Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 14, Issue 2, 2014
PRINT ISSN 2284-7995, E-ISSN 2285-3952

ANALYSIS OF THE FACTORS AFFECTING EFFECTIVENESS OF RANGELAND-DEPENDENT DAIRY CATTLE FARMS IN ERZURUM PROVINCE

Abdurrahman KARA[1], Semiha KIZILOĞLU[2]

[1] Dicle University, 21280 Sur District Diyarbakır, Turkey, Phone: +904122488509, Internal: 8563, Fax: + 904122488153, Email: abdurrahman_kara@hotmail.com
[2]Ataturk University, 21280, Yakutiye District, Erzurum, Turkey, Phone: +904422312584, Fax: +904422312678, Email: ksemiha@atauni.edu.tr

Corresponding author: abdurrahman_kara@hotmail.com

Abstract

With a special emphasis on the rangeland condition, factors affecting effectiveness of the farms were researched in this study. Study area covers Erzurum Province, Turkey. Villages were purposively selected from those of which rangeland conditions had been studied previously. Stratified sampling method was employed in determination of the sample size. Data were collected from the randomly selected farmers through face to face interviews, resulted in 99 completed questionnaires. Collected data by structured questionnaires were of 2004-2005 production year. Farms were studied under three farm size groups of 0-12, 12,1-25 and 25+ ha. In analysis of the data stepwise regression and multiple linear and log-linear regression models were used. As farm success criteria, net product and gross margin were calculated for every studied farm. According to the results, rangeland condition, stable type, number of cattle, size of cultivated land, amount of labour per farm and small ruminant flock existence in the village and number of small ruminant were found to be the most important factors affecting farm effectiveness. It was concluded that more robust and long-term studies should be conducted using a wider variation in rangeland condition to confirm the study findings.

***Key words*:** *dairy cattle farms, Eastern Anatolia, Erzurum, farm effectiveness, rangeland condition, Turkey*

INTRODUCTION

Composed of a wide variety of plant species, natural vegetations, pastures and meadows, are the most important biological sources of wealth for the nations. With their ecological functions, they preserve the soil and water while producing feed for a considerable part of animal kingdom [1].
So, rangeland biodiversity contributes to a number of commercially immeasurable outcomes such as ecosystem functions like elasticity to environmental disorders, soil and water quality and rural tourism [17].
Eastern Anatolia region of Turkey comes first among the other 6 regions with 57% and 36% of the total natural meadow and pasture assets respectively (Table 1).
Hence, rangeland dependent extensive animal production has been a way of life for rural populations in this part of country for centuries.
This region encompasses the easternmost provinces of Turkey. It has the highest average altitude of all other regions and consequently, it has a more severe climate but greater precipitation than the Anatolian plateau. Climate limits the production pattern.
Main crops are cool season cereals, forage crops, sugar beet, potato and sunflower.
Cereals and forages are the dominant crops of the farming system.
Due to the rugged nature of the geography, arable land is limited.
Only 19% of the total land is arable and mostly allocated to cereals. Acreage of other crops is limited [26].
However, economy is based on agriculture which keeps its traditional ways of production. Mainly low yielding local crop varieties are used and farmers are generally unaware of suggested new agronomic techniques [20]. Animal sheds are mostly primitive, unhygienic constructions without sufficient ventilation and illumination [9],[19].
Farm animals have to be kept inside for 6 months during very long and harsh winter.

Table 1. Natural rangeland and meadow asset in the study area, Eastern Anatolia and Turkey

Geographic Unit	Meadow			Rangeland		
	Amount (ha)	Share in the Region (%)	Share in Turkey (%)	Amount (ha)	Share in the Region (%)	Share in Turkey (%)
Erzurum	9.732,9	11,8	6,7	135.113,8	28,3	10,3
Eastern Anatolia	82.776,6	100,0	57,1	476.839,4	100,0	36,2
Turkey	144.931,3		100,0	1.316.737,5		100,0

Source: [36]

Large ruminant population of the region is made of indigenous cattle breeds and their crosses which are hardy to local environmental conditions and utilize the regional grazing lands more efficiently. Small ruminant population, on the other hand, is composed of local sheep and goat breeds.

Up to now, regarding the studies related to rangelands mostly vegetation studies have been conducted but the relationship between animal production and rangeland attributes have not been touched and investigated adequately. In recent years, natural rangeland improvement studies have gained importance in Turkey. For their sustainability and expansion their importance and future benefits should be touched in various aspects. So, in this paper were investigated the rangeland condition and other socioeconomic factors possibly affecting the farm effectiveness in the rangeland dependent dairy cattle farms to provide information for regional agricultural development studies.

MATERIALS AND METHODS

Study material was collected with questionnaires from the randomly selected farms. Also, records of the public organizations were used as secondary material.

Study villages were purposively selected to make sure rangeland condition data were known. Sample size was calculated with stratified sampling method [7] at 90% confidence interval with a standard error of 10% of population mean. Strata were determined as 1-12 ha, 12.1-25 ha and 25.1 ha and higher. Data collected through face to face farmer interviews were of 2004-2005 production year and all of 99 questionnaires were evaluated. Rangeland conditions of the villages were determined previously according to Resource and Environmental Data Interpretation System (REDIS) [11], using Integrated System for Plant Dynamics (ISPD) software package [4]. Village rangeland conditions varied between 30.8% and 52.1% (Table 2).

Table 2. Distribution of the villages by their rangeland condition values

No	Name of the Village	Rangeland Condition (%)	Rangeland Condition Groups
1.	Yayladağ	30,8	1
2.	Pekecik	36,0	
3.	Taşağıl	36,7	
4.	Demirdöven	39,2	2
5.	Gerek	45,1	
6.	İncedere	45,5	
7.	Yeniköy	48,4	3
8.	Tipili	49,4	
9.	Şehitler	52,1	

Household labour supply was calculated in adult male equivalent and farm family labour force was calculated in family labour workdays [10]. Ten hours of daily work was assumed [16],[22]. Prices stated by respondents were considered in evaluation of the farm products in economic analysis of the farms. Average wages paid to off-farm labour were taken into account in valuing the wages of household labour. In dairy cattle and sheep production, production unit (PU) was considered and one PU was calculated according to the data collected from the farms [10]. One PU comprises 1 head cow, 0.95 head calf, 0.80 head yearling and 0.77 head two yearling (of which 0.20 head to be preserved and 0.57 head to be sold). In sheep production 1 PU calculated to be 1 head sheep, 0.05 head ram, 1 head lamb, 0.12 head female yearling and 0.02 head male yearling in the light of primary and secondary data [2].

In depreciation of the farm assets the rates reported by [15],[16],[21] and [24] were

employed. Factors determining the effectiveness and success of the farms are classified as size, productivity and financial or economic indicators [23]. In this study, economic (financial) indicators were considered, and so, net product and gross margin were calculated for each farm. Moreover, amount of cultivated land, labour, number of cattle and sheep as scale indicators were given place as variables in the models. Also, animal breed and stable type, which are effective on productivity, education level and age of farmer, which are effective on farm effectiveness [3],[22],[26],[27],[33] were the variables included in the models.

The differences among the farm enterprises were investigated with multiple linear regression models using Ordinary Least Squares approach [8],[13] Categorical variables were represented with dummy variables [28],[32]. Accordingly, net product and gross margin are thought to be separate functions of the following continuous and discrete variables.

$$Y = \alpha+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+ \beta_7X_7+\beta_8X_8+\beta_9X_9+\alpha_2D_2+\alpha_3D_3+\alpha_4D_4+\alpha_5D_5+ \alpha_6D_6+\alpha_7D_7+\alpha_8D_8+\alpha_9D_9+ \alpha_{10}D_{10}+ \alpha_{11}D_{11} \quad (1)$$

Where:

Y	(NetProduct/ GrossMargin)	: Net Product or Gross Margin (TRY)
X_1	(RangeCond)	: Rangeland Condition (%)
X_2	(NoofCattle)	: Number of Cattle (PU)
X_3	(NoofSheep)	: Number of Sheep (PU)
X_4	(FLabour)	: Family Labour (AME)
X_5	(TCultLand)	: Total Cultivated Land (ha)
X_6	(ForAcreage)	: Forage Acreage (ha)
X_7	(AgeofFarmer)	: Age of Farmer (year)
X_8	(DtoRangeland)	: Distance to Rangeland (m)
X_9	(StockingRate)	: Stocking Rate in the Village Rangelands ($AU.ha^{-1}$)
D_i	(CattleBreed)	: Cattle Breed (local/cross/purebred)
D_2	(Crossbred)	: Crossbred (1=crossbred, 0=others)
D_3	(Purebred)	: Purebred (1=purebred, 0=others)
D_4	(WaterSpot)	: Water Spot in Rangeland site (1= near, 0=far)
D_5	(RotGrazing)	: Rotational Grazing (1=yes, 0=no)
D_6	(Supplement)	: Feed Supplement in Grazing Season (1=yes, 0=no)
D_7	(SRexistence)	: Small Ruminant Flock Existence in the Village (1=exist, 0=not)
D_k	(EducLevel)	: Education Level of the Farmer (illiterate, literate, primary, higher)
D_8	(Literate)	: Literate (1=literate, 0=others)
D_9	(Primary)	: Primary (1=primary, 0=others)
D_{10}	(Higher)	: Higher (1=higher, 0=others)
D_{11}	(CattleShed)	: Type of Cattle Shed (1=concrete, 0=traditional)
e		: Error term

In obtaining the regression models, the most explanatory variables were determined with stepwise regression technique. F test was employed to test the significance of models as a whole. Normality of the dependent variables was controlled with Skewness and Curtosis test as heterokedasticity was tested with Breusch-Pagan test. Moreover, multicollinearity was checked with variance inflation factor (VIF) [5],[13],[28]. In statistical analysis STATA 10.0 software package was used.

According to Skewness-Curtosis test distribution of Gross margin is not normal as normality assumption was met for net product (Table 3).

Table 3. Skewness/Kurtosis tests for normality diagnostics for the dependent variables

Variable	Pr(Skewness)	Pr(Kurtosis)	adj chi2(2)	Prob>chi2
NetProduct	0.344	0.144	3.11	0.2115
GrossMargin	0.000	0.050	17.71	0.0001
Log-GrossMargin	0.166	0.538	2.36	0.3069

Table 4. Multicollinearity diagnostics for net product model

Multicollinearity Diagnostic		
Variable	VIF	1/VIF
NoofCattle	1.30	0.767416
RangeCond	1.27	0.785697
TCultLand	1.25	0.800117
SRexistence	1.19	0.837189
FLabour	1.18	0.848272
CattleShed	1.13	0.882987
Mean VIF	1.22	

Table 5. Heteroskedasticity diagnostic for net product model

Heterokedasticity Diagnostic
Breusch-Pagan/Cook-Weisberg test for Heterokedasticity
Ho: Constant variance
Variables: Fitted values of Milkyield
Chi2(1) = 1.43
Prob > chi2 = 0.2321

In order to cure non-normality of gross margin log-linear transformation procedure was applied using natural logarithm.
As seen from Table 4, 5, 6 and 7, VIF and Breusch-Pagan tests proved that net product and log-linear gross-margin models do not have multicollinearity and heterokedasticity problems [5],[13],[28].

Table 6. Multicollinearity and heteroskedasticity diagnostics for log-linear gross margin model

Multicollinearity Diagnostic		
Variable	VIF	1/VIF
RangeCond	1.16	0.8646
NoofCattle	1.14	0.8745
NoofSheep	1.09	0.9214
CattleShed	1.07	0.9338
Mean VIF	1.11	

Table 7. Multicollinearity and heteroskedasticity diagnostics for log-linear gross margin model

Heterokedasticity Diagnostic
Breusch-Pagan/Cook-Weisberg test for Heterokedasticity
Ho: Constant variance
Variables: Fitted values of Milkyield
Chi2(1) = 0.280
Prob > chi2 = 0.598

RESULTS AND DISCUSSIONS

Gross margin and net product were given by farm size groups (strata) in Table 8. In all groups, net product is positive but is the highest in second group and the lowest in the first group of farms. On the other hand, gross margin was increased parallel to the farm size groups.

Table 8. Success and effectiveness criteria for the farms studied (TRY.farm^{-1}).

Farm Success Criteria	Farm Size (ha)			Average Mean
	1-12	12,1-25	25,1+	
Net Product	2.508,5	5.073,7	2.826,2	3.214,3
Gross Margin	12.010,4	16.508,3	20.207,1	14.019,6

Considering the farm effectiveness per unit cultivated land, both of the success criteria decreased by farm size groups. It suggests that small farms are the most successful compared to the larger ones (Table 9).

Table 9. Success and effectiveness criteria per hectare of farm land (TRY.ha^{-1})

Farm Success Criteria	Farm Size (ha)			Average Mean
	1-12	12,1-25	25,1+	
Net Product	667,9	624,6	130,4	478,8
Gross Margin	3.197,7	2.032,3	932,5	2.088,4

Of the 16 variables investigated for the multiple regression models given and explained above, according to the stepwise regression analysis 6 variables were placed in the net product model as 4 variables entered into the gross margin model. The findings for the net product and gross margin models were given in Table 10 and 11 respectively.

Table 10. Regression analysis results for the factors effective on gross margin

Source	**SS**	**df**	**MS**	**Number of obs**	**= 99**	
Model	16.2487	4	4.0622	F(4, 94)	= 14.15	
Residual	26.9843	94	0.2871	Prob > F	= 0.0000	
Total	43.2330	98	0.4412	R squared	= 0.3758	
				Adj.R.squared	= 0.3493	
				Root MSE	= 0.53579	
Loggmargin	Coef.	Std. Err	T	P>|t|	[95% conf.	Interval]
RangeCond	0.1157	0.0663	1.75	0.084	-0.0159	0.2472
NoofCattle	0.1288	0.0252	5.11	0.000	0.0787	0.1789
NoofSheep	0.0102	0.0047	2.18	0.032	0.0009	0.0194
CattleShed	0.3216	0.1237	2.60	0.011	0.0760	0.5673
Constant	8.4992	0.1546	54.99	0.000	8.1923	8.8061

Despite of higher t and F values normal and adjusted R^2 values fall between 27.5 and 34.9 in the models. The reason for this is the cross sectional data used in the study and their nature of higher variation [39]. However, low R^2 does not so much matter and it can be claimed that the coefficients of factors in the models were estimated quite accurately since the aim is to estimate the effect of the factors on the farm income instead of estimating the farm income itself [14].

According to the results given above, rangeland quality, cattle shed type and number of cattle (in production unit) entered both models. Total cultivated land, labour force and small ruminant existence in village were only represented in net product model as number of small ruminants (in production unit) was only found place in log-linear gross margin model (Table 8 and 9).

The models suggest that rangeland condition, number of cattle and type of cattle shed are the most important factors affecting farm success and effectiveness since they entered both models. The importance of rangeland condition in farm effectiveness can clearly be seen from Fig. 1.

Table 11. Regression analysis results for the factors effective on net product

Source	SS	df	MS	Number of obs	= 99	
Model	3.1173e+09	6	519546346	F(6, 92)	= 7.20	
Residual	6.6426e+09	92	72202336	Prob > F	= 0.0000	
Total	9.7599e+09	98	99590744	R squared	= 0.3194	
				Adj.R.squared	= 0.2750	
				Root MSE	= 8497.2	
Netproduct	Coef.	Std. Err	t	P>|t|	[95% conf.	Interval]
RangeCond	2343.9770	1102.2570	2.13	0.036	154.7993	4533.1540
NoofCattle	877.7842	426.9417	2.06	0.043	29.8413	1725.7270
TCultLand	-31.4931	13.1008	-2.40	0.018	-57.5123	-5.4739
FLabour	-604.8077	372.1199	-1.63	0.108	-1343.8700	134.2544
CattleShed	6265.1900	2017.9380	3.10	0.003	2257.3910	10272.9900
SRexistence	-3560.6230	1871.391	-1.90	0.060	-7277.3670	156.1209
Constant	1054.7450	3683.111	0.29	0.775	-6260.2320	8369.7220

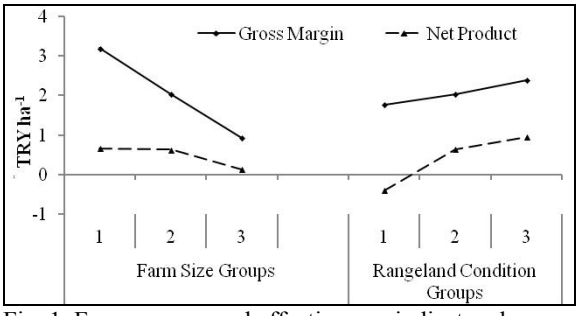

Fig. 1. Farm success and effectiveness indicators by farm size and rangeland condition groups

When mentioned about the trampling damage of the grazing animals to rangelands it is reported that 10-15% of the feed produced by the pastures could be lost due to trampling and trampling damage varied by the type of grazing animals [25], cited in [12]. For example, it was reported that sheep grazed 33% and trampled 27% as cattle grazed 50% and trampled 13% on the same vegetation.

However, negative effects of the grazing are much more obvious in the villages where small ruminant flocks exist since cattle are more disadvantageous than sheep when grazing together under heavy grazing conditions [12] and rangelands have been subject to misuse and exploitation in an opportunistic manner in the region as is the case throughout the country [37].

In proving this, the dummy variable *"existence of small ruminant flock in the village"* entered to the net product model which is significant at 90% confidence level (Table 9). As stated above, this result suggests that rangelands are damaged more in the villages where small ruminants exist due to higher trampling damage. Another reason for this is that small ruminants can better utilize the rangelands with their special mouth structure than large ruminants [6]. Of course, this result should not be interpreted as the necessity of abandonment from small ruminant production because this result may arise from disorganized and haphazard grazing. As a matter of fact, mix grazing, grazing with two or more kind of animals, is suggested for better utilization of the rangelands [12],[29],[30], since pasture plants preferred by different kind of animals vary. So, small ruminant existence in the villages is necessary for better utilization of the pastures. Trampling damage could be minimized through grazing fitting well to carrying capacities of the pastures.

Like rangeland condition, stable type found place in both regression models. This implies that it is one of the most important factors affecting farm effectiveness since physiological characteristics of dairy cattle are negatively affected under insufficient ventilation conditions [34]. In order to increase the performance of the farm animals, housing conditions should meet the most basic behavioural and physiological requirements [18],[30],[31]. It is obvious that farms with concrete stables have superiority to the others regarding the effectiveness indicators although concrete stables are not fully equipped to fulfil the animal welfare issues as well. This implies million TRYs of economic losses each year due to unfavourable animal housing conditions (Table 11).

Arising public sense and EU legislation on animal welfare in case of a possible membership will bring important limitations. Rehabilitation of animal housing conditions is of great importance in increasing animal production oriented farm income and achieving the higher animal welfare standards in the region.

Since animal production has an important share in total farm income in the region number of cattle per farm entered to each model. Considering the gross margin model in Table 10, one PU of increment in number of cattle will result in an increase in average gross margin per farm by 13.8%[1] as this increment is 877.8 TRY for net product model (Table 11).

Total cultivated land placed in net product model and appeared to be the factor affecting farm effectiveness negatively. A similar finding was also reported by [38] for the Polish private farm enterprises. The size of the cultivated land is a size indicator used in analysis of the farm enterprises and in making comparisons with other farms [23]. Contrary to the expectations, the reason for this effect of the total cultivated land can be explained with over fragmentation of the farm land which increases with farm size in this study. Another reason bears in mind that bigger farms are not managed well. Because it is naturally expected that unit costs will decrease due to the higher effectiveness of the production factors with increases in farm size resulting in higher profitability compared to the smaller farms.

Labour force, on the other hand, was determined to be another factor having negative effect on farm effectiveness in net product model. A similar finding was also reported by [35] as well. The reason for this negative effect can be explained with the higher idle labour in the farms (82%) determined in present study and the managerial failure in the bigger farms.

CONCLUSIONS

Eastern Anatolia region is suitable for extensive animal production due to its vast natural rangeland and meadow asset. Study results revealed that rangeland and housing conditions had significant effects on farm income. This suggests the necessity of rangeland improvement studies and supportive measures for animal production with a special emphasis on housing conditions in order to better utilize the natural resources of the region. However, it should be remembered that this study is the first example investigating the relationship between rangeland condition and farm effectiveness in the region. Yet, a narrow range of rangeland condition data (%30.8-52.1) was used in present study. For that reason, the magnitude of the effect of rangeland condition on farm income may be much more than the findings of the present study. So, repetition with a dataset for about three production year in the villages carefully selected according to rangeland condition classes will be of beneficial.

[1] In interpreting the coefficients of log-linear models, we should consider that each one unit increase in X multiplies the expected value of Y by e^{β}. So, the coefficient of variable *number of cattle* (β) (0.1288 in Table 10) means that one unit increase in number of cattle brings about 13.8% (= $e^{0.1288} - 0.13748$) more gross margin.

ACKNOWLEDGMENTS

We would like to express our gratitude and extend our thankfulness to the *Rangeland Team of Eastern Anatolia Agricultural Research Institute* who carried out vegetation surveys and determined rangeland conditions of the study villages previously.

REFERENCES

[1] Altın, M.A., Gökkuş, A., Koç, A, 2005, Pasture and Meadow Improvement. General Directorate of Agricultural Production and Development, Ministry of Agriculture and Rural Affairs. Ankara, Turkey, 466 p.
[2] Anonymous, 2009, Small Ruminants On-Farm Breeding Scheme: Morkaraman Sheep 2008 Development Report. Eastern Anatolia Agricultural Research Institute, Erzurum, Turkey.
[3] Ansaloni, F, 1995, Success factors for dairy farming in the North Italy, Proceedings of the 10th International Farm Management Congress, 10-16th July, Reading, UK. pp.307-317.
[4] Bosch, O.J.H., Gauch, H.R., Boysen, J., Stols, S.H.E., Gouws, G.A., Nel, M.W., Van Zyl, E, 1992, ISPD, An Integrated System for Plant Dynamics (Computer Software Package and Users Guide). Department of Plant and Soil Sciences, Potchefstroom University for Christian Higher Education, Potchefstroom, South Africa. 101 p.
[5] Callaghan, K. J., Chen, J., 2008, Revisiting the Collinear Data Problem: An Assessment of Estimator 'III-Conditioning' in Linear Regression. Practical Assessment Research & Evaluation, 13 (5):1-5.
[6] Çakır, A., Aksoy, A., Haşimoğlu, S., 1995, Animal feeding operations. Erzurum: Atatürk University Press. No: 179, Erzurum, Turkey, 413 p.
[7] Çiçek, A., Erkan, O., 1996, Research Sample and Sampling Methods in Agricultural Economics, Gaziosmanpaşa University Faculty of Agriculture Publications:12, Tokat, Turkey, 118 p.
[8] Düzgüneş, O., Kesici, T., Kavuncu, O., Gürbüz, F., 1987, Research and Experimental Methods (Statistical Methods-II), Ankara University Faculty of Agriculture Publications: 1021, Textbook: 295, Ankara, Turkey, 381 p.
[9]Emsen, H., 1997, Principles of Animal Husbandry (Third Edition), Ataturk University Publications No.720, Faculty of Agriculture Publications No: 310, Textbook Serials No: 62, Ataturk University Faculty of Agriculture Press, Erzurum, Turkey, 231 p.
[10]Erkuş, A., Demirci, R., 1996, Agricultural Enterprises and Business Planning. Ankara University Publications: 1435, Faculty of Agriculture Textbooks: 417, Ankara, Turkey, 120 p.
[11] Gibson, R. S., Allen, W.J., Bosch, O.J.H,, 1995, Condition assessment concepts and their role in facilitating sustainable range management. In: Annals of Arid Zone, 34 (3): 179-189.
[12] Gökkuş, A., Koç, A., 2001, Range and Pasture Management, Atatürk University Faculty of Agriculture Publications No:228, Erzurum, Turkey, 329 p.
[13] Gujarati, D. N., 1995, Basic Econometrics (Third Edition). McGraw-Hill, New York, USA, 838 p.
[14] Gujarati, D. N., 2011, Econometrics By Example, McGraw-Hill, USA.
[15] Gülten, Ş., 1975, Valuation, Ataturk University Publications No:425, Faculty of Agriculture Publications: 202, Textbook No: 29, Baylan Press, Ankara, Turkey, 144 p.
[16] Hatunoğlu, T., 1973, Economic Analysis of the Sugarbeet Growing Farm Enterprises Operating in Upper Pasinler Plain Using Linear Programming Method. Ataturk University Publications No: 302, Faculty of Agriculture Publications: 147, Research Series No: 84, Sevinç Press, Ankara, Turkey, 98 p.
[17]Hopkins, A., Holz, B., 2006, Rangeland for agriculture and nature conservation: production, quality and multi-functionality. Agronomy Research, 4 (1): 3-20.
[18]Hristov, S., Stankovic, B., Zlatanovic, Z., Todorovic, M.J., Davidovic, V., 2008, Rearing conditions, health and welfare of dairy cows. Biotechnology in Animal Husbandry, 24 (1-2): 25-35.
[19]Kara, A., 2000, Agricultural enterprises in Erzurum and Kars provinces: Capital structure and comparison of agricultural activity results. MSc thesis (Unpublished), Ataturk University Graduate School of Natural and Applied Sciences, Erzurum, Turkey.
[20] Kara, A., Kadıoğlu, S., Küçük, N., Günay, G., 2002, Determination of Farmer Problems and the Factors Limiting Agricultural Production in Farming Systems Dependent on Meadow, Pasture and Forage Crops in Erzurum, Kars, Ardahan and Ağrı provinces, Project Final Report, Project No: TAGEM/TA/98/11/01/002, Eastern Anatolia Agricultural Research Institute, Erzurum, Turkey.
[21] Karacan, A.R., 1975, Economic Analysis of the Farm Enterprises Operating in Elazığ Central District, Problems Related to Agricultural Credit Cooperatives and the Role of Agricultural Credit and Cooperatives in Community Development, Ataturk University Publications No: 372, Faculty of Agriculture Publications No: 176, Research Series No: 107, Sevinç Press, Ankara, Turkey, 188 p.
[22]Karagölge, C., 1973. Econometric Analysis of the Farm Enterprises in Erzurum According to Tenure Rights, Ataturk University Publications No: 312, Faculty of Agriculture Publications No: 153, Research Series No: 90, Sevinç Press, Ankara, Turkey, 112 p.
[23]Karagölge, C., 1996, Agribusiness, Ataturk University Publications No: 427, Faculty of Agriculture Publications No: 326, Textbook No: 107, Erzurum, Turkey, 127 p.
[24]Kızıloğlu, S., 1989, The Rotation-Farm Activity Relationship and Determination of Optimum Production Plan in Farm Enterprises of Oltu District, PhD thesis (Unpublished), Ataturk University Graduate School of Natural and Applied Sciences, Erzurum, Turkey.

[25]Laycook, W.A., Harniss, R.O., 1974, Trampling damage on native forb-grass ranges grazed by sheep and cattle, XII. International Grassland Congress Proceedings, Grassland Utilization-1, 11-20th June, Moscow, Russia, 349-354.

[26] Lionberger, H.F., 1960, Adoption of New Ideas and Practices. The Iowa State University Press, Ames, Iowa.

[27]Lockheed, M. E., Jamison, D.T., Lau, L.J., 1980, Farmer Education and Farm Efficiency: A Survey. In: T. King /Ed), Education and income: A background study for World Development Report, World Bank, Washington D.C, pp. 52-111.

[28] Neter, J., Wasserman, W., Kutner, M.H., 1989, Applied Linear Regression Models, Second Edition, Richard D Irwin, Boston, USA, 667 p.

[29] Nolan, T., 1982, Meat production in efficient grassland farming. Proceedings of the 9th General Meeting of the European Grassland Federation Occasional Sympozium No:14, British Grassland Society, 5-9 September, Reading, UK.

[30] Nolan, T., Connolly, J., 1989, Mixed *v.* mono-grazing by steers and sheep, Animal Production. 48 (3): 519-533.

[31]Özlütürk, A., Kopuzlu, S., Dursun, E., 2002, Improvement of Beef Production From Local Cattle (Eastern Anatolian Red Cattle) Through Beef Bulls (Charolais and Simmental), Project Final Report, Project No: TAGEM/HAYSÜD/98/09/05/010, Eastern Anatolia Agricultural Research Institute, Erzurum, Turkey.

[32] Park, H.M, 2009, Linear regression models for panel data using SAS, Stata, LIMDEP, and SPSS. Working Paper. The University Information Technology Services (UITS), Center for Statistical and Mathematical Computing, Indiana University, Available:
http://www.indiana.edu/~statmath/stat/all/panel

[33] Rogers, M.E., 1983, Diffusion of Innovations. The Free Press, New York, USA, 453 p.

[34] Sabuncuoglu, N., Akbulut, O., Çoban, O., Lacin, E., Yıldız, A., Sağsöz, Y., Ceylan, Z.G., 2007, Effect of barn ventilation on some physiologic and milk traits of dairy cows. Journal of Animal and Veterinary Advances 6 (2): 190-193.

[35]Topçu, Y., 2008, Analysis of Success Factors in Dairy Farms: Case Study of Erzurum Province, Journal of Faculty of Agriculture, Ondokuz Mayıs Universitesi, 23 (1): 17-24.

[36]TURKSTAT, 2010, General Agricultural Census, 2001. Prime Ministry Turkish Statistical Agency, www.tuik.gov.tr

[37] Unal, S., Karabudak, E., Ocal, M.B., Koç, A., 2011, Interpretations of vegetation changes of some villages rangelands in Çankırı province of Turkey, Turkish Journal of Field Crops, 16 (1): 39-47.

[38] Wasilewski, M., 2005, Effectiveness and financial condition of private farms in relation to agricultural land area, Electronic Journal of Polish Agricultural Universities (EJPAU), 8 (4), Available: http://www.ejpau.media.pl/volume8/issue4/art-83.html

[39]Yavuz, F., Dağdemir, V., Altunkaynak, A., 2002, An Econometric Analysis of the Factors Affecting Winter Food Storage in Erzurum Central District. Atatürk Üniversitesi Ziraat Fakültesi Dergisi, 33 (3): 323-330.