of overgrazing and erosion. .

[14] By late July, temperatures are reaching their peak and the rainfall is declining. Rangelands at lower elevations have already started to 'dry-out' which is demonstrated by the increase of areas classified as of a poorer condition (34%). This process worsens on the lower pastures, but does extend up into the higher pastures, especially where the soils are shallow or very rocky (Ibid, 2011)

Hay Land and Grazing Management

During Soviet times the practice of the traditional cattle-breeding, based on zone division and pasture rotation, was abandoned with soil erosion especially apparent on land previously cultivated but now used for grazing and with landslides becoming a danger in areas of degraded higher pasture (Gambashidze, 2012).

Poor grazing management can lead to a decline in the nutritional value of pasture and hay land through the growth of unpalatable, inedible and noxious plants of low nutritive value (Sardjveladze, 2010). Intensive and frequently unregulated grazing over the years has a severe impact on the vegetation and its botanical diversity declines as nutritionally valuable and palatable species and their biomass are grazed and are replaced with unpalatable or poisonous plants or bare soil.(Ibid, 2010).

Extended grazing pressure on overstocked land, leads over the years to the depletion of original grass cover, its alteration and degradation and a shrinkage of grass-covered areas, which eventually gives rise to soil erosion and salinization. Excessive sheep stocking on rangelands results in phytomass accumulation in the surface soil layer. The greater the stocking density of the range, the thinner the layer and the closer the phyto-mass to the surface. In such cases the soil is easily eroded (*National Programme against Desertification*, 2003). However much overgrazing is localized along transhumance routes and areas where livestock are concentrated such as pastures within easy reach of settlements as otherwise grazing practices tend to be extensive i.e. with low stocking density. In Kvemo Kartli and Samstkhe Javakheti remote sensing research found no evidence of the widespread overgrazing, except locally along transhumance routes and around the summer encampments and municipal pastures (*Remote Sensing Study into the Rangeland Condition in Kvemo Kartli and Samtskhe-Javakheti Regions*, 2011).

In addition to stocking density, the timing of the commencement, duration and termination of grazing are of great importance to pasture condition. Early grazing of sheep immediately after melting of the snow, inhibits growth which leads ultimately to a later reduction in biomass, Late grazing may similarity inhibit growth, reducing regrowth and possibly reseeding. In sub alpine zones, the first pasture utilization is possible when the height of forbs reaches 10-15 cm, but in Alpine zones the height of the forbs would at this time be only 6-7cm. Grazing should also be terminated 25-30 days earlier before the end of the vegetative period of plants and adjusted across zones. Otherwise plants cannot grow and accumulate storage substances for surviving the winter period (*Restoration of the Scheme of Traditional Usage of Pastures in Village Chigo, Tusheti Region*, 2012). Despite the erosion of traditional grazing management however management practices are still utilized in the *Remote Sensing Study into Rangeland Condition in Kvemo Kartli and Samtskhe-Javakheti Regions*, (2011) shepherds in the stakeholder consultations referred to rotational grazing and movement cattle or sheep to better pastures.

As in the *Remote Sensing Study into Rangeland Condition in Kvemo Kartli and Samtskhe-Javakheti Regions*, 2011, Gintzburger, (2012) found in the study of Vashlovani National Park no evidence of overgrazing through line Intercept and biomass measurements. The rangelands were found to be in good condition, with no real hint of degradation, with high vegetative cover and standing biomass according to soil and climate conditions. The Vashlovani pastures of the study area were conversely found to be presently underutilized (with perhaps the exception of the *Eldari Artemisieta* lowlands) with pioneer species beginning to colonize underutilized land (Gintzburger, 2012).There is no evidence of a desertification threat or damaged landscape due to human activities, even on pristine badlands and arid forests (Ibid, 2012). Livestock is only observed at pastures that are within a walking distance of settlements, those within the 5 km radius.

Fire has been traditionally used as a pasture management tool generally undertaken from the second half of February until the first week of April. However in spite of quick clearance of more woody species the fires damage and destroy newly germinated grass and contribute to erosion (*National Programme against Desertification,* 2003).

Pasture Access

Changing ownership and access arrangements for both rangelands and municipal pastures following from the sale of government owned land as part of a drive by government for increased private ownership, may influence rangeland condition. Access to land which is currently under government ownership but utilized by livestock owners may become increasingly restricted if privatized. Cases of this have already become common in Georgia with land to which livestock owners have traditionally had access being sold on online auctions after which it is sometimes fenced or access no longer granted. This can have the effect of increasing the concentration of livestock on municipal lands around villages with a resultant increase in grazing pressure and overgrazing (*Remote Sensing Study into Rangeland Condition in Kvemo Kartli and Samtskhe-Javakheti Regions*, 2011).

3. FARMERS SURVEY: SUMMARY RESULTS

The following section describes the results from the farmer's survey. Hay is named by farmers interviewed as the main source of animal nutrition and the role of all other feeds is minor in comparison. However other feeds are still used as additional nutritional inputs. In general, hay meadows and pastures are described as being of medium level productivity in the region[15]. Land potential is not fully exploited and the level of hay production by small and medium livestock producers has decreased over the last 3 years. Nevertheless, there is potential for these lands to have a higher level of productivity e.g. through over seeding, the use of fertilizer, crop rotation as well as improved pasture management e.g. rotational grazing. The main drawback for fully exploiting the land potential was named as being the lack of access to the machinery or the finances to purchase or rent the machinery. In addition, it is worth mentioning that, all stakeholders give absolute priority to the need for small and medium sized machinery/implements for hay making. The main results of the farmers' survey are summarized in seven sections.

1. Description of Meadows and Pastures in the Region
2. Hay Making
3. Machinery and Draught Animals and their Use in Hay Making and Hay Making by Hand
4. Hay Making Infrastructure
5. Supplementary Nutritional Input
6. Associated Costs and Benefits of Hay Making
7. Access to Information

1. DESCRIPTION OF THE MEADOWS AND PASTURES IN THE REGION

The majority of hay lands in the region, 94% are not improved. Approximately 52% of the areas of available hay meadows are on easy terrain. On average per village, about 500 ha of hay meadows with easy/normal terrain and 450 with difficult terrain are available. The largest area of lands per village is available for farmers from Tsalka municipality, and the smallest for Tetritskaro Municipality (please see Figure 1and 2 below).

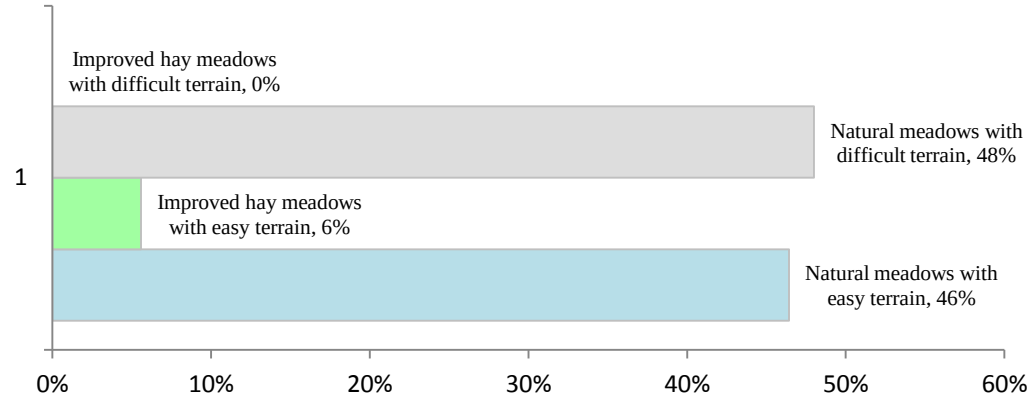

Figure 1: General Description of Hay Meadows in the Programme Area
% of the Area with Improved and Natural Meadows with Ease and Difficult Terrain)

[15] In general, hay meadow is regarded to be of high productivity if the number of bales per ha exceeds 200 bales, of medium productivity if production per ha varies between 100 and 200 bales and of low productivity if production per ha is less than 100 bales.

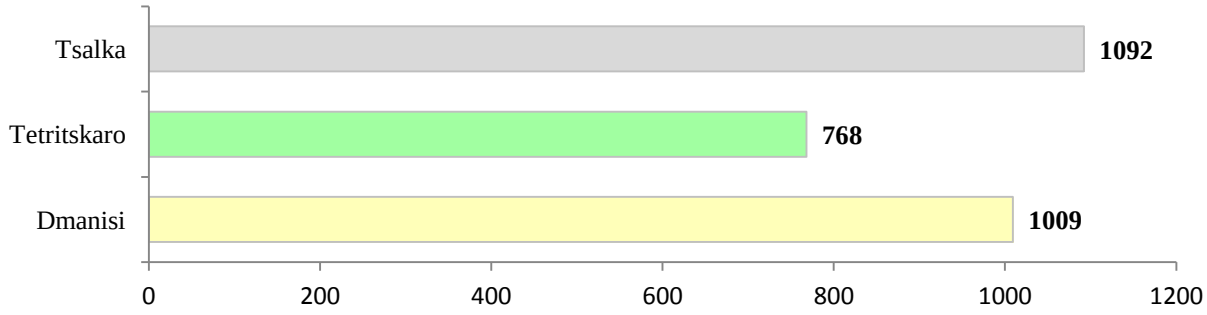

Figure 2: Average ha of Hay Meadows per Village, Across Three Municipalities

The fertility of hay lands is described as being of a medium level by 76 % of the respondents from each group, 19% regard fertility to be low and only a few state that land is degraded by erosion [16]. Hay land composition in the region is composed of naturally mixed species of grass, legumes and weeds (71% of the respondents) [17]. Over seeding and/or improving pastures (by fertilizers and re-seeding) is not common in the region: only an average of 13% were found to be over seeding/improving pastures, with the highest proportion in Dmanisi see Figure 3. Interestingly, proportionally more SSLP farmers over seed (15% of the SSLP respondents) than medium and large scale farmers (8% of the medium and large scale farmer respondents). The explanation for this could be that as SSLPs have access/own smaller areas of land which are easier to work and irrigate than larger open tracts and have a greater interest given limited resources in maximizing the land's potential. The difference in results, according to gender was not significant. The preferred species for over seeding are Alfalfa (48% of respondents) followed by cereals, (33% of respondents), grass mixes (10%) and Esparcet (9%). [18]

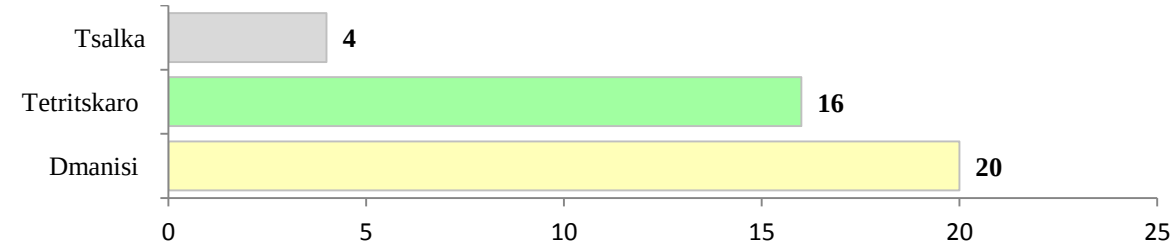

Figure 3: Farmers/Respondents Seeding/Improving Pastures (Distribution across Municipalities, %)

2. HAY MAKING

Hay production has in general increased by approximately one to two tonnes per household, per year, over the last three years: 2009-2011, in the region. However, the tendency is not true for all of the groups. While large and medium scale farmers have increased per household production of hay from 10 tonnes to 13, SSLPs have decreased from 9 to 7 tonnes per year. Neither did all municipalities show an increased production trend. For instance, in Dmanisi, hay production has not increased and is 8 tonnes per household per year. (See Annex 3).

[16] In general, a hay meadow is regarded to be of high productivity if the number of bales per ha exceeds 200 bales, of medium productivity if production per ha varies between 100 and 200 bales and of low productivity if production per ha is less than 100 bales.
[17] This question was difficult for farmers to answer.
[18] See also Section A: *Description of the Meadows and Pastures in the region(farmers perception*, in Annex 2

Where respondents were asked to compare their estimation of potential hay production potential to their actual production; all demographic groups agreed that land potential was not exploited fully for several main reasons. According to farmers the full potential of all hay meadows had not been fully utilized over the past 3 years with only 63% of hay land cultivated out of the total available. Apart from the weather and climate, lack of machinery (up to 40% of the respondents) was named as the major reason for not utilising the full capacity of the land in use by the respondents. (See Figures 4 and 5 below). [19]

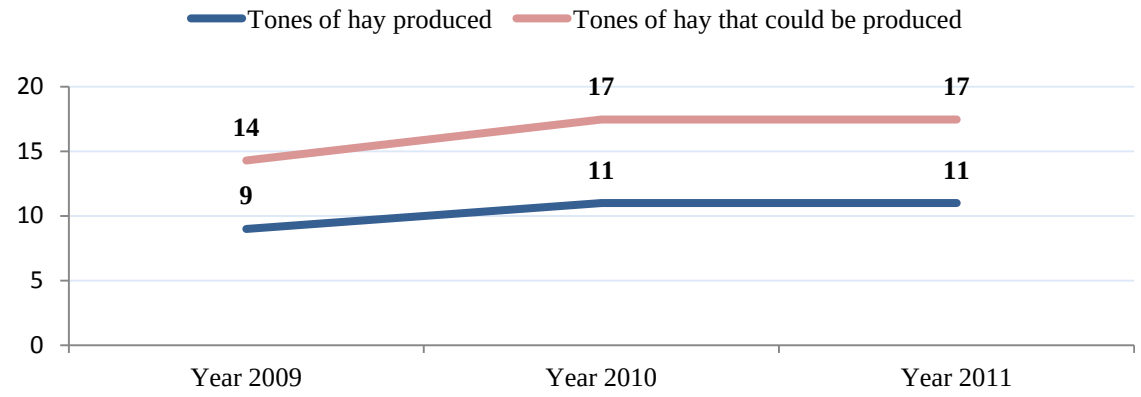

Figure 4: Hay Production Potential According to Farmer Estimation # of Tonnes of Hay per Household versus Actual

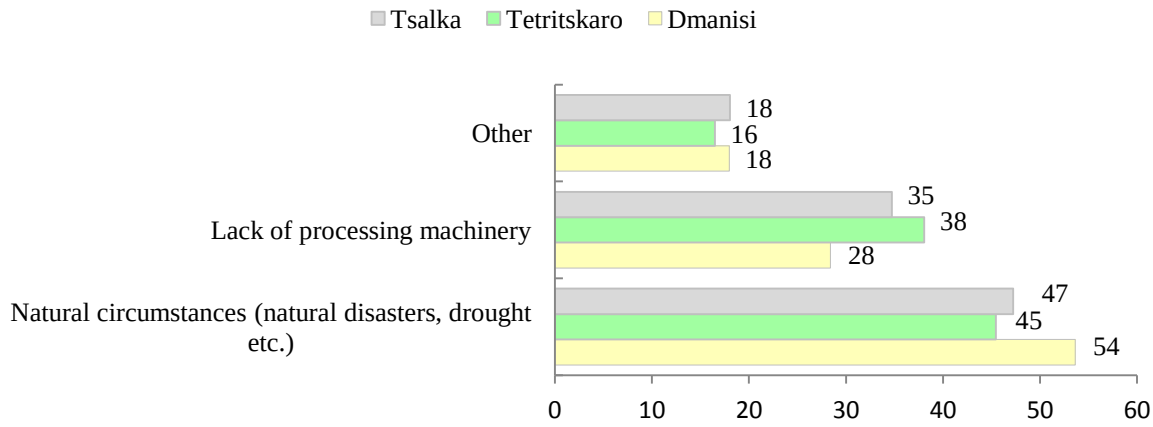

Figure 5: Farmers/Respondents Reasons for Underutilization of Land (%, Distribution across Municipalities)[20]

[19] See also Section B: *Hay Making (farmers perception)*, in Annex 2

[20] The reasons for stating 'other' were varied but the major ones were; if productivity of ha is lower than 70 bales per ha it is not worthwhile for farmers to process that land and these lands together with hay are left, the other significant reason is that lands with non-nutritional species are not used. .

3. Machinery and Draught Animals[21] and Their Use in Hay Making and Processing by Hand

Hay making season begins at the end of July or beginning of August, in the Alliances KK Programme area depending on the weather. The research concluded that the majority of hay is made by hand with smaller percentages of famers using machinery and draught animal power respectively. (See Table 4 below)

Table 1: % of Farmers/Respondents Processing Hay Meadows Using the Following Means of Production

	Dmanisi	Tetritskaro	Tsalka
Machinery	24	46	24
Draught animal	12	5	19
Manually	64	49	57

Two major reasons are named by farmers for processing by hand, lack of access to finance and lack of access to machinery. These reasons did not much differ according to gender or municipalities, but only between SSLPs and other farmers. SSLPs regard lack of finance to be the major problem; however SSLPs admit that in the case of proper access to machinery the issue of lack of access to finance to buy machinery would become unimportant. I.e. access to machinery services versus buying machinery for oneself. (See Figure 6 below). Difficult terrain is also a reason for processing hay meadows manually and/or by draught animal according to 12% of SSLPs and 18 % of medium and large scale farmers, which tally's with the fact that half of the area of hay meadows in the programme area are described as having difficult terrain[22].

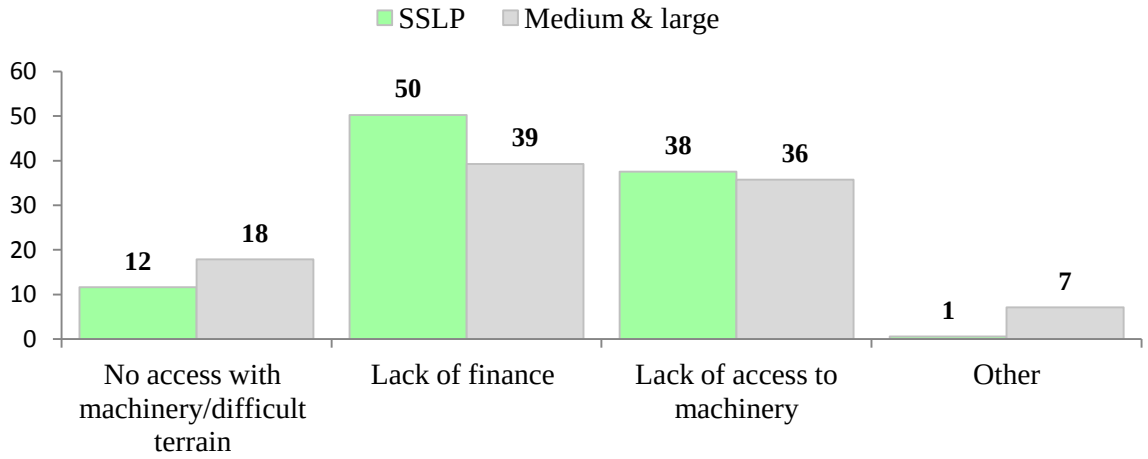

Figure 6: Farmers/Respondents Naming Following as the Reasons for Not Processing Hay by Machinery (%)

Amongst SSLP's draft animal and draft animal machinery usage for hay making is fairly common with an average of about 12% of farmers are using draft animals and 5% using machinery in tandem with draught.

[21] Oxen, horses and donkeys. In the Alliances KK Focus Group Survey (please see the survey on the downloads page of www.allianceskk,ge) it was revealed that horses and donkeys in particular are considered essential for transport, herding and cultivation by significant proportion of the respondents, particularly women (page 9).
[22] See page 10 Figure 1: General description of meadows in project area.

The results on the usage of draught did not vary significantly for men and women, but did differ across the municipalities and according to altitude. 19 % of the respondents in the highlands of Tsalka use draught animal for processing hay meadows while for Dmanisi and Tetritskaro the figures are 12% and 5% correspondingly (see Figure 7 below).

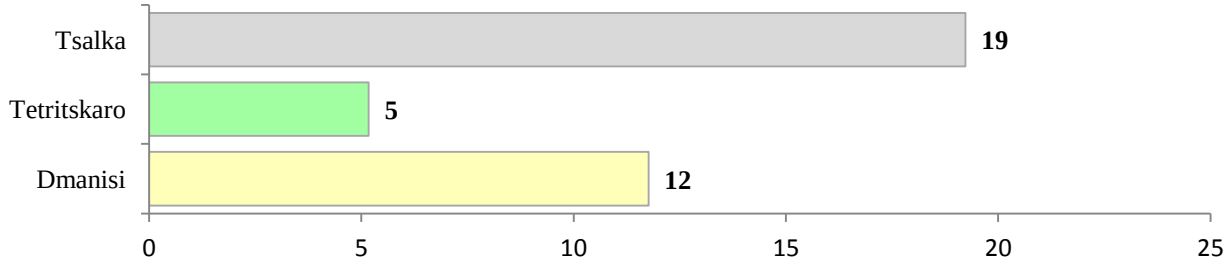

Figure 7: Farmers/Respondents Using Draft Animal for Processing Hay Meadows (%, Comparison across Municipalities)

In general, draught animal usage is more common in high lands where larger hay meadows have difficult terrain to work (17% of the respondents), rather than medium altitude (9%) and low lands (4).[23] Medium and large scale farmers (15% of the respondents) tend to use draught animal more than SSLPs (11% of the respondents), possibly it is easier for them to keep draught animals than for small scale farmers. It may also be that they have better access to equipment or the means of maintaining equipment that is in short supply and difficult to maintain[24].

Among those who use draft animals the majority own their own draft animal (60%) with the most commonly used animal being horses (90%) and then donkeys (10%). Draught animals are mostly used for raking – as noted by 60% of the respondents, for transportation – by 20%, mowing – 10% and other functions 10%. These tendencies stay true while looking at the results for each demographic group separately.[25]

4. HAY MAKING INFRASTRUCTURE, MACHINERY AND SERVICES

Infrastructure related to hay making is mostly described as being in bad condition, by the absolute majority of farmers (both SSLP's and other) in all three municipalities: particularly infrastructure and services integral to the hay making process, maintenance for hay making machinery, buildings for hay storage. On the positive side these pieces of infrastructure and services are located are fairly close to the hay meadows in Tetritskaro and Tsalka (see Table 5) although not for Dmanisi.

Table 2: Average Distance from Meadows to Following Infrastructure (Km)

[23] As defined by altitudes, see methodology section.

[24] In a (2010) survey of draught animal usage in Samstkhe Javakheti draught animal usage was severely limited by dwindling skills and knowledge of trades such as blacksmithing and harness-making and thus limited access to appropriate and efficient equipment. Much enthusiasm for the efficacy and even superiority of draught over tractors was expressed, particularly for lighter operations such as inter row cultivations or operations on smaller or more inaccessible land parcels.

[25] See also Section C*: Machinery and Draught Animals (Oxen, Horses, Donkeys) and Their Use in Hay Making (Farmers Perception),* in Annex

	Dmanisi	Tetritskaro	Tsalka
Building for hay storage	4.36	0.00	0.26
Maintenance for hay making machinery	7.92	0.52	0.26
Shelter for humans in bad weather	4.01	0.00	1.01

The villages in programme area do not possess enough machinery.[26] On average, 8 (8, 7 and 10 in Dmanisi, Tetritskaro and Tsalka respectively) pieces of machinery/implements are present per village but most of them are very old and in very poor if unworkable condition. The machinery in the villages of Tsalka municipality is in the best condition, an average of 6 pieces of machinery are in working order per village as opposed to 3 in Dmanisi and Tetritskaro. (See Figure 8).

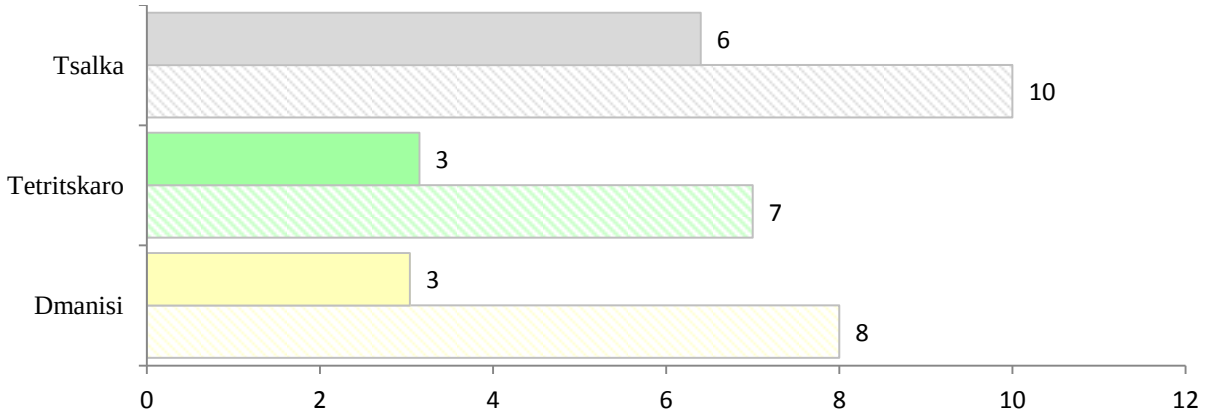

Figure 8: Number of Pieces Machinery Present per Community (Dashed Bars) and Pieces of Machinery in Working Order (Solid Bars)
(Comparison across Municipalities)

The main source for obtaining machinery services as named by the respondents are individuals from their villages[27] and not LTDs or other service providers who might possess various types of machinery needed and provide a better service. About 45% on average name "individuals" as the main source for machinery services, 1% naming LTDs and service providers. Up to 8% say that they do not have access to a service at all. (See Annex 2 for the comparison across municipalities).

As in the case of machinery, 75% of farmers use hired transport for hay transportation rather than their own 22%. As for the remainder 4% use hired or their own draught animals to transport hay and the rest use other sources or do not transport hay at all (stooking it in the field). (The information is true for each demographic group separately, for more detailed information see Annex 2).

[26] Farmers were asked to count the pieces and/or type of machinery presented in their villages.
[27] In the Alliances Programmes these individuals who provide services to other villages with their machinery are referred to as Machinery Service Providers.

The constraints caused by lack of machinery and transportation are regarded to be the major drawback to hay production by farmers in the region. Consequently machinery and transport are named as the most desired items to be present in higher number in their villages. 95% of respondents wish to see improved access to machinery[28].

5. SUPPLEMENTARY NUTRITIONAL INPUT

The survey showed that farmers in the region are using several different nutritional inputs for their cattle in addition to hay. Hay remains the main feed but supplementary feeds are fed; with maize(stover and grain), oats and bran predominant, respectively. The research showed that 55% of farmers feed supplementary feed to cattle mostly for the purpose of improved milk yield 54% of respondents and fattening 41% of respondents.

Demographics seem to be an important determinate for the use of supplementary feed for cattle. More medium and large scale farmers (77% of the respondents) use supplementary feed than SSLPs (48% of the respondents). The result is quite natural, as more funds are available for larger farming households, and more nutritional input is needed for larger farms (see Figure 9 below). In addition farmers from Tsalka municipality (63%) tend to use more supplementary nutritional input for the cattle than farmers from Tetritskaro (59%) and Dmanisi (43%) municipality. This can be explained by more severe weather conditions in winter in Tsalka municipality. (For more detailed information please see Annex 2).

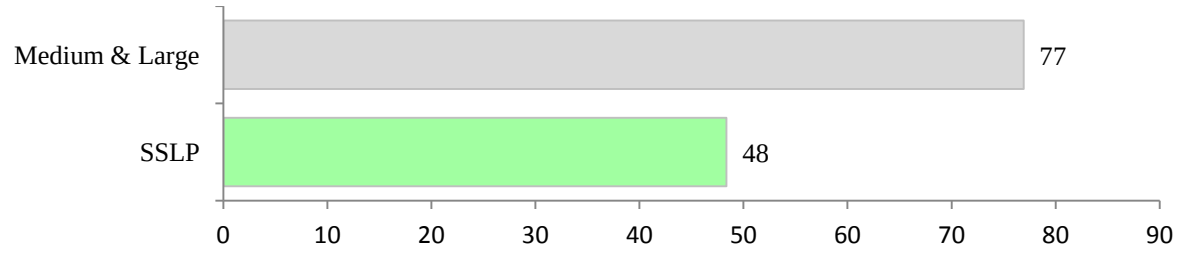

Figure 9: Respondents/Farmers Feeding Supplementary Feed to Cattle (Comparison between SSLP and Larger Farmers, %)

Normally, regardless of demographic group, of those farmers who feed supplementary feed in addition to hay, 55% give it to cattle. Figure 10 below displays the results for the most commonly used supplementary nutritional input, for cattle. Maize (both stover and grain) is the most commonly fed nutritional input, as farmers produce maize for their own use. The next most common nutritional input is oats produced mainly for cattle use[29].

[28] See also Section D: *Hay Making Infrastructure, Machinery and Services (farmers perception),* in Annex 2

[29] Supplementary feed in the form of maize, oats and cereals always tend to be given as both milled grain and stover or straw.

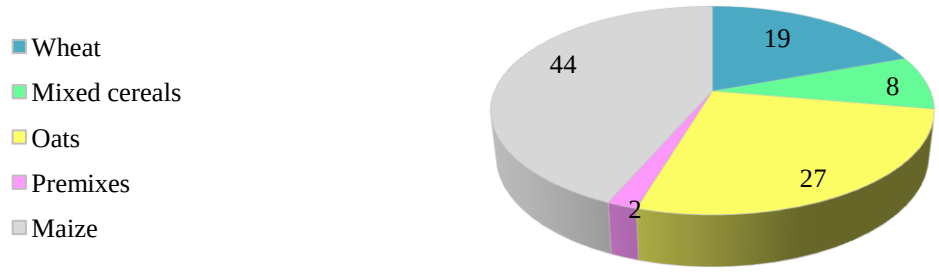

Figure 10: Farmers/Respondents Using the Following as Supplementary Feed for Animals (% out of Those Who Use Supplementary Feed)

The farmers in the region tend to produce supplementary nutritional input themselves rather than purchasing it, growing it and using village mills for processing it. Otherwise farmers buy inputs from agricultural shops. The results differ across municipalities. Farmers from Dmanisi municipality mostly grow and mill supplementary nutritional input themselves (24%), while in Tsalka and Tetritskaro they also use mills and also purchase feed from agricultural shops (see Figure 11 below):

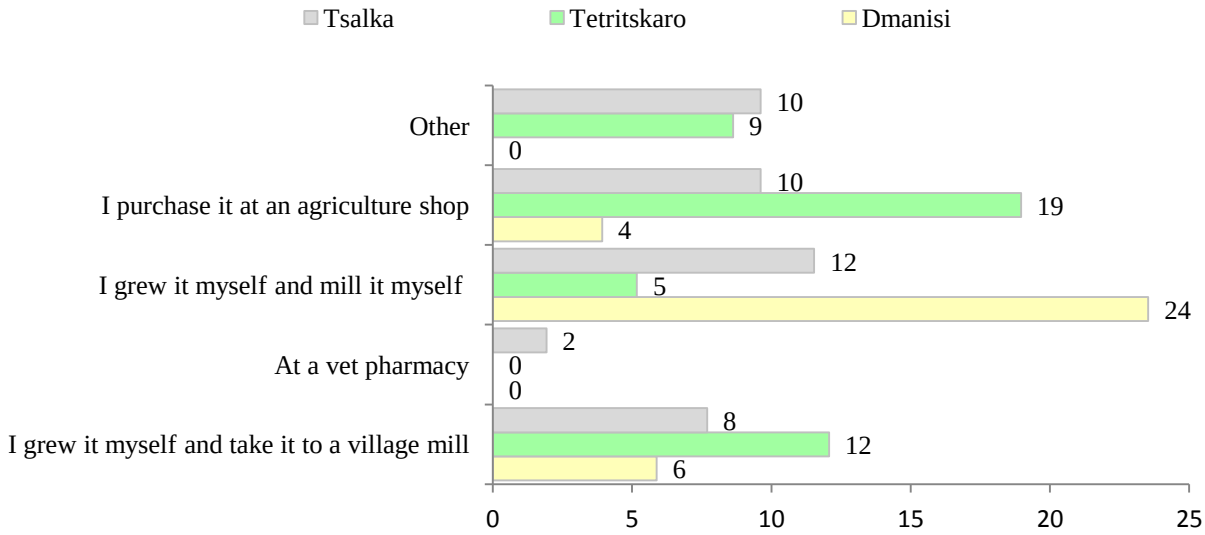

Figure 11: Farmers/Respondents Naming Following as Sources for Supplementary Feed (Comparison across Municipalities, % Of Those Who Use Supplementary Feed)

Production of the supplementary nutritional input for cattle has been generally tending slightly downwards during last three years. Farmers who grow and mill it themselves were asked to say whether they are producing more, less or the same amount of supplementary feed as opposed to the preceding s years. 34% of the respondents stated that they produce less in comparison while 16% state the opposite and the rest 50% produce the same amount. Again the results are not similar across the municipalities; in Tsalka municipality 56% of respondents produced less last year less than they used to. Noteworthy is also the difference between SSLPs and larger farmers: the majority of SSLPs - 49% produce less supplementary feed for cattle and only 8% produced more, while the majority of larger farmers – 59%, produced almost the same quantity with 32% producing more than they used to (see Annex 2). [30]

[30] See also Section E: *Supplementary Nutritional Input (farmers perception),* in Annex

6. Associated Costs & Benefits of Hay Making

The production of hay is fairly costly for farmers, both in terms of time and money. The production process itself consists of following steps: mowing, turning the hay, hay collection, baling or stooking[31], transportation and storage. In general, farmers either do the work themselves or hire labourers for this purpose. Consequently, the tendency is such that, activities are described in terms of time or cost. According to the results, the most time intensive activity is the transportation of hay: 97 hours per season/farmer, and the most costly activity is mowing with outlays for farmers of between 80-120[32] Gel per ha of land mowed. Annex 2 shows how much time and money is spent on average per each of the above listed activities.

The farmers choose to produce bales, stooks or stacks based on whether they are baling by hand or machine. Access to balers however is often limited and fairly costly so farmers may choose to stook by hand where land is considered unproductive. Figure 12 shows that more hay is harvested from hay meadows in Tetritskaro and Dmanisi municipality rather than Tsalka municipality. The main determinants regarding yield are: the fertility of the land, altitude, climatic condition and the size of the hay lands per village.

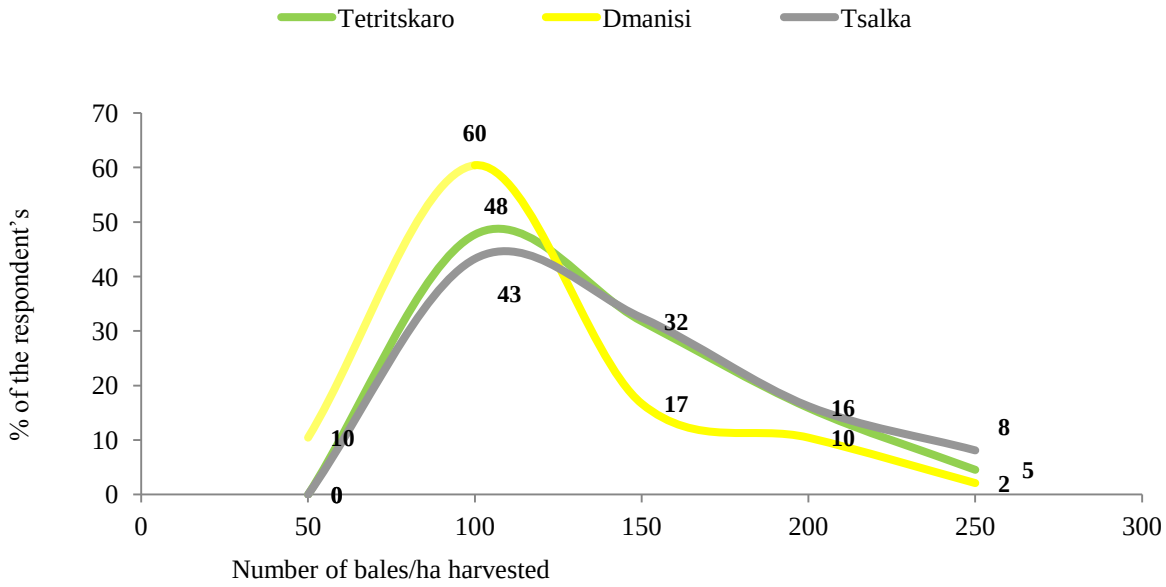

Figure 12: % Of the Respondent's V's Amount of Bales in Harvested 2011
(Farmers Data, Comparison across Municipalities, %)

The productivity of hay land, together with size and other factors has an influence on purchase and sale of hay in the region. In general, farmers from the region do not tend to sell hay; on average only 12% of the farmers sell excess hay (See Annex 2). More farmers/respondents purchase hay. Figure 13 below shows

[31] A stook is a small hay stack, often seen in back yards or in fields.
[32] The official going rate for mowing is 100-120 Gel/ha depending on region. However the lower rate accounts for non cash exchange and favours including for example just paying for diesel.

hay purchase across municipalities. Farmers in Dmanisi municipality buy the most hay: 65%, followed by Tsalka 60% of the respondents and Tetritskaro: 48% of the respondents.

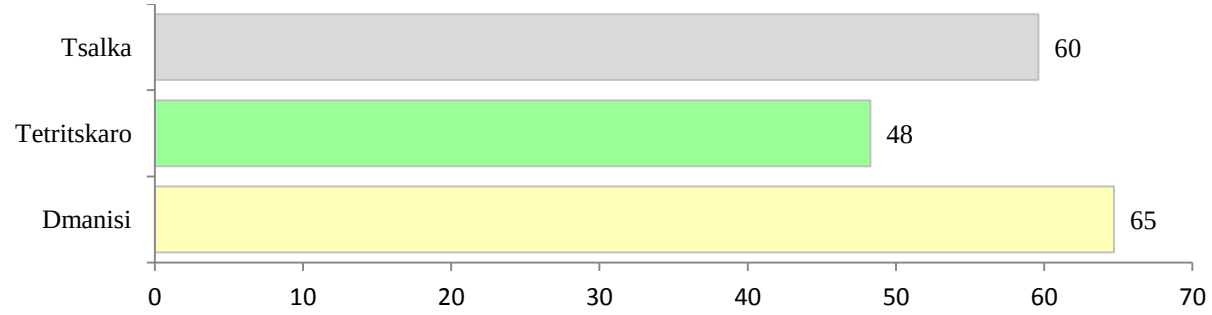

Figure 13: Farmers/Respondents Purchasing Hay (%, Comparison across Municipalities)

The markets for hay for the farmers (both for selling and buying) are mostly located within the programme region. Moreover, farmers tend mostly to buy and sell hay in their villages. Only farmers from Tsalka municipality name abroad (Turkey) places for selling and purchasing hay.[33] Figure 14 and 15 below display the figures for the selling and buying of hay respectively with a comparison across municipalities.

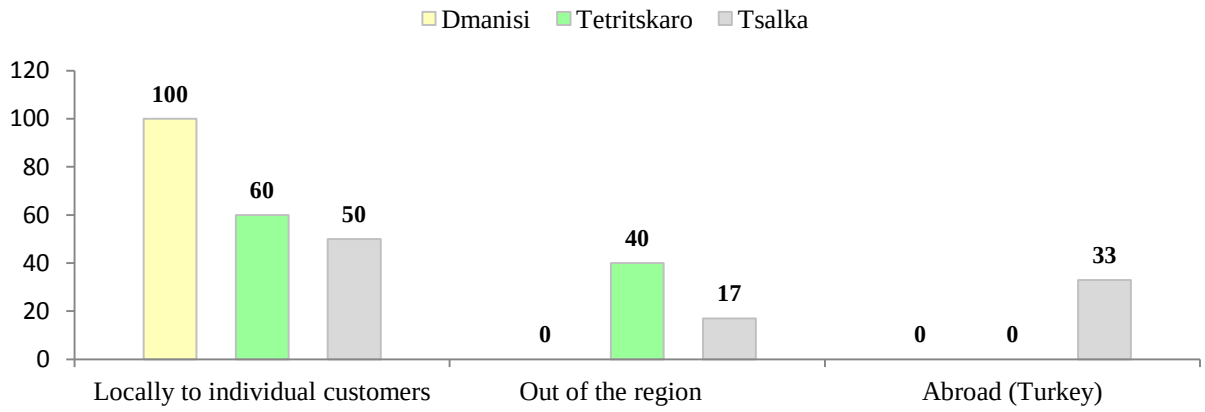

Figure 14: Farmers/Respondents Naming the Following to Be the Market for Selling Hay (% Out Of Those Who Sell Hay, Comparison across Municipalities)

[33] There is a large Adjarian IDP/eco-migrant population in Tsalka, who maintain strong social and economic links with Adjara, many for example use Batumi as a market for their products e.g. cheese as well as Tbilisi. The Adjaran community in Tsalka has shown itself to be strongly business minded.

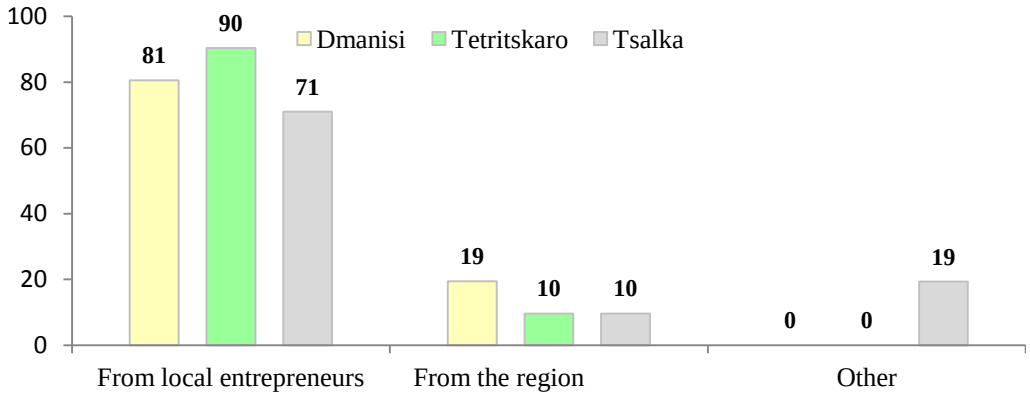

Figure 15: Farmers/Respondents Naming Following to Be the Market for Buying Hay (% Out Of Those Who Sell Hay, Comparison across Municipalities)

7. ACCESS TO INFORMATION

The farmers in the region do not have much access to information relating to hay from official sources. They name their neighbours to be the most reliable (43% of the respondents) and important (34% of the respondents) source of information for hay prices, machinery service prices, and technological innovations and so on. The second most important (18%) and reliable (28%) source named is the television[34] (See Figure 16 below): For more detailed information (gender disaggregated data, comparison across the municipalities please see Annex 2).

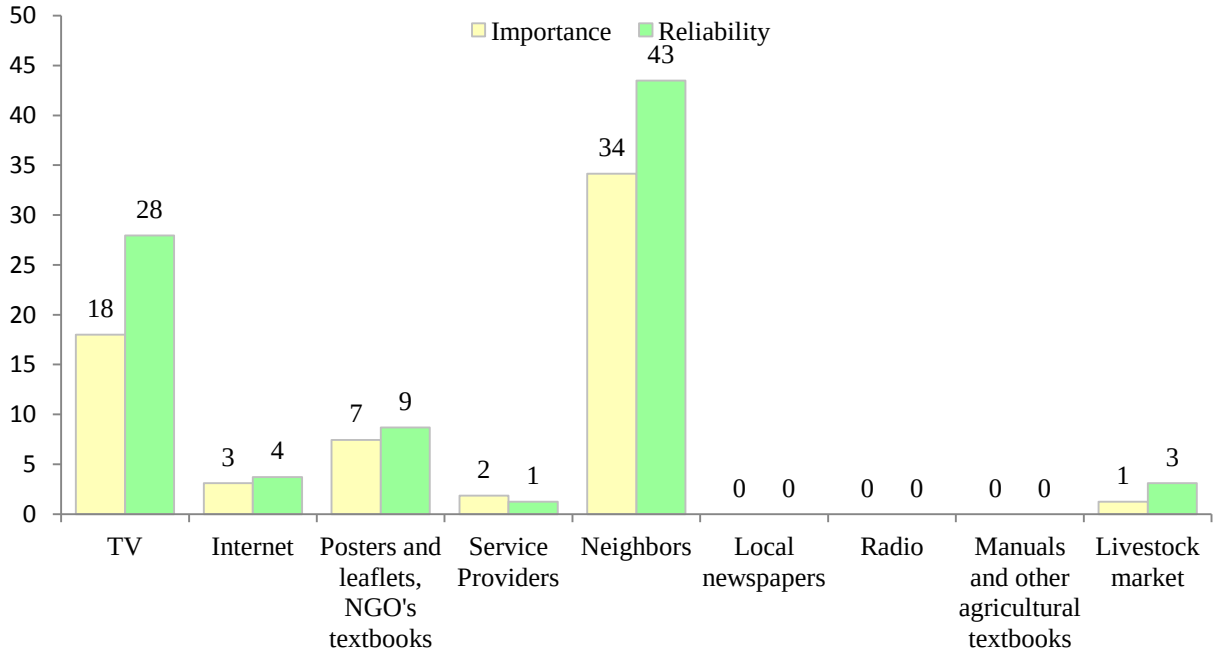

Figure 16: Respondents/Farmers Naming Following Sources of Information to Be Important or Reliable Sources for Them (%)

[34] The TV programmes referred to are national level broadcasts or those from outside of Georgia and the information provided relates to national level news broadcasts and a few agricultural related programmes. Local and more specific information is extremely scarce although the situation is improving with the expansion and inclusion of a supplement in a local newspaper and the potential expansion of the local TV coverage to the programme area.

4. MAIN RESULTS MACHINERY SERVICE PROVIDERS AND GOVERNMENT REPRESENTATIVES

Both service providers and government representative's results corroborate those obtained from farmers and confirm most of the tendencies observed. 31 Machinery SP's and 3 government representatives (one per municipality) were interviewed. The government representatives described hay meadows and pastures as being in less than optimum condition in terms of the quality of hay and level of productivity due to the fact that no substantial measures for improving pastures and/or hay land had been taken over the last few years.

Hay Production:

The results on hay production are similar to those obtained from farmers. The service providers say that hay production in the region has increased over the last 3 years but that the rate of increase as well as the production itself differs across municipalities. Figure 17 below displays these results.

Table 3 Average Number of Farmers and Villages Served By 1 Service Provider, 2012

	Dmanisi	Tetritskaro	Tsalka
Number of customers served per season	53	60	32
Number of villages served per season	3	3	3

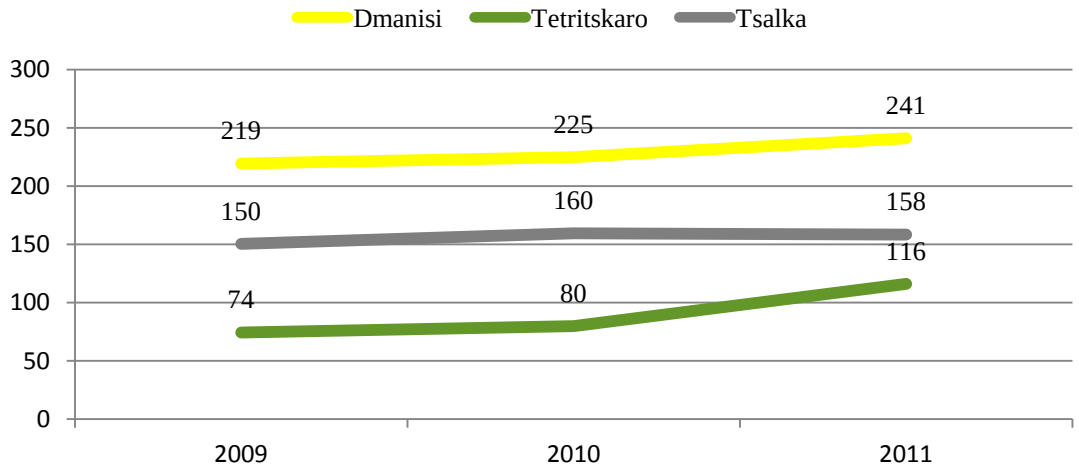

Figure 17: Average # Of Tones of Hay Produced by SP's In Each Municipality over the Last 3 Years

In addition, service providers and government representatives confirm that hay land is not fully utilized as noted below old, broken machinery and a lack of machinery are named as the primary causes. Machinery SP's estimated that on average they could produce 60 tons more hay each per annum with if they had the capacity to utilize hay land to its full potential. (See the Annex 2 for Land Utilization).

Hay Making Infrastructure, Machinery and Services:

The poor quality of existing and lack of machinery is named to be the main reason for low performance of service providers and for not utilizing the full potential of hay lands. This once again is proves the significance of the reason named by the farmers[35]: i.e. lack of access to the machinery. In addition to this, service providers name the poor condition of roads, and low demand by farmers (caused by high prices) to also be the important constraints for their businesses. A by-product of this is that to retain business in cash poor environments with a cash poor customer base, some service providers and farmers use non-cash payment (29%) and barter exchange (20%) as a substitute to cash payment[36].

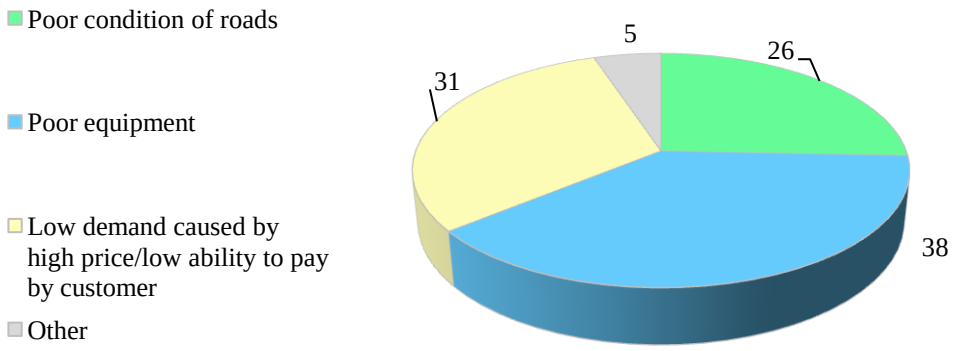

Figure 18: Number of Service Providers Naming Following as the Major Drawback for Their Businesses

Like farmers, government representatives and service providers give preference to the need for small and medium sized machinery as a solution to their constraints (rather than large machinery). (See Annex 2)

Description of the Machinery Service Market, Machinery Service Providers' perception:

The majority of the clients for machinery services in the region are SSLP's (58%) and the rest are medium and larger farmers and organizations [37](42%), see Figure 19. The high cost of the service together with poor availability of cash creates significant drawbacks for the business, as named by both Service providers and the farmers. The problems are partially resolved through barter (20%) and non-cash exchange (50%).[38]

35 See Figure 5: Farmers/respondents reasons for underutilization of land, Section 2 *Hay Making.*

36 This corroborates the information gleaned in the Alliances KK study of the informal economy in the programme area. *Beyond Statistics the Non Cash Economy in Rural Georgia* it can be found on www.allianceskk.ge downloads page.

37 Mostly NGO's.

38 See also Section H: *Summary Results for Machinery Service Providers and Government Representatives*, in Annex 2.

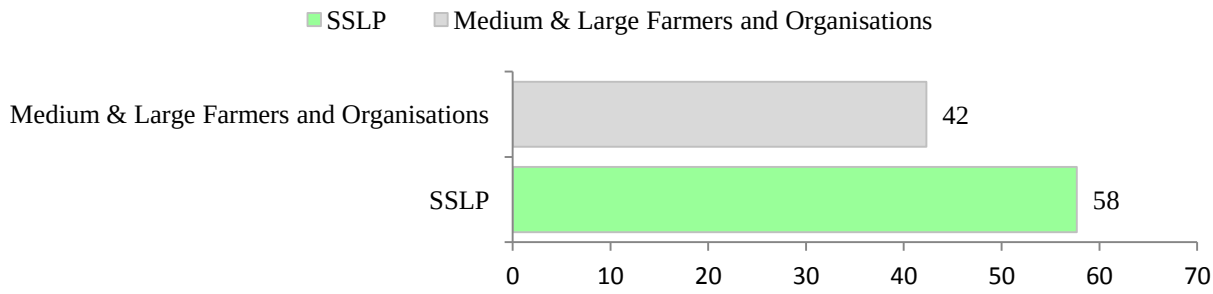

Figure 19: Share of SSLP among the Customers (%)

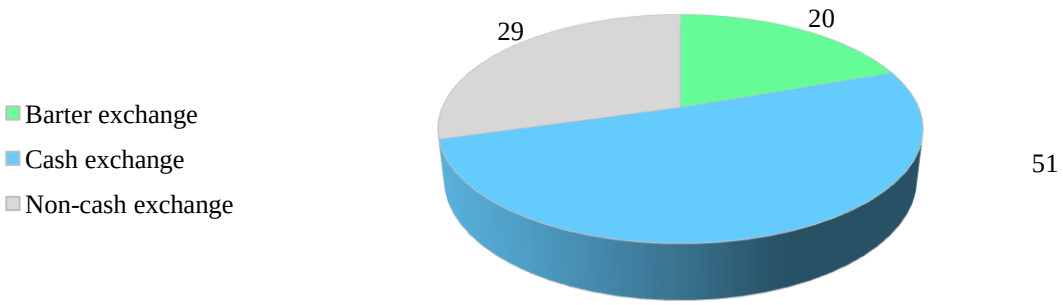

Figure 20: Respondents/SPs Naming Following to Be Common Sources of Payment from Their Customers (%)

5. AN ECONOMIC PROFILE OF HAY PRODUCTION AND PROVISION FOR FARMERS AND MACHINERY SERVICE PROVIDERS

SUMMARY OF MAIN FINDINGS

In this section the findings of the main report were used to provide figures for the calculations below. The aim of the economic profile was to provide a financial measure of the economic cost and value of hay for farmers and the factors influencing this cost and value given the knowledge that hay is the main feed resource for livestock in the programme area and that the production, transport and purchase of hay is the major impact on farmer's outgoing income. One key observation from the data that became obvious immediately was the extent of the effect that the weather i.e. a good or a bad year for hay production has on the profit of farmers. This is clearly shown in Table 7. The findings reinforced that hay is the main outgoing expense for farmers in a minimal input farming system and that no matter how bad the year is in terms of the production of hay the farmers have no alternative but to buy it at the market price and suffer the loss to their profit. The figures also showed the speed of the recovery of profit in a good year. The figures in Table 7 show the efficiency of the small holder farmer with the minimal input/minimal risk system who suffer the least difference in profit in a bad or good year as compared to medium and larger scale farmers who have more to lose. However these figures in Table 7 are as indication only, they are over simplified and do not take in account hay land owned which would considerably reduce the cost of buying hay. Neither does it take into account the rental of hay land as acquiring this data i.e. hay land and rental holdings was beyond the remit of the survey and therefore the calculations are based on the purchase of their entire requirement at market price.

For service providers Table 8 which uses figures for costs derived from old and inefficient machinery with high maintenance costs, clearly highlights that better efficiency of machinery would allow for a considerable increase in profits with beneficial effects for more efficient and cost effective service.[39] Table 4 highlights that making hay by machine is not only efficient in terms of time and production but in terms of cost and despite the fact that labour is costed into the labourers required for making hay by hand calculation that could in practice often be provided for free or in kind, the calculation still emphasizes the opportunity cost of making hay by hand.

In conclusion: If a farmer can produce a surplus for sale it has a major impact on income. Good management practices related to hay production and the availability of good quality and appropriate machinery services that allow for cost effective and timely hay operations will help to defray the impact of bad years and maximize the positive impact of good years. In addition a sufficient amount and upgraded quality of hay over winter can play a determining role in the development of the small scale livestock producer in the expansion of number of milking cows or in the improved feeding for better productivity.

NOTE ON THE ASSUMPTIONS USED IN THE CALCULATIONS

Various assumptions, based on the data included in the survey section were used in the calculation of the data presented below, they are:

- The farmer hires 3 additional labourers whom he/she pays as shown Table 5.
- Hay production is an average of 175 bales or 3.6t/ha

[39] This has been borne out by the success of the machinery intervention in providing the service to farmers through access to machinery for service providers in SDC's Mercy Corps Georgia Alliances Samstkhe Javakheti.

- In a good year for hay production farmers can harvest 150-250 hay bales/ha thus for the calculation an average figure of 200 bales/ha will be used
- In a bad year for hay production farmers can harvest 50-100 bales/ha this for the calculation and average figure of 75 bales/ha will be used
- The average number of milking cows for: a) small farmers = 3cows, b) medium farmers=10 cows, c) large farmers =17 cows[40]:
- Based on general statistics in Georgia, 1 milking cow needs 70 bales/year.
- The average milk yield of the local cow is 1300 litre/year and average price of milk is 0,6 GEL/Litre:

Economic Profile of the Cost of Hay Provision for Farmers

Table 4: Prices/Municipalities From Spring 2011/2012/ by Machine

(GEL/Bale)	Tetritskaro 2011	Tetritskaro 2012	Tsalka 2011	Tsalka 2012	Dmanisi 2011	Dmanisi 2012
Price of per bale farm gate	3	5,50	3	6,00	3	7,00
Price of per bale with delivery	3,5	6,00	3,5	6,6	3,5	7,5
Cost of Mowing (per ha)	120	120	100-120	100-120	100-120	100-120
Bailing price (per bale)	0,6	0,6	0,6	0,6	0,5	0,5

Table 5: Farmers: Time and Cost Economic Comparison of Hay Making by Hand and by Machine on 1 ha∗

	Hay making by hand (Based on 4 labourers famer +3)		Hay making by machine	
	Time	Cost	Time	Cost
Mowing 1ha(Day)	1	150	0.15	120
Raking	.75	50	.75	50
Making Hay Stacks	1	40	-	-
Bailing	-	-	0.25	50
Transport and loading Cost GEL/truck	2500 kg (loose)[41]/.25 day	40[42]	4000 kg (bales/.15	24
Total	3	280[43]	1.3	244

∗Calculations based on a good year i.e. an average of 200 bales/ha

Note on Machinery Versus Making Hay by Hand: An advantage of mowing by machinery is the time saved. Hay making by hand requires rowing by hand for bailing by machine or loading or putting into stooks, which is more labour intensive and takes considerably more time than hay made by machine. It also requires a minimum of 3 labourers in addition to the farmer. Hay mowed by machine is collected and

[40] As derived from the Alliances KK 2011 Focus Group Survey
a) Small scale livestock producer- owning 5 or less milking cows
b) Medium farmers – owning 6 to 13 milking cows
c) Large farmers – owning 14 and more milking cows
[41] As the hay is not compressed and in square bales, less can be carried on the lorry.
[42] Loading is more difficult and time consuming (labour cost)
[43] Sometimes labour will be provided by friends or neighbour as a form of non cash payment or barter exchange. So this figure would be lower.

baled by machinery and does not require any additional labourers, apart from loading the bales onto the truck. Cutting and bailing hay by machine allows the farmer to bale up to 1, 000 hay bales/day (5ha) but in the case of making hay by hand, mowing and stacking 5ha would take more than 10 days for 1 farmer with 3 additional labourers.

EXPENDITURE ON HAY

Unfortunately the calculations above i.e. the costs of producing hay either by hand or machine per/ha cannot be fed into the tables below as the information of how much hay land a small, medium and large farmer has or rents was beyond the remit of the survey and the calculation has too many variables[44] to hazard assumptions based on key informants. Therefore the calculations below are based on the purchase of the farmers entire requirement at market price which will be a much higher cost than that of producing hay from one's own land.

Table 6: Amount of Hay Required and Expenditure on Hay (GEL) for Small, Medium and Large Farmers

	Large Farmer		Medium Farmer		Small Farmer	
	Bad Year	Good Year	Bad Year	Good Year	Bad Year	Good Year
Number of bales needed/year	1190	1190	700	700	210	210
Hay land needed ha/year[45]	15,9	8	9,3	4,6	2,8	1,4
Price for buying hay GEL/year	**7140**	**3570**	**4200**	**2100**	**1260**	**630**

Table 7: Profit and Loss for Small, Medium and Large Livestock Producers (GEL)

	Large Farmer		Medium Farmer		Small Farmer	
	Bad Year	Good Year	Bad Year	Good Year	Bad Year	Good Year
Income from milk GEL/year	13260	13260	8580	8580	3120	3120
Cost of hay/year	7140	3570	4200	2100	1260	630
Other feed (salt, Barley, etc)	4250	4250	2500	2500	750	750
Vet Service	340	340	200	200	60	60
Value of labor force	800	800	0	0	0	0
Profit/year	**730**	**4300**	**1680**	**3780**	**1050**	**1680**

Table 8: Profit & Loss Hay Making Service Provider

Service	Income	Expenditures*	Profit (GEL)
Bailing	20 625	14 300	6 325
Mowing	24 725	21 000	3 725
Total	**45 350**	**35 300**	**10 050**

*This includes the costs of fuel, maintenance and repairs which tend to be very high on the old machines that the service providers generally own. Their efficiency is also very low, limiting the amount of land that can be processed, the effects of which are passed on in the cost of the service to farmers.

[44] E.g. hay made by hand or by machine, with paid or unpaid labour, amount of land owned or rented.

[45] However this basic calculation of how much land a small medium and large farmer would need if producing their own hay in entirety for the average number of cows based on the number of bales required was made.

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ANNEX 1. RESEARCH METHODOLOGY

The research was comprised of three main components:

1. Desk study and literature review of existing sources on subjects related rangeland, pastureland, hayland in Georgia and Kvemo Kartli. (Section 2)
2. Economic Profiles of Hay Production for Farmers and Machinery Service Providers (Section 4)
3. Three semi formal/ semi closed ended questionnaires:

- Questionnaire 1: A randomized SSLP survey.
- Questionnaire 2: Key informant interviews surveys with machinery Service Provider's
- Questionnaire 3: Key informant Interviews with Local Government Representatives[46]

Questionnaire 1: Small Scale Livestock Producer (SSLP) Farmers
These represent the main target beneficiaries of the programme and are the main buyers, producers harvesters and sellers of hay.
Sample: 126 SSLP's were randomly selected to ensure a distribution per municipality of gender and ethnicity and the three different altitudes which represent the three different agro-ecological zones (as determined by altitude) inhabited by SSLP's in the programme area and the types of pasture, hay meadows and crop land which are utilized. The sample was chosen to provide results with a 95% confidence level with 70% (municipality level) significance level. (See Table 1 below for the sample). One large and one medium farmer will also be interviewed per village as key informants to compare data against the findings for SSLP's.

Table 2 Distribution of Sample according to Municipality for Gender, Ethnicity

Distribution of the Sample (Gender, Ethnicity, Municipalities)							
Municipality	Gender	Ethnicity					
		Georgian	Russian	Armenian	Azeri	Greeks	Total
Dmanisi	Men	7	0	0	14	0	21
	Women	7	0	0	14	0	21
Tetritskaro	Men	18	1	2	1	0	22
	Women	18	1	2	1	0	22
Tsalka	Men	9	0	8	2	1	20
	Women	9	0	8	2	1	20
Total		68	2	20	34	2	126

[46] The surveys were conducted by: 5 survey personnel (1 Azeri, 1 Armenian and 2 Georgian language speaking) and trained by M&E Officer and the IAAD nutrition expert. And was carried out in May (2012).

Questionnaire 2: Machinery Service Providers Operators - potential Service Providers i.e. producers of nutritional input for the cattle (# in operating in programme area)
Sample: Registered and unregistered Machinery SP's interviewed, based on those mentioned in the SSLP interviews

Table 3 Machinery Service Providers interviewed

	Dmanisi	Tetritskaro	Tsalka
LTD	1	0	0
Governmental LTD	0	0	0
Entrepreneur	5	1	5
Other (Individual, not registered)	3	8	8
Total	8	9	13

Questionnaire 3: Government and Key Agency Representatives – as key stakeholders, in charge for decision making process (# in operating in programme area).
Sample: The Head of the Council for each Municipality (or their representative/advisor in agricultural issues) interviewed as key informants to provide information about land use, designation and improvement schemes in each municipality.

ANNEX 2: ADDITIONAL MAIN SURVEY RESULTS

A. DESCRIPTION OF THE MEADOWS AND PASTURES IN THE REGION (FARMERS PERCEPTION)

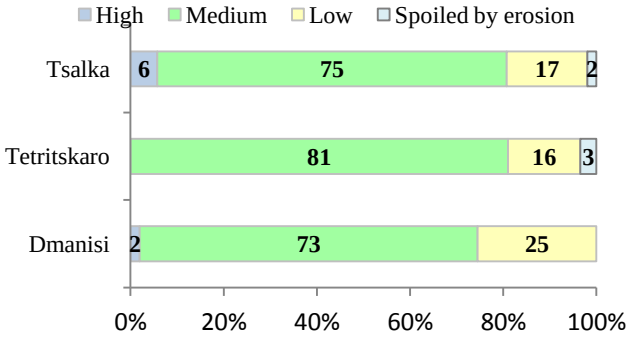


Figure A1: % of farmers/respondents describing fertility level of meadows in their villages as high, medium, low and spoiled by erosion

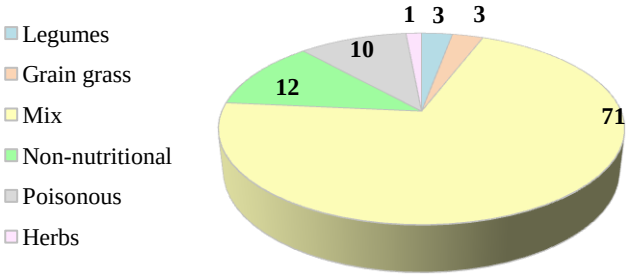


Figure A2: % of farmers/respondents naming following species to be found in their pastures

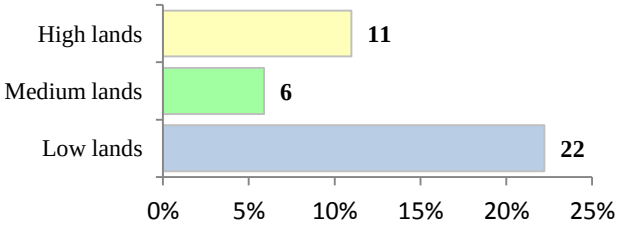


Figure A3: Farmers/respondents seeding/improving pastures (Distribution according to altitude, %)

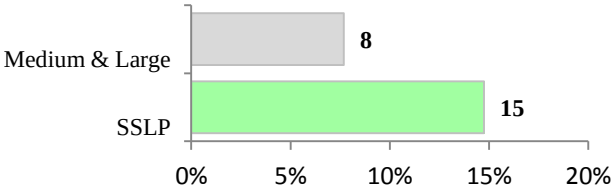


Figure A4: SLLPs and larger farmers seeding/improving pastures (%)

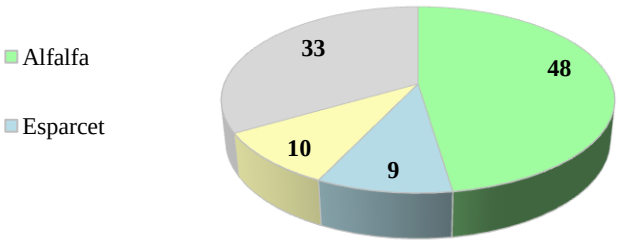


Figure A5: Farmers/respondents using following cultures for seeding/improving pastures (%)

B. Hay Making (farmers perception)

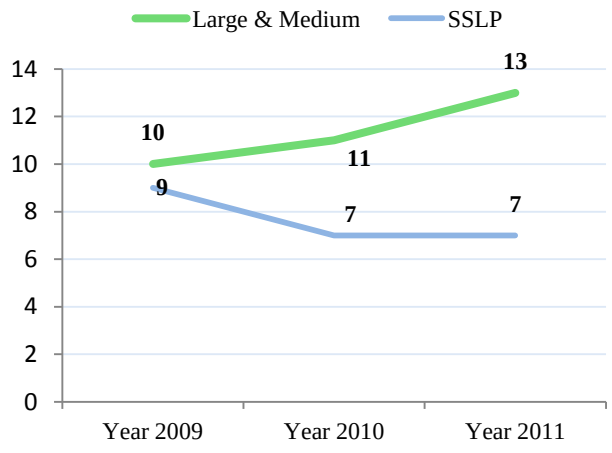


Figure B1: Average number of tones of hay produced per SSLP and larger households during last 3 years

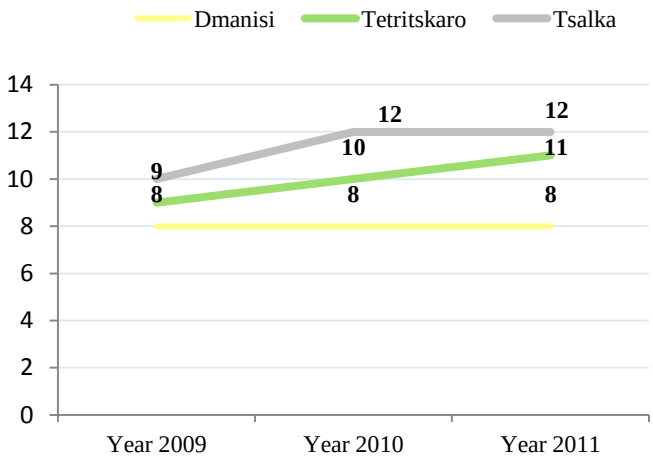


Figure B2: Average number of tones of hay produced per household over the last 3 years (Comparison across municipalities)

C. Machinery and Draught Animals (Oxen, Horses, Donkeys) and Their Use in Hay Making (Farmers Perception)

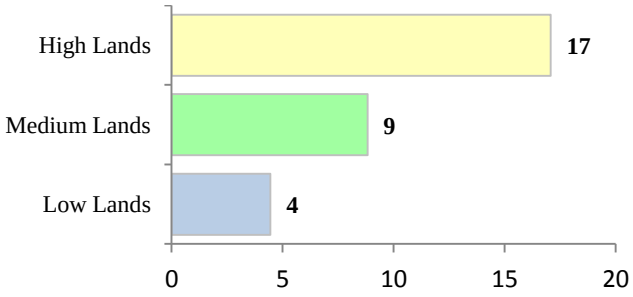


Figure C1: Farmers/respondents using draft animal for processing hay meadows

(%, comparison according to altitude)

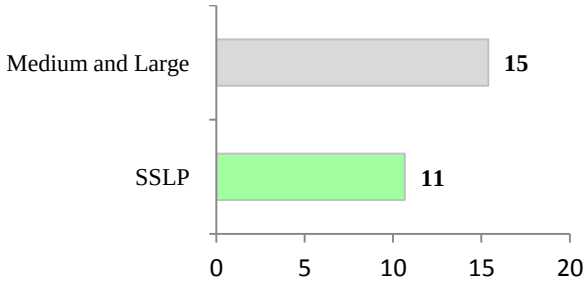


Figure C2: Farmers/respondents using draft animal for processing hay meadows

(%, comparison according to farmer status)

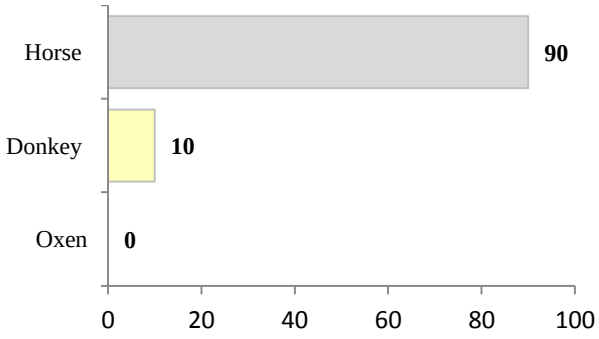


Figure C3: Farmers/respondents naming following draft animal to be used during hay making (%)

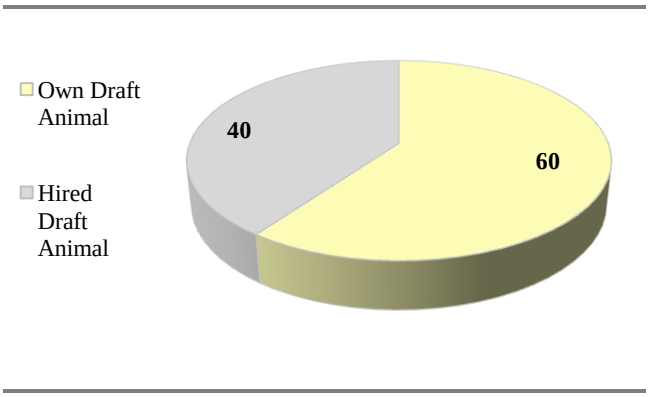


Figure C4: Farmers/respondents using own and hired draft animal (%)

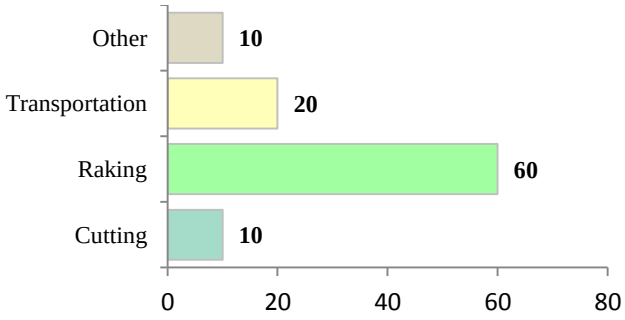


Figure C5: Farmers/respondents using draft animal for following stages of hay making (%)

D. Hay Making Infrastructure, Machinery and Services (farmers perception)

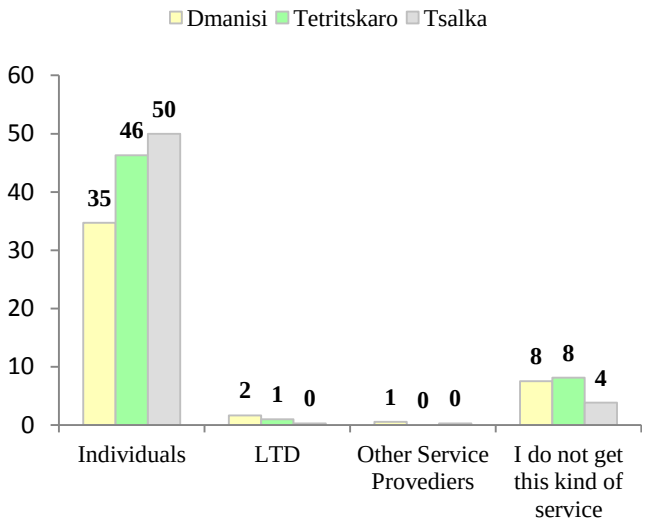


Figure D1: Respondents/farmers naming following as sources of obtaining machinery services

(Comparison across Municipalities, %)

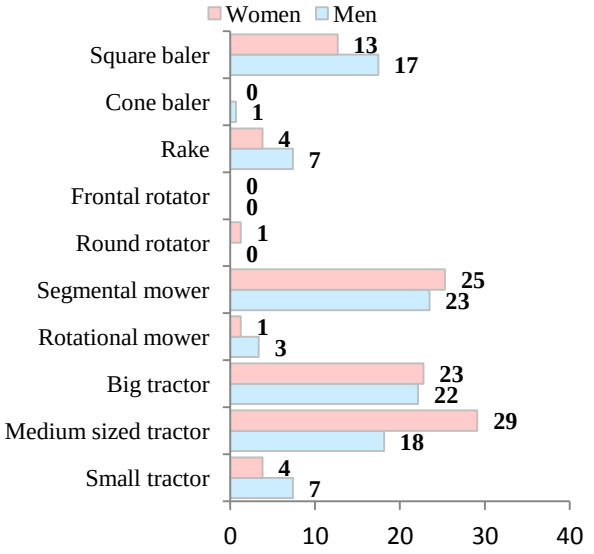


Figure D2: Respondents/farmers naming the machinery the desired ones in their communities

(Comparison between men and women, %)

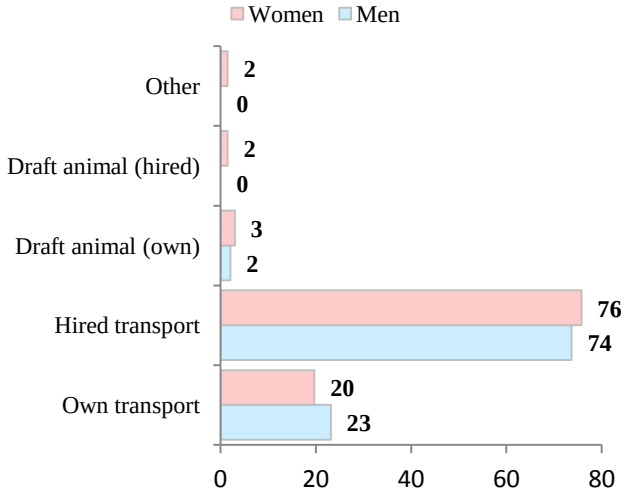


Figure D3: Respondents/farmers naming following as common ways of hay transportation

(Comparison between men and women, %)

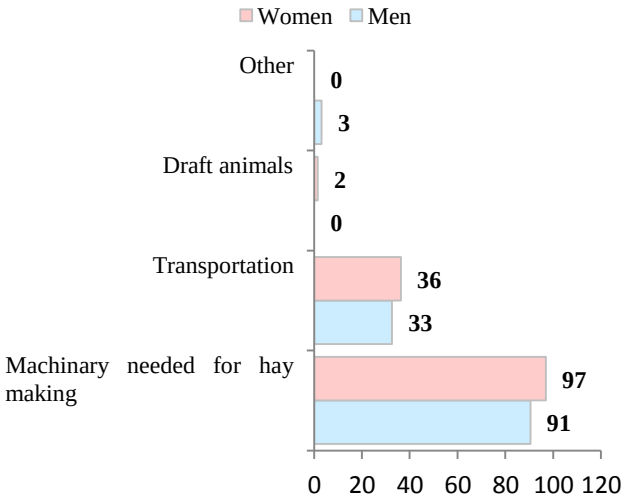


Figure D4: Respondents/farmers naming the following as necessary items in their communities

(Comparison between men and women, %)

E. SUPPLEMENTARY NUTRITIONAL INPUT (FARMERS' PERCEPTION)

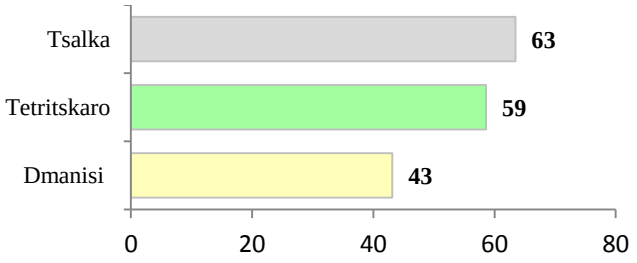


Figure E1: Respondents/farmers feeding supplementary feed to cattle

(Comparison across Municipalities, %)

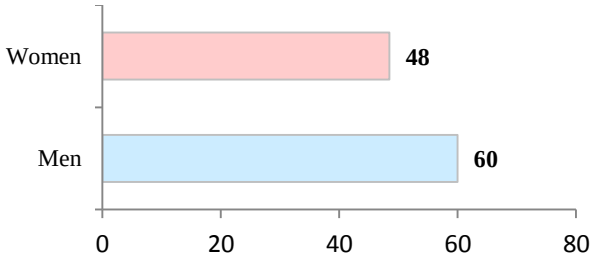


Figure E2: Respondents/farmers giving supplementary feed to cattle

(Comparison between men and women, %)

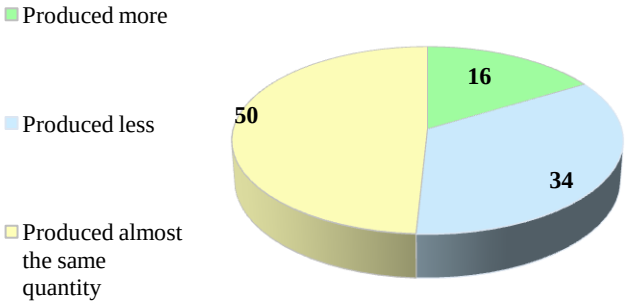


Figure E3: % of farmers/respondents producing more, less or the same amount of supplementary feed for cattle compared to last year/years

(% out of those who uses supplementary feed)

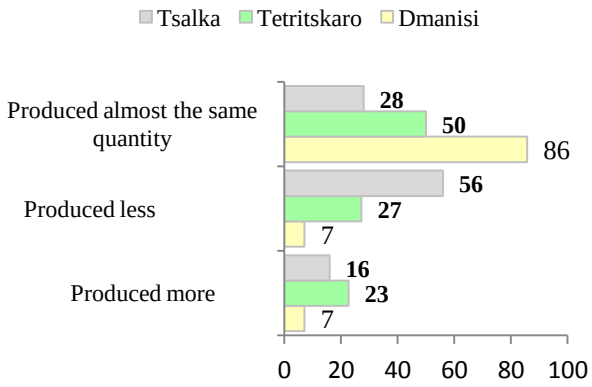


Figure E4: % of farmers/respondents producing more, less or the same amount of concentrated/supplementary feed for cattle, compared to last year/years

(% out of those who use supplementary feed, comparison across municipalities)

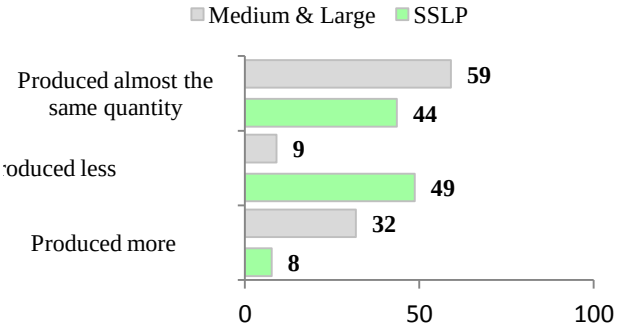


Figure E5: % of farmers/respondents production of supplementary feed for cattle
(Comparison between SSLP and larger farmers, % out of those who use supplementary feed)

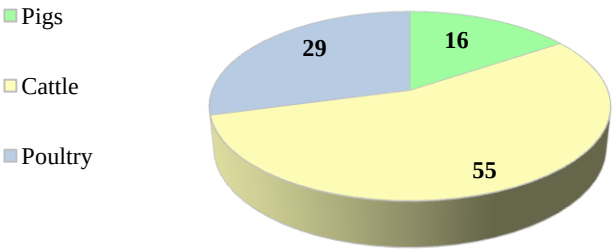
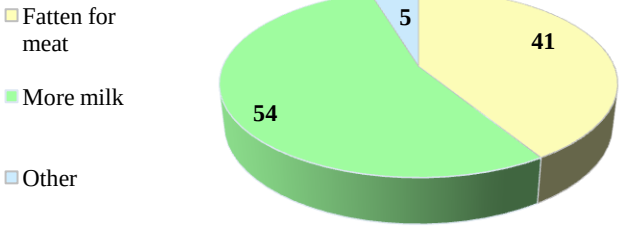


Figure E6: Farmers/respondents who use supplementary feed for the following animals
(% out of those who uses supplementary feed)



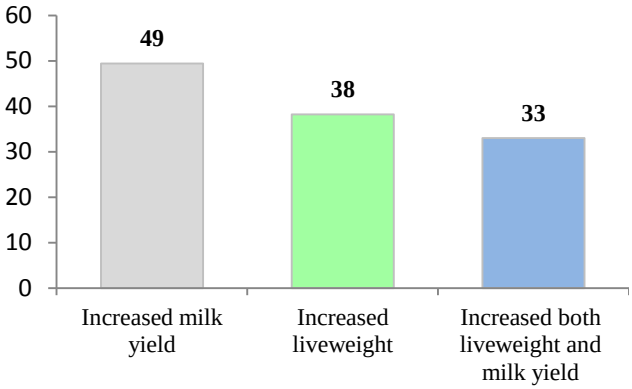


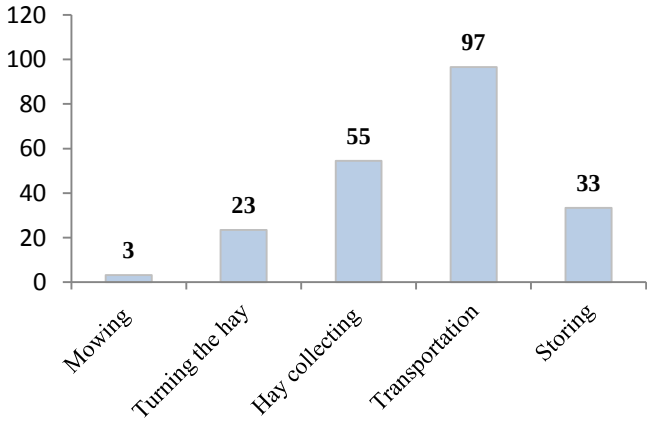
Figure E7: Farmers/respondents who use supplementary feed for following purposes

(% out of those who uses supplementary feed)

Figure E8: Farmers/respondents reporting increased milk yield and/or live weight of cattle

(% out of those who uses supplementary feed)

F. ASSOCIATED COSTS & BENEFITS OF HAY MAKING (FARMER'S PERCEPTION)



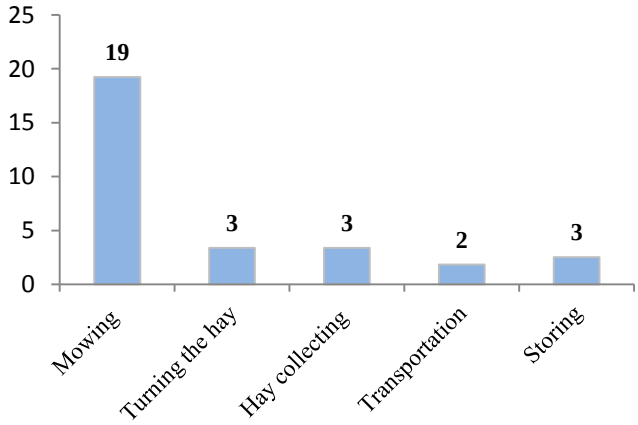


Figure F1: Average amount of time spent on hay making activities (Hours)

Figure F2: Average amount of money spent on hay making activities (Gel)

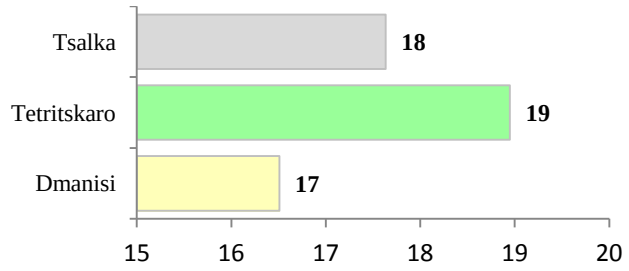


Figure F3: Average of kg per bale
(Farmers data, Comparison across Municipalities, kg/bale)

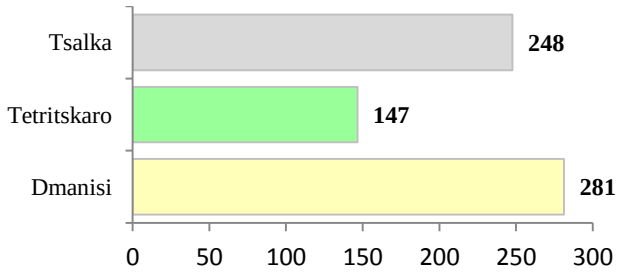


Figure F4: Average size of one hay stack
(Farmers data, Comparison across Municipalities, kg)

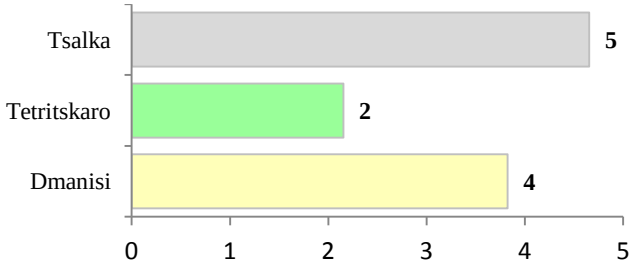


Figure F5: Average numbers of stacks from ha of land
(Farmers data, Comparison across Municipalities)

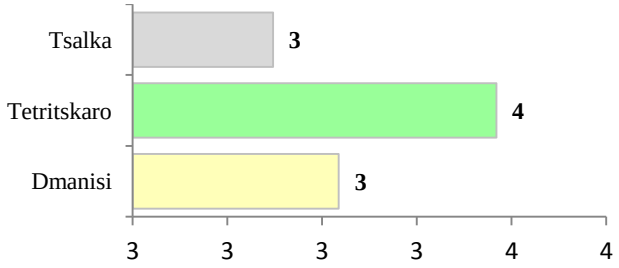


Figure F6: Selling price per bale
(Farmers data, Gel, Comparison across Municipalities)

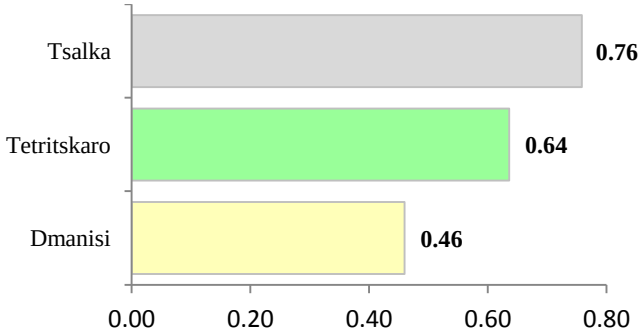


Figure F7: Purchase price of kg hay
(Far

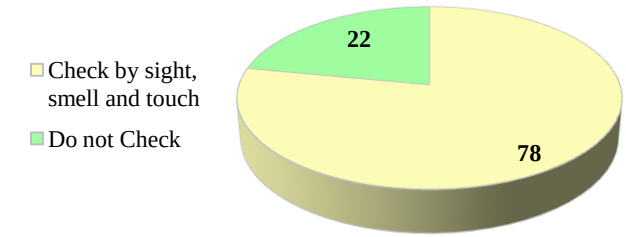


Figure F8: Farmers/respondents checking quality of hay
(% out of those who purchases hay)

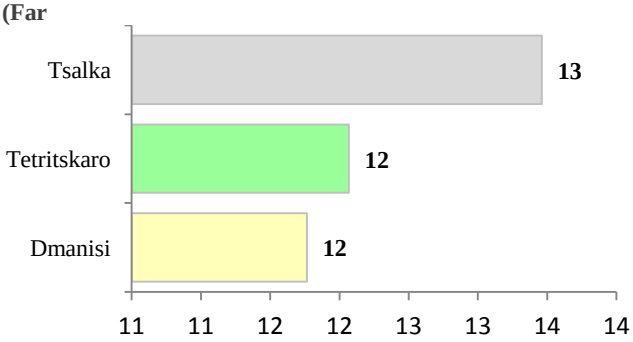


Figure F9: Farmers/respondents selling hay
(%, Comparison across Municipalities)

G. ACCESS TO INFORMATION (FARMERS PERCEPTION)

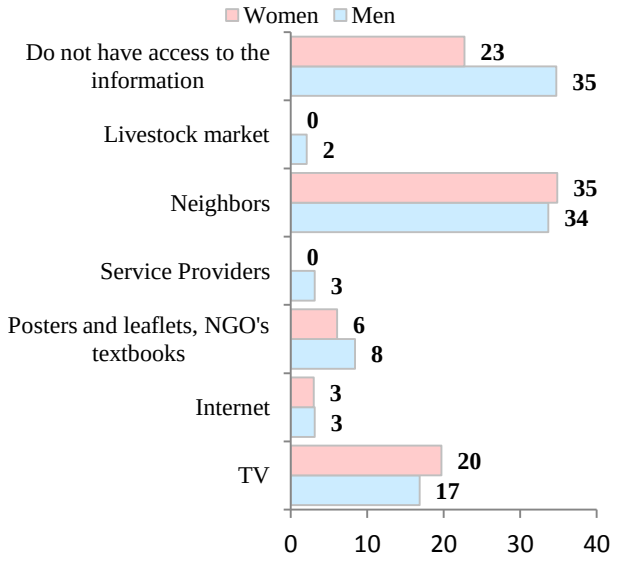


Figure G1: Respondents/farmers naming following sources of information to be important sources for them - (Comparison between men and women, %)

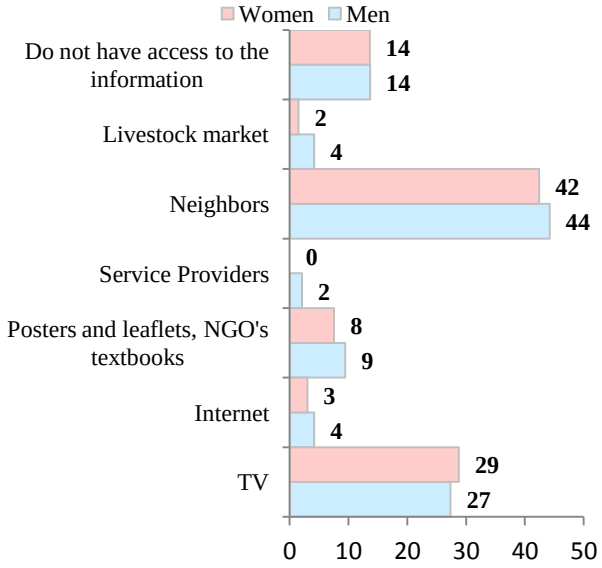


Figure G2: Respondents/farmers naming following sources of information to be reliable sources for them (Comparison between men and women, %)

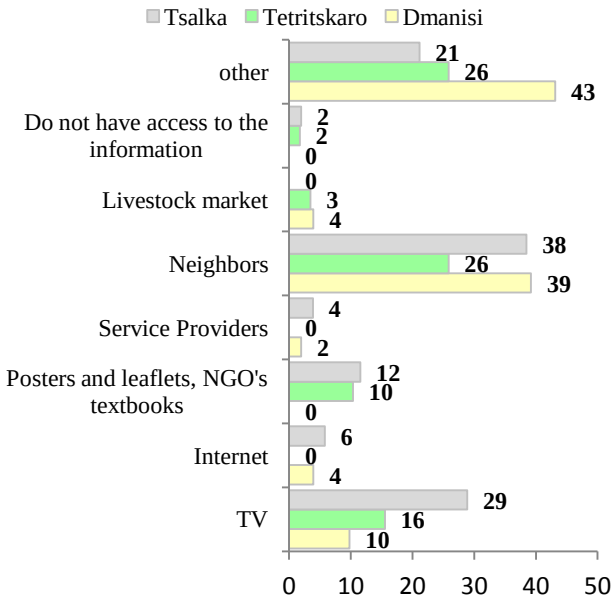


Figure G3: Respondents/farmers naming following sources of information to be important sources for them (Comparison across Municipalities, %)

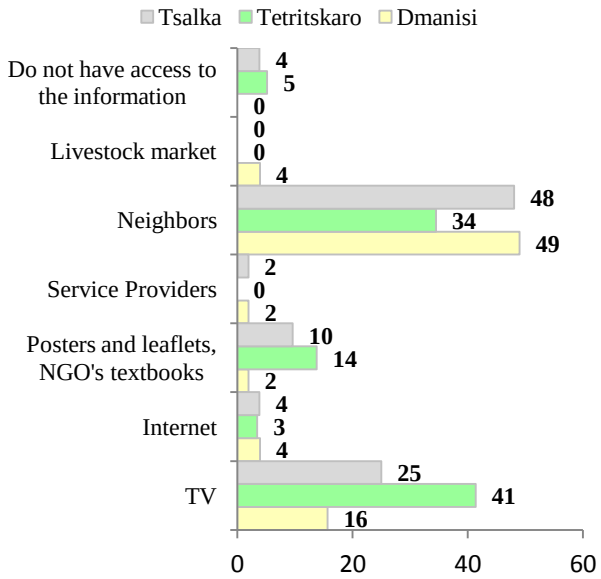


Figure G4: Respondents/farmers naming following sources of information to be reliable sources for them (Comparison across Municipalities, %)

H. Summary Results for Machinery Service Providers and Government Representatives

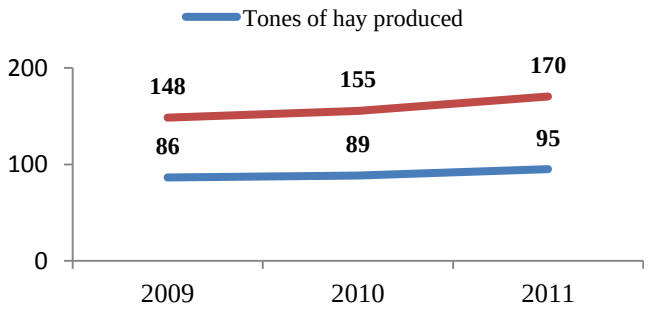


Figure H1: Over last three years: production potential per SP if able to utilise hay lands to full capacity verses actual hay production

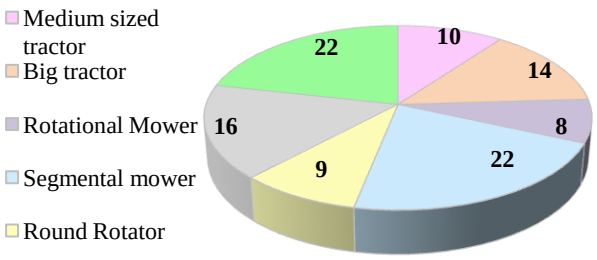


Figure H2: Respondents/SPs naming following to be most desired machinery (%)

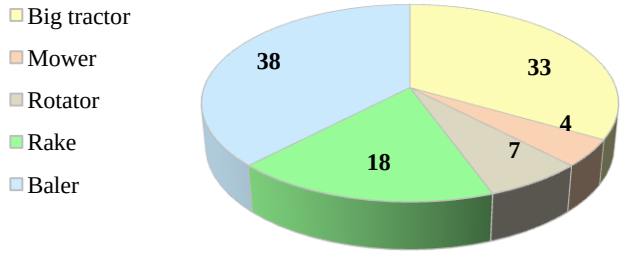


Figure H3: Respondents/SPs naming the following to be the machinery services most in demand among SSLP customers

Table H1: Average number of following pieces of machinery owned by one Service Provider[47] (%)

	Dmanisi	Tetritskaro	Tsalka
Small tractor	0	0	2
Medium sized tractor	4	10	1
Big tractor	2	1	2
Mower	3	1	1
Rotator	0	1	0
Rake	1	1	1
Baler	1	1	1

Table H2: Average prices charged for following activities by SPs (Gel)

	Dmanisi	Tetritskaro	Tsalka
Fertilization	5	6	23
Ploughing	65	64	124
Seeding	45	4	109
Mowing	59	50	75
Hay Raking	3	3	8
Collecting	17	13	18
Baling	0	0	0

[47] Up to 60 % of machinery is in bad condition or not in working condition