

Adoption and Diffusion of Grass Silage in Trabzon Province of Turkey

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Abstract: Developments in agricultural sector largely depend on the application of advanced agricultural technologies. These technologies sometimes consist of very complex issues but sometimes include very simple practices. Use of these technologies especially in disadvantaged regions enables farmers to increase their income and welfare level, as well as, makes contributions to a reduction of developmental gaps among regions. Depending in the area where they are being used, the new technologies have one of the effects of decreasing production costs, increasing productivity, easing the work being done, and reducing labor requirement. Grass silage for small holder cattle owners is considered as one of these technologies for Trabzon Province of Turkey since it has not been commonly used in the region.

The main objectives of this research were to determine socioeconomic characteristics and communication behavior of small holder cattle owners, to determine what practices are being applied by the farmers in the present farming system, to determine problems encountered by farmers, and to determine the awareness level of grass silage in the region and possible contributions that grass silage will make to the farmers in the region. It is aimed also to develop recommendations for the region to accelerate the adoption and diffusion process of this technology. Descriptive statistics were used for data analyses. Research findings showed that small holder cattle farmers are mostly older people and operate in conventional ways. They face serious problems with drying their grass and lack information about grass silage. In order to adopt grass silage, farmers must be aware of its benefits, and extension work is needed for this purpose.

Key words: grass silage, diffusion of innovations, adoption of innovations, Trabzon, Turkey

1. Introduction

The use of advanced technology in agriculture, particularly in disadvantaged areas and regions make remarkable contributions to the income and welfare of farmers. Advanced technologies, depending on the area they are used, make it possible for farmers to reduce production costs, save labor, and play a role on increasing the quality and quantity of agricultural production. While contributing to the prosperity of the people of a

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region for the first time, any use of a technology can be considered as an innovation for the region. In this context, grass silage technology is an innovation for the Eastern Black Sea region, while the region is considered as a disadvantaged region due to a lack of sunny days during the harvest season. Grass silage is not a common technology that is being applied by farmers in the region. Even in Turkey, corn is the first crop that comes to mind in silage making. Although grass silage is used widely in developed countries, it is not common in Turkey, even in areas where the most intensive farming structures prevail. In order to understand the benefits of grass silage and promote it to the farmers of Trabzon province it is important to describe the existing unique farming systems of the region.

Trabzon is located on the Black Sea Coastal region of Turkey with a population of 766.782 and surface area of 4,685 square kilometers. It is bordered by the provinces of Rize from the east, Giresun from the west, and Gümüşhane and Bayburt from the south. The total area is 22.4% plateau and 77.6% hills (Wikipedia, 2015).

Agriculture is one of the main occupations providing livelihood to thousands of rural families in Trabzon. Majority of farms are specialized in hazelnut and tea production, particularly in coastal area. The eastern neighbor province, Rize is popular with tea plantations while the western neighbors of Giresun and Ordu provinces with hazelnut production in their coastal lands. Trabzon can to some extent economically grow both commodities. As we move to 40-50 kilometers inland from the coast the altitude goes up to 800-1200 meters and it becomes almost impossible to economically grow hazelnut and tea. However, geographical and climatic conditions in these altitudes allow farmers to grow maize, beans, potatoes, cabbage, and various fruits and vegetables. There are forests, pastures and meadows areas starting from these altitudes and going up to 2500 meters from sea level. Because the landscape is shaped by natural forces, it is almost impossible to use farm machinery in sloppy and fragmented parcels of lands, therefore farming activities largely depend of labor. These conditions create a different farming system producing mainly annual maize and beans in the operated fields and perennial grass for livestock. In addition, in the higher uphill and mountainous areas public rangelands are available for grazing livestock, mainly caws and sheep, from early June to late September, depending on the altitude.

Climate in Trabzon is considered suitable for livestock. Due to abundant rainfall grasslands (pasture and meadows) are always covered with lush grass. Particularly native breeds and Jersey for cattle, sheep and goats can graze at least 5 mounts in public rangelands. Grazing period can be extended to 8-10 months for sheep and goats but due to uphill and mountainous areas are covered by snow in the winter season, lower lands which are private properties must be utilized. During the winter season, hazelnut gardens can also provide grazing opportunities for sheep and goats. However, in order to utilize these lands for grazing purposes there must be an agreement between the land owner and the herd owner. Caws, on the other hand, kept in barns and fed by

roughage and concentrate feeds which must be prepared from the summer season or purchased from feed markets. Many farmers have to purchase concentrate feeds but to be economically viable they must prepare their own roughage feeds from their own field. Therefore, they keep some part of grass land away of animal grazing and harvest it in early August for winter feeding.

Grass silage is expected to make two important contributions to animal husbandry in the region. The first one is it will provide sustainable roughage feed production which cannot be provided by the current farming system. This is because during the harvest season the weather is quite rainy in the research area and therefore, it is quite difficult- some seasons impossible because of continuing rainy days- to dry harvested grass for winter feeding. If grass is harvested in a sunny morning and it begins raining in the afternoon, grass cannot be dried. Some farmers collect and cover it by nylon until the sun appears again. But this time it is necessary to spread harvested grass in sun and let it completely dry. This procedure requires too much hard work and labor, and therefore, grass silage making will make another contribution to farmers which is labor save. In some years rainy days take so long that (a couple of weeks) and it becomes impossible for farmers to get dried grass from their own field. This lack of roughage feed results in selling the animals or purchasing roughage feed from other regions.

The primary purpose of this study was to investigate possible adoption and diffusion of grass silage making in Trabzon province of Turkey. The specific objectives were to determine socioeconomic characteristics and communication behavior of small holder cattle owners, to determine what practices are being applied by the farmers in the present farming system, to determine problems encountered by farmers, and to determine the awareness level of grass silage in the region and possible contributions that grass silage will make to the farmers in the region. It is aimed also to develop recommendations for the region to accelerate the adoption and diffusion process of this technology. Research findings are intended to make contributions to the public in the region, researchers, extension personnel of the Ministry of Food Agriculture and Livestock, and other stakeholders.

2. Materials and Methods

Target population for this study was defined as small holder cattle owners in Trabzon province of Turkey. Two districts from this province, namely Çaykara and Maçka districts and three villages from each district (total six villages) were selected based on their agricultural potential, distinct from the city center, socioeconomic characteristics of rural communities, and potential of livestock production. From each village a list of small holder cattle owners showing their number of cattle was obtained from the District Agricultural Office. Lists of farmers and their cattle sizes from six selected villages made the accessible population of the

study. Considering frequency distributions of the number of animals, accessible population was divided in three strata with 1-5 animals, 6-10 animals, and more than 10 animals. Yamane's (2001) stratified sample size determination formula was used to determine sample size. The equation for this formula is:

$$n = \frac{N \sum N_h S_h^2}{N^2 D^2 + \sum N_h S_h^2}$$

Where

n = sample size,

N = accessible population,

N_h = number of farmers in a stratum,

S_h = standard deviation within a stratum,

D^2 = desired variance,

e = accepted error from the mean, and

t = t value corresponding the accepted confidence interval.

Accepting 5 percent error from the mean (e) and 95 percent confidence interval ($t = 1.645$), the sample size was calculated as 52. This number was proportionally distributed to three strata, and respondents from each stratum were randomly selected.

Data were collected by conducting face to face interviews with farmers during which a questionnaire was administered. It was included three sections, the first section included questions related to socioeconomic characteristics of respondents while the second section communication behaviors. Finally the third section included questions related to present farming systems in the region and possible adoption of grass silage making. Technically the questionnaire included both open ended and closed ended questions. Respondents' opinions and comments were noted for the open ended questions. Genever (2013), Budak et al., (2012), Güven (2011), Castro et al., (2010), Carvalho et al., (2010), Arslan and Dinç (2009), Bilal (2009), Bingöl et al., (2009), and Gebremedhin (2003) were utilized for preparing the questionnaire. Data were collected in March and April 2015. It was approximately half an hour to complete a questionnaire.

Descriptive statistics including frequencies, percentages, means, and standard deviations were used to analyze quantitative variables. For the items collected in a five point Likert scale, an interpretive scale was developed by the researchers. During data collection process many notes were taken by the researchers from respondents comments in a given issue related to their farming system. If many farmers concerned about similar problems and made comments accordingly, these were also considered in data analysis process.

3. Results and Discussion

Table 1. Socioeconomic characteristics

Variable			Variable		
Age of farmer	n	%	Credit use for inputs	n	%
Younger than 35	5	9.6	Yes	17	32.7
35-50	15	28.8	No	35	67.3
Older than 50	32	61.5	TOTAL	52	100.0
TOTAL	52	100.0	Use of bank loans for investments		
Level of education			Yes	12	23.1
Illiterate	3	5.8	No	40	76.9
Elementary school	22	42.3	TOTAL	52	100.0
Secondary school	15	28.8	Yearly income		
High school	8	15.4	Less than 20 thousand	24	46.2
University	4	7.7	20-30 thousands	14	26.9
TOTAL	52	100.0	31-40 thousands	11	21.2
Cooperative membership			More than 40 thousands	3	5.8
Member	6	11.5	TOTAL	52	100.0
Not Member	46	88.5	Owning farm tractor		
TOTAL	52	100.0	Yes	0	0
Participation in village administration			No	52	100.0
Yes	12	23.1	TOTAL	52	100.0
No	40	76.9	Can you change your future by yourself?		
TOTAL	52	100.0	Yes	7	13.5
Amount of land			Somewhat	7	13.5
No land	6	11.5	No	38	73.1
Up to five decares	23	44.2	TOTAL	52	100.0
6-10 decares	10	19.2	Farming experience		
11-20 decares	5	9.6	Up to 10 years	6	11.5

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More than 20 decares	8	15.4	11-20 years	7	13.5
TOTAL	52	100.0	21-30	9	17.3
Social security	N	%	More than 30	30	57.7
No social security	3	5.8	TOTAL	52	100.0
BAĞ-KUR	18	34.6	Income level		
SSK	30	57.6	Low	22	42.3
Green card	1	1.9	Medium	28	53.8
TOTAL	52	100.0	High	2	3.8
			TOTAL	52	100.0

Socioeconomic characteristics of respondents are presented in Table 1. From the table majority of respondents (61.5%) are older than 50 years of age, 43.3% are elementary school graduates, 88.5% aren't cooperative members, 79.6% participated in village administration, 44.2% had land up to 5 decares, 94.2% had social security, 67.3% didn't use credit for inputs, 76.9% didn't use bank loans for investments, 46.2% had yearly income less than 20 thousand Turkish liras (1 US Dollars = 2.80 Turkish liras in August 14, 2015), no farmers had a farm tractor, 73.1% believed that they cannot change their future with their own effort, 57.7% had farming experience more than 30 years, and 53.3% considered themselves in the medium income category in their village.

Table 2. Communication behaviors

Variable	n	%	Variable	n	%
Reading newspaper			Travels to district center		
Every day	23	44.2	Every day	12	23.1
At least once a week	13	25.0	2-3- times a week	9	17.3
At least once a month	9	17.3	Once a week	22	42.3
Never	7	13.5	2-3 times a month	4	7.7
TOTAL	52	100.0	TOTAL	52	100.0
Listening to radio			Travels to province center		
2-3 hours a day	16	30.8	2-3 times a week	4	7.7
2-3 hours a week	7	13.5	Once a week	7	13.5
2-3 hours a month	4	7.7	2-3 times a month	15	28.8

Almost newer	25	48.1	Once a month	8	15.4
TOTAL	52	100.0	More seldom	18	34.6
Watching television			TOTAL	52	100.0
2-3 hours a day	50	96.2	Meeting with extension agents		
More seldom	2	3.8	2-3 times a week	4	7.6
TOTAL	52	100.0	Once a week	8	15.4
Awareness of the Internet			2-3 times a month	5	9.6
Yes	38	73.1	Almost never	35	67.3
No	14	26.9	TOTAL	52	100.0
TOTAL	52	100.0	Seeking farming advice		
Use of the Internet			Newer	5	9.6
2-3 hours a day	9	17.3	Always	22	42.3
2-3 hours a week	6	11.5	Sometimes	25	48.1
Newer	37	71.2	TOTAL	52	100.0
TOTAL	52	100.0	Taking part in farm events /seminars, field days etc.		
			Newer	40	76.9
			Many times	5	9.6
			A couple of times	7	13.5
			TOTAL	52	100.0

Communication behaviors of farmers are presented in Table 2. From the table it can be seen that 44.2% read newspaper every day. But during the interviews it was observed that most of the farmers read newspaper in tea-houses located in the center of the villages. Approximately half of the respondents listened to radio almost never while 96.2% watched television 2-3 hours a day. Approximately one-third of the respondents were aware of the internet but 71.2% almost newer used the Internet. Majority of the respondents traveled to district center at least once a week or more often while majority of the respondents traveled to province center at least once a month or more often. More than two-third of the respondent never met with extension personnel while almost half of them sought advise related to farming problems. More than three-fourth of the respondents never participated any farming events such as meeting, seminar, field day etc.

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Table 3. Farming practices

Variable	n	%	Variable	n	%
Livestock provided			Meadows grazed properly		
Own production	49	94.2	Yes	40	76.9
Purchase	2	3.8	No	12	23.1
Own production+purchase	1	1.9	TOTAL	52	100.0
TOTAL	52	100.0	Manure used		
Dry grass provided			Own field	51	98.1
Own production /purchase	30	57.7	Wasted	1	1.9
Own production	13	25.0	TOTAL	52	100.0
Purchase	9	17.3	Change in number of animals recently		
TOTAL	52	100.0	Decrease	44	84.6
Concentrate feed provided			No change	8	15.4
Purchase	36	69.2	TOTAL	52	100.0
Own production /purchase	8	15.4	% of grass properly dried		
Own production	8	15.4	0-40%	2	3.8
TOTAL	52	100.0	%41-%60	14	26.9
Livestock sold			%61-%80	18	34.6
Butchers	18	34.6	%81-%100	18	34.6
Ritual slaughter	15	28.8	TOTAL	52	100.0
No sales	14	26.9	Grass can be made silage without drying		
Neighbors / market	5	9.6	Yes	21	40.4
TOTAL	52	100.0	No	31	59.6
Observing animals for diseases			TOTAL	52	100.0
Yearly	27	51.9	Roughage concentrate feed ratio applied		
Seasonal	23	44.2	Never	36	69.2
Never	2	3.8	1/2 - 1/2	8	15.4
TOTAL	52	100.0	1/3 - 2/3	1	1.9
Type of barn	N	%	1/4 - 3/4	2	3.8
Concrete	38	71.1			

Wooden	14	26.9	2/3 – 1/3	5	9.6
TOTAL	52	100.0	TOTAL	52	100.0
Criteria of slaughtering time			Considering protein content of feeds		
Live weight	25	48.1	Never heart of it	41	78.8
Market price	3	5.8	No	11	21.2
Age of animal	24	46.2	TOTAL	52	100.0
TOTAL	52	100.0	Considering metabolic energy of feeds		
Source of information about diseases			Newer hearth of it	41	78.8
Extension service	4	7.7	No	11	21.1
Private veterinarians	48	92.3	TOTAL	52	100.0
TOTOAL	52	100.0			

Average small holder cattle farmer in the region owns 4.77 hybrid breeds, 1.21 native breeds, and 0.35 improved breeds. Selected farming practices applied by small holder cattle owners in the region are presented in Table 3. From the table 94.2% of the respondents provided their cattle by their own production, 57.7% provided dry grass from their own production, 69.2% provided concentrated feeds by purchasing from the market. Almost two-third of the respondents sold their cattle to butchers or for ritual slaughter every year. More than half of the respondents yearly observed their cattle for diseases and other problems, almost half of the respondents considered live weight of the animals as a criteria when decided selling time, 92.3% used private veterinarians as information source about animal diseases, more than three-third reported that meadows were grazed properly, almost all respondent used manure in their own land, 84.6% experienced a decrease in their cattle size. Almost two-third of the respondents could properly dried 80% or less of their grass, 40.4% believed that grass can be turned in silage without drying, 69.9% didn't consider roughage to concentrated feed ratio in feeding their animals, 78.8% never heart of protein content of the feeds while the same percent of the respondents never heart of metabolic energy content of feeds.

Research finding of this study showed that 84.6 percent of farmers reported that their number of cattle decreased (Table 3). Reasons for this decrease was investigated in a five point Likert scale from 1 = Not important at all, 2 = Not important, 3 = Neutral, 4 = Important, 5 = Very important. An interpretive scale considering the means was developed. According to this scale means were evaluated as 0.00-1.46 = Not important at all, 1.50-2.49 = Not important, 2.50-3.49 = Neutral, 3.50-4.49 = Important, and 4.50-5.00 = Very

important. Considering this interpretive scale, the only item in the important category was lack of family members dealing with animals (Table 4). This was because young people in the region want to change occupation other than farming.

Providing roughage feeds is one of the most important problems in the area because of climatic conditions. Farmers were asked what kind of problems they encountered during providing their roughage feeds in a five point Likert scale and results are presented in Table 5. Considering the above interpretive scale drying of roughage feeds was the only item in the very important category. Harvesting, transportation, temporary storage in the field were in the important category. This finding verifies that providing roughage feed from own land is quite difficult in the region.

Findings of this study showed that majority of farmers in the research area had no information about grass silage (Table 6). When the question “what can grass silage provide for you?” was asked on a five point Likert scale, respondents remained neutral in four of the five items and disagreed with the item “livestock would be better occupation”. This finding showed that farmers lack information about grass silage and they need to be informed. They don’t believe that grass silage will make livestock a better livelihood in the region.

Table 4. Reasons for decreasing cattle size

Awareness of grass silage	n	Mean	Standard deviation
Lack of family members dealing with animals	52	3.60	1.963
Feed prices high	52	3.23	1.967
Low income	52	3.19	2.010
Lack of governmental support	52	3.06	1.984
Lack of capital to purchase live animals	52	2.75	1.714
Illegal animal entries	52	2.42	1.913
Low meat prices	52	2.19	1.663
Lack of pasture and meadows	52	2.12	1.700
Low milk prices	52	1.71	1.446

Table 5. Problems encountered with roughage feeds

Problems encountered with roughage feeds	n	Mean	Standard deviation
Drying	52	4.62	0.599
Harvesting	52	4.08	1.186
Transportation	52	3.88	1.199
Temporary Storage in the field	52	3.87	1.299
Storage in the farm building	52	3.08	1.480

Table 6. Farmers' awareness of grass silage

Awareness of grass silage	n	%
I have never hearth about this practice	32	61.5
I have hearth it but have not enough information to apply it	10	19.8
I have heart it but my farm conditions do not provide adequate possibilities to practice it.	8	15.4
I have hearth it but I do not believe that it will be useful	2	3.8
TOTAL	52	100.0

Table 7. What grass silage can provide for farmers

What grass silage can provide	N	Mean	Standard deviation
Drying problem will disappear	52	2.90	2.070
It will provide more nutritious feeding	52	2.65	1.877
Reduces feed wastes	52	2.60	1.871
Labor save	52	2.50	1.863
Livestock would be better occupation	52	2.42	1.851

4. Conclusion

This study investigated the adoption and diffusion possibilities of grass silage among small holder cattle farmers in Trabzon province of Turkey. A socioeconomic profile of small holder cattle farmer in the region is an old man, elementary school graduate, has no membership in cooperatives, participated in village administration, own approximately 5 decares of land, had social security, doesn't use credit and bank loans, owns a yearly income about 20 thousand liras, doesn't have a tractor and has farming experience of more than 30 years. In terms of communication behavior he read newspaper mostly in tea-house of the village, doesn't listen radio too much but watch television every day. Although he is aware of the Internet he doesn't use it. He has regular travels to district and province centers but doesn't meet with extension personnel. Although he sometimes seeks farming advice from different people he doesn't participate in in farming events.

Farming in the region mostly carried out by conventional practices. Farmers are mostly older people and they have no option to switch profession. They must try to earn income as much as they can with their limited opportunities. Within the present farming system providing roughage feeds is quite problematic due to rainy season. It is also very much labor intensive. Grass silage will probably make it possible for farmers to produce cheaper and healthier feed for livestock. This may increase the profit margins and attract younger farmers to stay in their villages.

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