Journal of Animal and Veterinary Advances 11 (10): 1713-1718, 2012
ISSN: 1680-5593

Factors Influencing the Adoption of Selected Innovations by Sheep Farmers in the East Mediterranean Region of Turkey

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Abstract: Sheep production is one of the main agricultural activities for farmers in East Mediterranean region of Turkey. This research conducted to determine the socio-economic and communication behavior factors which are effective in adopting selected innovations and best management practices for sheep production. Face to face interview was conducted with 148 sheep farmers to collect data. More than half (51%) of the respondents were between 35-50 years of age. While 18% of respondents were illiterate, 61% had elementary school degree.

Key words: Sheep, innovation, communication, income, adoption, Turkey

INTRODUCTION

Turkish agriculture has been a major employer and contributor to GDP over the past years. In 2009, it represented 9.2% of GDP. One third of the agricultural activities relate to livestock farming, involving about 2.1 million enterprises and farms.

Turkey has favorable geographical and ecological conditions for livestock production. Sheep and goat production is predominantly undertaken in family holdings (Boz and Akbay, 2005). Sheep farming requires low capital and not much specialized machinery compared with most of the other agricultural production alternatives (Nix, 1988). Sheep farming is an alternative production activity in areas characterized by abundant semi mountains and mountainous pasture, sheep farm families with the surplus labor and by-products of cereals (Kitsopandis *et al*., 1980).

Historically, sheep farming has evolved very slowly and remained unaffected by external factors. In recent years however, there have been substantial changes in response to numerous external factors, e.g., globalization, common agricultural policy, animal health and welfare concerns and environmental protection (Morand-Fehr and Boyazoglu, 1999). Turkey has been one of the major sheep and goat producers of Europe, the West Asia and North Africa (WANA) region in the 20th century. Sheep and goats followed a declining trend since the early 1980s and are no longer the major meat and milk supplying species. One of the reasons for this decline is producers' attitudes towards innovation and adoption of new techniques (Gursoy, 2006). One of the main reasons for proven technologies not being adopted could be due to either unawareness or complexity of the technology. Unless, the recommended practices are fully adopted by the farming community, achieving beneficial results will be challenging (Manivannan *et al*., 2009).

Farmers' decision to adopt technological innovations is an issue extensively studied since the early 1950s. There have been significant amount of studies on adoption both in developing and developed countries. Rogers and Shoemaker (1971) defined adoption of innovation as a decision to apply an innovation and to continue to use it. Getahun *et al*. (2000) defined adoption as the degree of using a new technology in a long-term equilibrium when a farmer has all of the information about the new technology and it's potential.

In Turkey, the technology transfer to small scale farmers is carried out by the public agricultural extension services. However, these services are faced with problems which are also common in other developing countries. The sheep husbandry will always be the only alternative to generate income for the subsistence of the people in large areas where good agricultural land and water are scarce (Gursoy, 2006). The research area evaluated in this study has these characteristics. Thus, the aim of the study was to determine the factors influencing the level of adoption of innovations regarding to selected sheep farming practices in the Eastern mediterranean region of Turkey.

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MATERIALS AND METHODS

The study was based on farm-level data obtained face to face interviews with 148 sheep farming households in the East Mediterranean of Turkey. A two-stage sampling procedure was used to collect the data. At the first stage, four provinces and three administrative districts in each province were selected with the criteria of the sheep production intensity in the region. Then, three villages were selected from each administrative district. At the second stage, in order to determine the sample size the stratified random sampling method was used. The following formulas were applied (Yamane, 1967):

$$n = \frac{N\sum N_h S_h^2}{N^2 D^2 + \sum N_h S_h^2}; \quad D^2 = \frac{e^2}{t^2}$$

Where:

n = The sample size
N = The total number of sheep farms in the population
S^2_h = The variance of hth stratum
e^2 = The error size permitted from population mean
t^2 = The t value in the Student's t-distribution table
N_h = The number of sheep farms in the hth stratum

The sample size calculated with a 95% of confidence interval was 148 sheep farms. The sheep farmers selected were participated voluntarily in the survey. A comprehensive standardized questionnaire was conducted by researchers in order to obtain sheep farming practices and socio economic data between September to October, 2007 and January to June, 2008.

In measuring the overall adoption level of innovations, researchers considered the practices farmers actually employed. To find adoption level of each farmer, sampled farmers were categorized as adopters and non-adopters for each innovation. Then, the adoption score of individual farmer was determined by counting the number of practices adopted by farmer among the thirty three practices shown in Table 1. Based on the adaption score, farmers were classified into three categories as fallows; low adopters (0-11), moderate adopters (12-22) and high adopters (>22).

Table 1: Adoption level of sheep farming practices by farmers

	Applied		Not applied		Don't aware	
Practices	N	Percentage	N	Percentage	N	Percentage
Mating by categories	8	5.4	140	94.6	-	-
Mating in hand	22	14.9	126	85.1	-	-
Flushing	85	57.4	33	22.3	-	-
Trimming of the skins around the penis	85	57.4	33	22.3	30	20.3
Applying iodine to the navel disinfectation	24	16.2	92	62.2	32	21.6
Trimming wtih machine	2	1.4	146	98.6	-	-
Taking care of the sheep's breast	117	79.1	25	16.9	6	4.1
Taking care of the sheep's nail	112	75.7	26	17.6	-	-
Feeding with concentrate feeds	134	90.5	14	9.5	-	-
Barn hygiene	128	86.5	12	8.1	8	5.4
Using pulvarizator against the parasites	6	4.1	142	95.4	-	-
Knowledge about the toxic wild grasses around	93	62.8	55	37.2	4	2.7
To own forage feedboxes	93	62.8	55	37.2	-	-
To own combine feedboxes	4	2.7	144	97.3	-	-
To own concentrate feedboxes	49	33.1	99	66.9	-	-
To own divisions in the barn	59	39.9	89	60.1	-	-
To own feed warehouse	66	44.6	82	55.4	-	-
To own a milking place in the barn	13	8.8	135	91.2	-	-
To own a trimming place in the barn	10	6.8	138	93.2	-	-
To own an animal bath	34	23.0	114	77.0	-	-
To vaccinate against alum	111	75.0	10	6.8	25	16.9
To vaccinated against sheep smallpox	102	68.9	16	10.9	30	20.3
To vaccinated against ektima	19	12.8	98	66.2	31	21.0
To vaccinated against nail parasites	84	56.8	33	22.3	31	20.9
To vaccinated against abortion disease	48	32.4	62	41.9	38	25.7
To vaccinated against blue tongue disease	30	20.3	95	64.2	23	15.6
To vaccinated against poisoned intestine disease	93	62.8	39	26.4	16	10.9
To vaccinated against infectious liver disease	58	39.2	70	47.3	20	13.2
To vaccinated against anthrax	46	31.1	56	37.8	46	31.1
To vaccinated against infectious abortion disease	46	31.1	65	43.9	37	25.0
To vaccinated against epidemic milk-cutting disease	54	36.5	64	43.2	30	20.3
To vaccinated against blooded urine disease	45	30.4	80	54.1	23	15.6

The Ordered Probit Model is suited for a dependent variable which has categories in an ordinal nature. The Ordered Probit Model is built on the assumption that the level of adoption of innovations depends on some set of underlying explanatory variables that is:

$$y^* = \beta' x_i + \varepsilon_i,\ \varepsilon_i \sim N[0,1]$$

Where:

y^* = An unobserved level of adoption
x_i = A matrix of independent variables
β = A vector of parameters
ε = A vector of random error terms

The relationship between y^* and the observed variable y is the following:

$$y_i = \begin{cases} 0 & \text{if } y* \le 0 \\ 1 & \text{if } 0 < y* \le \mu_1 \\ 2 & \text{if } \mu_1 < y* \le \mu_2 \end{cases}$$

where, y_i is the observed level of adoption categories varies 0-2 (0 = low adopters, 1 = moderate adopters, 2 = high adopters). The μ_j are unknown thresholds parameters that estimated along with the other parameters in the model. The probabilities of a farmer's level of adaption in a specific category can be expressed as follows:

$$\begin{aligned} &\text{Prob}[y=0] = \Phi(-\beta' x), \\ &\text{Prob}[y=1] = \Phi(\mu_1 - \beta' x) - \Phi(-\beta' x), \\ &\text{Prob}[y=2] = \Phi(\mu_2 - \beta' x) - \Phi(\mu_1 - \beta' x) \end{aligned}$$

where, Φ (.) is the standardized cumulative distribution function. The parameters μ_j and β are estimated jointly. Based on these probabilities, the likelihood function can be written as:

$$L = \prod_{y=0} \Phi(-\beta' x) \prod_{y=1} [\Phi(\mu_1 - \beta' x) - \Phi(-\beta' x)] \prod_{y=2} [\Phi(\mu_2 - \beta' x) - \Phi(\mu_1 - \beta' x)]$$

Log form of the function is:

$$\ln L = \sum_{y=0} \log[\Phi(-\beta' x)] + \sum_{y=1} \log[\Phi(\mu_1 - \beta' x) - \Phi(-\beta' x)] + \sum_{y=2} \log[\Phi(\mu_2 - \beta' x) - \Phi(\mu_1 - \beta' x)]$$

Where:

Φ (.) = The standard normal cumulative distribution function
μ_j = The thresholds
β = The shift in the distribution as a function of independent variables

The marginal effects of the variables are calculated for each of the probabilities:

$$\partial \text{Prob}[\text{cell j}]/\partial x_i = \begin{bmatrix} f(\mu_{j-1} - \beta' x_i) - \\ f(\mu_i - \beta' x_i) \end{bmatrix} \times \beta$$

where, f (.) is the standard normal density. Studies on adoption behavior of farmers imply that the level of adoption of innovations influenced by a set of determinants related to farmer and household characteristics, economic factors, communication pattern and knowledge level about farm technologies (Randhir-Singh *et al*., 1996; Rezvanfar, 2007)

In this study, researchers focused on two set of potential determinants of the level of adoption; socio economic variables and communication pattern variables. Thus, to analyze the potential determinants two ordered probit models were constructed.

RESULTS

The aim of this study was to determine the factors influencing the level of adoption of innovations and best management practices in sheep farming. To reach this aim, first socioeconomic characteristics and communication behavior of sheep farmers were investigated, then the adoption levels of innovations and best management practices were determined.

The average age of farmers was 44.26 with a 10.69 standard deviation. More than half (51%) of the respondents were 35-50 years of age. While 18% of respondents were illiterate, 61% had elementary school degree. The 42% of respondents fell in the low income category while 49% mid-income category and 9% high income category. Only 25% of the respondents were the member of cooperatives and only 9% of them or their family members participated in the village administration. 34% of farmers made an investment in agriculture in the last 3 years; these investments were either buying a land or animal. The average farm size was 40.62 (SD = 191.15). The 29% of farmers did not own a farm land. The average number of animals per farm was 3.6 (SD = 17.1) culture and 82.39 (SD = 61.72) native.

To determine the levels of innovations and best management practices adoption among sheep farmers, 32 innovations/practices of sheep farming were identified and respondents were asked whether or not applied each of these innovations/practices (Table 1). Of the 32 items, feeding with concentrate feeds was applied by the highest percentage of farmers (90.5%). This was followed by barn hygiene (86.5%), taking care of sheep's breast (79.1%), taking care of the sheep's nail (75.7%) and vaccination against alum (75.0%).

Those who adopted <11 innovations were assigned to the low-level adoption category, those who adopted 12-20 innovations were assigned to the medium-level and those who adopted >20 innovations were assigned to the high level. Similar naturally ordered categories have been used in other studies (Boz and Akbay, 2005; Khattak *et al*., 1992; McLean-Meyinsse, 1997; Abdel-Aty, 2000). Data analyses showed that of 148 farmers, 49.2% were low level, 34.6% were medium level and 16.2% were high level adapters of innovations and best management practices.

The ordered probit procedure was used to determine the factors influencing the level of adoption of innovations and best management practices in sheep farming (Table 2). Seven socioeconomic independent variables were entered into the model and two were significant, experience ($p<0.10$) and income ($p<0.01$). While four variables had a positive signs, other three variables (cooperative membership, investment and land) had a negative signs (Table 3). The marginal efforts for significant socioeconomic variables can be interpreted as follows. Respondents' experience level increased

Table 2: Variable description and their relationship with the level of adoption

			Level of adoption (%)				
Variables	Definition and coding		Low	Moderate	High	χ^2-value	p-value
Socio economic variables							
Age	1	<35	51.7	34.5	13.8	2.040	0.728
	2	35-50	44.7	35.5	19.7	-	-
	3	>50	55.8	32.6	11.6	-	-
Edu	1	Illiterate	46.2	30.8	23.1	1.920	0.751
	2	Elementary	50.0	33.7	16.3	-	-
	3	Middle or higher	50.0	40.0	10.0	-	-
Income	1	Low	54.8	38.7	6.5	9.594	0.048
	2	Middle	45.8	33.3	20.8	-	-
	3	High	42.9	21.4	35.7	-	-
Co-Op	1	If member of the farmers' co-operate	44.7	42.1	13.2	1.380	0.501
	0	Otherwise	50.9	31.8	17.3	-	-
Invest	1	If invest in agriculture	45.1	41.2	13.7	1.598	0.450
	0	Otherwise	51.5	30.9	17.5	-	-
Land	1	No farmland	65.9	27.3	6.8	7.851	0.097
	2	<2.5 ha	42.5	37.5	20.0	-	-
	2	≥2.5 ha	41.7	37.5	20.8	-	-
Exper	1	If has 18+ years experience	54.2	34.7	11.1	2.923	0.232
	0	Otherwise	44.7	34.2	21.1	-	-
Variables related to communication behavior						-	-
Newspaper	1	If reads a newspaper at least ones a week	37.8	46.7	15.6	4.561	0.102
	0	Otherwise	50.4	29.1	16.5	-	-
Radio	1	If listens radio at least a couple times a week	48.4	31.2	20.3	1.522	0.476
	0	Otherwise	50.0	36.9	13.1	-	-
TV	1	If watches TV at least a couple times a week	47.0	37.1	15.9	3.954	0.138
	0	Otherwise	68.8	12.5	18.8	-	-
Internet	1	If uses internet at least several times a week	35.0	50.0	15.0	2.604	0.272
	0	Otherwise	51.0	32.0	16.4	-	-
Town	1	If goes to town at least ones a week	48.8	34.5	16.7	0.035	0.983
	0	Otherwise	50.0	34.4	15.6		
Ex_Worker	1	If visits to an extension worker at least ones a month	48.3	31.0	20.7	1.523	0.476
	0	Otherwise	50.0	36.7	13.3		
Veterinary	1	If connects with veterinary at least ones a month	62.9	14.3	22.9	8.363	0.015
	0	Otherwise	45.1	40.7	14.2	-	-

Table 3: Ordered probit estimates for the probability of innovation adoption by socioeconomic characteristics

				Estimated marginal probabilities		
Variables	Coefficient	SE	p-value	y_0 (low)	y_1 (moderate)	y_2 (High)
Constant	-1.65800***	0.54219	0.0022			
Age	0.00038	0.00920	0.9662	-0.0002	0.0001	0.0001
Experience	0.01356*	0.00778	0.0810	-0.0054	0.0026	0.0028
Edu	0.08207	0.28631	0.7744	-0.0327	0.0152	0.0175
Co-Op	-0.22730	0.28365	0.4229	0.0896	-0.0462	-0.0434
Invest	-0.02511	0.22347	0.9105	0.0100	-0.0048	-0.0052
Land	-0.00124	0.00577	0.8291	0.0005	-0.0002	-0.0003
Income	0.68480***	0.14670	0.0000	-0.2725	0.1305	0.1420
μ_1	1.07403***	0.13912	0.0000	-	-	-
Log likelihood	-126.24650	-	-	-	-	-
χ^2	26.15433***		0.0047	-	-	-
N	148	-	-	-	-	-

*, **, *** indicates significance at the 0.1, 0.05 and 0.01 level

Table 4: Ordered probit estimates for the probability of innovation adoption by communication behavior

				Estimated marginal probabilities		
Variables	Coefficient	SE	p-value	y_0 (low)	y_1 (moderate)	y_2 (high)
Constant	-0.37247*	0.24105	0.0859			
Newspaper	0.26736	0.22114	0.2267	-0.1063	0.0445	0.0618
Radio	-0.22200	0.22525	0.3243	0.0884	-0.0378	-0.0506
TV	0.33926	0.27636	0.2196	-0.1331	0.0661	0.0671
Internet	0.13850	0.37309	0.7105	-0.0552	0.0227	0.0325
Town	-0.00012	0.00093	0.8965	0.0000	0.0000	0.0000
Ex_Worker	-0.11979	0.23608	0.6119	0.0476	-0.0219	-0.0258
Veterinary	0.84059***	0.28441	0.0031	-0.3161	0.0718	0.2443
μ_1	10.03310***	0.13519	0.0000	-	-	-
Log likelihood	-1310.92060	-	-	-	-	-
χ^2	140.80608***		0.0038	-	-	-
N	148	-	-	-	-	-

*, **, *** indicates significance at the 0.1, 0.05 and 0.01 level

the likelihood of being a high and a medium level adopter by 0.28 and 0.26%, respectively while the likelihood of being a low level adopter decreased by 0.54%. The marginal effect for income shows that farmers with higher income had higher likelihood of being high level adopters and medium level adopters and 27.25% lower likelihoods of being low level adopters.

Seven independent variables were entered in the model and only one was significant ($p<0.01$) which is contacts with private veterinarians (Table 4). The marginal effects for significant communication behavior variable can be interpreted as follows. The marginal effects for visiting private veterinarians showed that farmers who had more visits had 24.43 and 7.18% higher and 31.61.0% lower likelihood of being high, medium and low level adopters, respectively.

DISCUSSION

As mentioned in the introduction of this study, Turkey has been a major sheep producer in the 20th century. The main reason for keeping sheep was the opportunity for cash incomes. However, the number of sheep has been declining, one of the reasons for this decline is the producers' attitudes toward innovation and best management practices. The result of this study indicate that sheep farmers in the research area are aware of innovations and best management practices however, the level of adoption is far from desired.

Experience of farmer is likely to have a range of influences on adoption. Experience will improve the farmer's skill at production. A more experienced farmer may have a lower level of uncertainty about the innovation's performance. Farmers with higher experience appear to have often full information and better knowledge and are able to evaluate the advantage of the technology considered (Mihiretu, 2008).

As confirmed by many studies, these farmers who have higher income level are likely to adapt improved agricultural technologies. It is also revealed in this study that there is a significant relationship between income and level of adoption. There is evidence that income may be a constraint for adoption.

Contact with private veterinary is found to have a significant positive effect on adoption. It is suggesting that farmers who are in contact with private veterinary have a greater likelihood of adopting innovation and best management practices. Farmers contact with private veterinarians mostly to receive information on animal care. The effectiveness of extension service is an important and mostly argued in Turkey. Unfortunately, this study has also shown that extension service has no impact on adoption of new technologies and best management practices in sheep farming.

Numerous studies showed that agricultural extension and educational programs have a positive effect on adoption of new techniques. Educational programs should be offered by agricultural extension service as free of charge for farmers in this research area in order to increase the rate of adoption of recommended practices.

CONCLUSION

Of 148 farmers, 49.2% had low level of adoption, 34.6% mid level of adoption and 16.2% had moderately high level of adoption. It was found that income level of farmers ($p<0.01$), experience in farming ($p<0.10$) and contacts with private veterinary ($p<0.01$) had an effect on adoption of selected innovations and best management practices.

ACKNOWLEDGEMENT

The current study is a part of a four section research project supported by the Turkish Scientific Research Council (in Turkish, TSRC-TUBITAK).

REFERENCES

Abdel-Aty, M.A., 2000. Using ordered probit modeling to study the effect of ATIS on transit ridership. Transport. Res. Part C: Emerg. Technol., 9: 265-277.

Boz, I. and C. Akbay, 2005. Factors influencing the adoption of maize in Kahramanmaras province of Turkey. Agric. Econ., 33: 431-440.

Getahun, H., W.B. O' Callaghan and T. Hartney, 2000. Experience with thickened red mud tailings (paste) tacking in tropical and temperate climates and applicability of the technology to other tailings. Proceedings of the 53rd Annual Conference of the Canadian Geotechnical Society, October 15-18, 2000, Montreal, Canada, pp: 683-690.

Gursoy, O., 2006. Economics and profitability of sheep and goat production in Turkey under new support regimes and market conditions. Small Rumin. Res., 62: 181-191.

Khattak, A., F. Koppelman and J.Schofer, 1992. Stated preferences for investigating computers diversion propensity. Proceedings of the 71st Annual Meeting of Transportation Research Board, January 1992, Washington, DC.

Kitsopandis, G. M, Martika and B, Monov, 1980. Economics of production and marketing of sheep farming. Aristotalian University of Thessalonic, Department of Agricultural Economics Research, Thessalaniki, Greece, pp: 3.

Manivannan, A., N. Narmatha and V. Uma, 2009. Adoption level of calf rearing practices. Tamilnadu J. Vet. Anim. Sci., 5: 77-79.

McLean-Meyinsse, P.E., 1997. Factors influencing early adoption of new food products in louisiana and Southern Texas. J. Food Distrib. Res., 28: 1-10.

Mihiretu, T.A., 2008. Farmer's evaluation and adoption of improved onion package in Fogera District, M.Sc. Thesis. South Gondar, Ethophia. Haramaya University.

Morand-Fehr, P. and J. Boyazoglu, 1999. Present state and future outlook of the small ruminant sector. Small Rumin. Res., 24: 175-188.

Nix, J., 1988. The Economics of Sheep Production. Br. Vet. J., 144: 246-248.

Randhir-Singh R, K.C. Tiagi and R. Singh, 1996. A study of communication behavior of dairy farmers. Indian J. Dairy Sci., 45: 405-408.

Rezvanfar, A., 2007. Communication and socio-personal factors influencing adoption of dairy farming technologies among livestock farmers. Livest. Res. Rural Dev., Vol. 19, No. 3.

Rogers, E. and F. Shoemaker, 1971. Communication of innovations: Cross culture approarch. 2nd Edn., New York, Pages: 476.

Yamane, T., 1967. Statistics and Introductory Anaysis. 2nd Edn., New York.