

# Demand of Livestock Manure for Improving Sustainability and Establishment of Its Market

Takeshi MARU

Laboratory of International Rural Development,  
Graduate School of Agriculture, Kyoto University  
Kitashirakawaiwake-cho, Sakyo-ku, Kyoto 606-8502, JAPAN  
e-mail: [marl@kais.kyoto-u.ac.jp](mailto:marl@kais.kyoto-u.ac.jp)

## 1. Introduction

The most serious problem of Turkish agriculture is a long run trend of decreasing soil fertility. This trend is especially severe in irrigated area. This is caused by strongly intensive use of land and decrease of area in fallow. In order to improve fertility, input of livestock manure into land is required nowadays. In other words, crop farming system and livestock production should be integrated effectively. Is there enough volume of manure that can support sustainable farming in Turkey?

First, we will check the number of livestock and situation of animal husbandry briefly, because number of animals is strongly related to possibilities of manure input. Second, supply and demand of livestock manure will be checked from the viewpoints of economics. Third, we will discuss what is the element that makes farmer input livestock manure. Finally, some conclusions and scenario of my research will be shown. In this report, the data that were collected in last year's village survey are used.

## 2. Animal Husbandry and Introduction of Irrigation

In Turkey, especially in Central Anatolia highland, animal grazing had been prosperous. But these 20 years, total size of fallow land has decreased. Since 1960s, irrigation has been introduced and mechanization and development/introduction of fertilizer/seed has

been done for many years. Especially, development/introduction of fertilizer/seed has an important meaning. Irrigation has been made wasteland into arable land. And after 1980s, development/introduction of fertilizer/seed accelerated the flow. As a result, total size of fallow land decreased. Furthermore, irrigation has changed the structure of crops. In irrigated area, farmers unanimously started to plant commercial crops that are more profitable than animal husbandry. Thus, number of livestock, especially sheep and goat<sup>1</sup>, decreased particularly in irrigated area. Table 1. shows that number of livestock. According to this, number of livestock has decreased actually.<sup>2</sup>

Table 1. Number of livestock

Year	Cattle			Sheep & Goat		
	1980	1990	2003	1980	1990	2003
Rain-fed area						
Total	54	140	181	1782	1417	1878
Ave.	3.00	5.00	5.17	77.48	59.04	78.25
H/H managed	18	28	35	23	24	24
Irrigated area						
Total	443	434	366	2975	1982	463
Ave.	13.42	12.40	9.63	185.94	152.46	115.75
H/H managed	33	35	38	16	13	4
Total	497	574	547	4757	3399	2341
Ave.	9.75	9.11	7.49	121.97	91.86	83.61
H/H managed	51	63	73	39	37	28

## 3. Classification of Demand and Supply of Livestock Manure and Establishment of Livestock Manure Market

In the former section, it becomes clear that number of livestock has decreased. This

<sup>1</sup> Contrary to cattle, sheep and goat needs grazing.

<sup>2</sup> From this table, it also become clear that number of sheep and goat in irrigated area was larger than that of rain-fed area and number of cattle in irrigated area is still larger than that of rain-fed area. This is because animal grazing was prosperous in Konya region, independently of irrigated area or rain-fed area.

decrease reduces supply of livestock manure. Table 2. shows the most optimum volume of livestock manure input and possibilities of its supply. These were calculated as follows.

(1) Desirable livestock manure input (DLMI):

this is the best volume farmers think for land improvement.

(2) Capable livestock manure input (CLMI): We

suppose one cattle defecates 50kg dung and sheep defecates 10kg dung per day, according to reference [5].

Firstly, we can find the fact number of H/H CLMI exceeds DLMI is larger than number of H/H DLMI exceeds CLMI in rain-fed area, and number of H/H DLMI exceeds CLMI is larger than number of H/H CLMI exceeds DLMI in irrigated area. This means that in irrigated area, irrigation and development/introduction of fertilizer/seed affected the choice of agricultural products and the decrease of pastureland and fallow land, and then number of livestock decreased. And so, especially in irrigated area, demand and supply of livestock manure become out of balance.

Table 2. Desirable and capable volume of livestock manure input

		Desirable	Capable	C≥D	C<D	C-D
Rain-fed area	Total(ton)	17.023	6.095	5.020	-15.948	-10.928
	per da	0.533	1.129	1.767	-1.459	0.846
	H/H	77	94	55	22	77
Irrigated area	Total(ton)	19.596	5.022	1.912	-16.487	-14.575
	per da	2.218	0.488	0.972	-2.365	-1.531
	H/H	64	90	16	48	64
Total	Total(ton)	36.619	11.116	6.932	-32.435	-25.503
	per da	1.298	0.816	1.588	-2.081	-0.233
	H/H	141	184	71	70	141

When it comes to light that demand and supply of livestock manure is out of balance in household level, how about that in village level, Table 3. shows DLMI and CLMI per da in each village. Except Karakaya, this village stands on mountainous area and in winter most villagers move to Konya city, DLMI exceeds CLMI in irrigated area villages and CLMI exceeds DLMI in rain-fed area villages. This means that even in village level, demand and supply of livestock manure is out of balance.

Table 3. Desirable and Capable livestock manure input per da

	Desirable input per da	Capable input per da
Kayışlı (IR, 25H/H)	1.10	0.83
Abdioğlu (IR, 24H/H)	0.48	0.06
Kılıçlı (RF, 25H/H)	0.20	0.70
Belören (RF, 26H/H)	0.23	1.00
Alemdar (IR, 25H/H)	2.12	0.68
Beylerce (IR, 16H/H)	5.00	0.81
Çeşmelisebil (RF, 21H/H)	0.10	0.85
Karakaya (RF, 24H/H)	4.23	0.39

Incidentally, when a farmer who doesn't have enough livestock manure to input into the land the farmer managed wants to do, what the farmer should do. If there's other farmer nearby the farmer and who had a lot of livestock manure, they may have transactions. Table 4. shows the result farmers purchased/sold from/to whom.<sup>3</sup> From this table, transactions in Adana are more frequent than those of Konya. Especially in Adana, tree crops, for example citrus, are planted in irrigated area and those need a lot of livestock manure continuously. But farmer who plants tree crops regularly doesn't have enough amounts of livestock. So farmers in this area want to have transactions more.

Table 4. Purchase and sell of livestock manure

		Cattle		Sheep & Goat		Chicken		Total	
		Purchase	Sell	Purchase	Sell	Purchase	Sell	Purchase	Sell
Kayışlı (IR.25H/H)	Trader		2					0	2
	Friend		1					0	1
	Other		1					0	1
	Total	0	4	0	0	0	0	0	4
	Trader							0	0
Abdioğlu (IR.24H/H)	Friend							0	0
	Other							0	0
	Total	0	0	0	0	0	0	0	0
	Trader							0	0
	Friend							0	0
Adana Kılıçlı (RF.25H/H)	Other							0	0
	Total	0	8	0	1	0	0	0	9
	Trader							0	0
	Friend	3	3					3	3
	Other		4					0	4
Adana Belören (RF.26H/H)	Total	3	7	0	0	0	0	3	7
	Trader							1	0
	Friend							0	0
	Other							0	0
	Total	0	0	0	0	1	0	0	0
Adana Alemdar (IR.25H/H)	Friend							0	0
	Other							0	0
	Total	0	0	0	0	1	0	1	0
	Trader							0	0
	Friend							0	0
Adana Beylerce (IR.16H/H)	Other							0	0
	Total	0	0	0	0	0	0	0	0
	Trader							0	0
	Friend	1	0	1	1			2	1
	Other		1					1	0
Konya Çeşmelisebil (RF.21H/H)	Total	2	0	1	1	0	0	3	1
	Trader							0	0
	Friend							0	0
	Other							0	0
	Total	0	0	0	0	0	0	0	0
Konya Karakaya (RF.22H/H)	Friend							0	0
	Other							0	0
	Total	0	0	0	0	0	0	0	0
	Trader	0	10	0	1	1	0	1	11
	Friend	4	4	1	1	0	0	5	5
Total	Other	1	5	0	0	0	0	1	5
	Total	5	19	1	2	1	0	7	21

<sup>3</sup> These transactions are done in same city-areas.

As Table 4. shows, farmers have trades to get livestock manure to input into their managed land. But according to Table 3., demand and supply of livestock manure doesn't poise even in village level. So, we must check whether farmers satisfy or not after having transactions. Table 5. shows the farmers' satisfaction. According to this table, more than half of farmers in both areas never satisfy about inputting livestock manure. Furthermore, most of farmers in irrigated area never satisfy. In addition, the ratio of farmers who don't input livestock manure is more than half and that of farmers who satisfy even without inputting livestock manure is nearly half in rain-fed area. From these results, it is clear that farmers in irrigated area tend to want to input more livestock manure than those in rain-fed area. This result can be explained by the change of structure of agricultural products in irrigated area. Irrigation and development/introduction of fertilizer/seed has brought about great changes in cropping system and farmers can plant tree crops and vegetables those need livestock manure for their quality. But on the other hand, tree crops and vegetables give farmers more profit than livestock, and pastureland and fallow land disappeared because of irrigation and development/introduction of fertilizer/seed. So in irrigated area, there came a great difference between demand and supply of livestock manure. In contrast, farmers in rain-fed area usually can't plant commercial crops, but new fertilizer/seed technology came to rain-fed area and so farmers started to use varieties that have much better response to chemical fertilizer. As a result, farmers in rain-fed area came to depend on chemical fertilizer heavily and the need for livestock manure decreased.

Table 5. Input and satisfaction of livestock manure input

		Input	No input	Total
Rain-fed area	Satisfied	9	20	29
	Not satisfied	22	24	46
	Total	31	44	75
Irrigated area	Satisfied	2	2	4
	Not satisfied	30	26	56
	Total	32	28	60
Total	Satisfied	11	22	33
	Not satisfied	52	50	102
	Total	63	72	135

It becomes clear that even in city areas farmers can't get enough livestock manure to input into their managed land. And then farmers try to have inter-city area transactions. But we must be careful not to forget the heaviness of livestock manure. At this time survey we couldn't get detailed information about inter-city area trades and livestock manure traders, but livestock manure traders exist actually and livestock manure traders answered that livestock manure trading is very profitable because farmers who plant tree crops and flowers those need livestock manure a lot for their quality buy livestock manure from traders and that number of traders is increasing.<sup>4</sup> This means farmers who buy livestock manure from traders think that value of livestock manure is higher than the cost to buy and input livestock manure.

#### 4. Logit Estimation of Livestock Manure Input

From the former session, it is found out that demand and supply of livestock manure is out of balance. Then, how farmers decide to input livestock manure or not. Table 6 is the outcome of logit estimation of livestock manure input. The explained variable is whether each farmer inputs livestock manure or not. The explaining variables are total land size each household managed (TLSIZE), whether each farmer plants tree crops and vegetables (1) or not (0) (TLMRNDCD), weighted average number of

<sup>4</sup> It is thanks to Mr. Hasan Alemdar -villager in Alemdar village- and Mr. Baran Yaşar -turkish side co-researcher- that I can get this information.

livestock (BBHB)<sup>5</sup>, number of male laborer whose age is over 15 in each household (ENBLLBTL), whether each household has more than one tractor (1) or not (0) (TRCTRN\_F), fertilizer cost per total managed land (FTPRSZ\_M), whether living in irrigated area (1) or rain-fed area (0) (IRCODE), and whether living in Adana (1) or Konya (0) (CITYID). From this table, decision does not rely on total land size, irrigation, and fertilizer-use, but commercial farm product, yield and quality of that depends on livestock manure, number of livestock, number of laborer, and tractor-possession. According to this result, it becomes clear that irrigation and development/introduction of fertilizer/seed don't have affects on decision directly but has affects indirectly by way of commercial crop production, mechanization and decreasing of pastureland and fallow land, and that farmers can't input livestock manure without capital, livestock and so on.

Table 6. The logit estimation of livestock manure input

Log of likelihood: -79.322				
Number of observations: 156				
	Estimated Coefficients	Standard Error	t-Statistic	p-Value
TLSIZE	0.000	0.001	-0.310	0.757
TLMRND	1.019	0.517	1.969 **	0.049
BBHB	0.027	0.008	3.487 ***	0.000
ENBLLBTL	0.587	0.310	1.892 *	0.058
TRCTRN_F	1.174	0.471	2.495 **	0.013
FTPRSZ_M	-0.034	0.023	-1.498	0.134
IRCODE	0.781	0.537	1.454	0.146
CITYID	1.244	0.549	2.266 **	0.023
Constant	-2.841	0.699	-4.062 ***	0.000

\*Significant at 10% level, \*\*Significant at 5% level, \*\*\*Significant at 1% level

## 5. Conclusions

In this survey, the existence of farmers who cannot input livestock manure becomes clear. To keep soil fertility and sustainable agriculture, political support, for example livestock manure co-using union, must be had that eases effects from inequality of number of

livestock or possession of tractors and helps farmers who want to input livestock manure into their land. And it also be needed that market trading of livestock manure become more active to coordinate supply and demand of livestock manure.

## 6. References

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<sup>5</sup> In this variable, numbers of cattle are multiplied into 5 times of originals.