

The Effect of Irrigation on the Adoption of Crop-Livestock Multiple-Farming and the Livestock Keeping

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1. Introduction

In the traditional agriculture, farmers manage crop production and animal husbandry multiply. There are several merits in multiple production. First, as a accumulation measure of more liquid assets compared to land. Secondly, it plays a important role of diversification of risk. Thirdly, economies of scope from utilizing crop residue for livestock feeding, livestock excreta for fertilizing land, and livestock itself for tilling land.

However, in areas where introduction of irrigation has been progressed, animal husbandry has been declined and farm production shifted to crops. The introduction of irrigation may have changed environment of crop production, and also affected animal husbandry through allocation of labor and capital.

Then, changes caused by the introduction of irrigation will be grasped and sorted out according to the farm survey, and factors of decision of the adoption of crop-livestock multiple-farming and the livestock keeping will be analyzed.

Data used in this report was obtained in farm survey conducted in Adana region from January to March in 2006. In this report, sample households for analysis are farmers who produce only crops and those who manage crop-livestock multiple-farming. Sample villages of this survey are as follows:

Irrigated Villages

- Geçitli (Yüreğir District)
- Gerdan (Seyhan District)

Rain-fed Villages

- Yenyayla and Cihadiye (Yüreğir District)
- Boztahta (Aladağ District)

2. Decision of the Adoption of Crop-Livestock Multiple-Farming and the Livestock Keeping

2.1 Situation of Surveyed Areas

The lower part of Seyhan river, running through Adana prefecture, is a Çukurova plain with fertile soil, where irrigation is well introduced. The middle part of Seyhan river is a hilly area goes to the upper plateau, where irrigation is not well introduced.

In irrigated area, production of wheat and cotton had been prosperous since before the introduction of irrigation. But in recent years, cotton production declined because of the declining of immigrant labor from east part of Turkey, and production of maize, citrus and vegetables has been increasing instead of cotton. About animal husbandry, in general a few cattle are kept and fed in drylot.

In rain-fed area, mainly wheat and barley is planted and farmers make their living by combining animal husbandry with production of these crops. In general, sheep and Goat are mainly grazed in piedmont and cattle are also kept in other area.

2.2 The Difference in Decision Whether or Not to Keep Livestock

In farm survey, the following question was asked to farmers: whether keeping livestock or not, purpose when keeping livestock, and reason when not keeping livestock. The results are shown in Table from 1 to 3.

Table 1 Whether Keeping Livestock or Not

(Unit: Number of Household)

| | Irrigated Area | | Rain-fed Area | |
|------------------|----------------|-------|---------------|-------|
| | | % | | % |
| Keep | 10 | 19.6 | 36 | 72.0 |
| Kept in the past | 10 | 19.6 | 11 | 22.0 |
| Not keep | 31 | 60.8 | 3 | 6.0 |
| Total | 51 | 100.0 | 50 | 100.0 |

Source: Farm Survey in 2006

From Table 1, only 20% of respondents keep livestock in irrigated area, on the other hand 72% of respondents keep livestock in rain-fed area.

Table 2 Purpose of Keeping Livestock

| Purpose | (Unit: Number of Answer) | | | |
|---|--------------------------|-------|---------------|-------|
| | Irrigated Area | | Rain-fed Area | |
| | | % | | % |
| As a stock of capital | 3 | 17.6 | 8 | 11.0 |
| For economic security of household | 5 | 29.4 | 16 | 21.9 |
| For home consumption | 5 | 29.4 | 25 | 34.2 |
| To sell livestock at the festival season | 0 | 0.0 | 7 | 9.6 |
| To sell milk, hair, and other by-products | 4 | 23.5 | 17 | 23.3 |
| Total | 17 | 100.0 | 73 | 100.0 |

Source: Farm Survey in 2006
Note: Multiple answer is possible.

Table 2 shows purpose of keeping livestock when farmers answered that they keep livestock. In irrigated area, animal husbandry is placed not as the main measure to make their living by itself, but as means to avoid risk and to get products for home consumption. In rain-fed area, animal husbandry is considered equally as means of ‘avoidance of risk and stabilization in household’, ‘home consumption’ and ‘income’.

Table 3. Reason for Not Keeping Livestock

| Reason | (Unit: Number of Answer) | | | | |
|--------------------|--------------------------|------------------|---------------|------|-------|
| | Irrigated Area | | Rain-fed Area | | |
| | | % | | % | |
| Kept in the past | No space or barn | 2 | 16.7 | 2 | 15.4 |
| | Lack of capital | 2 | 16.7 | 1 | 7.7 |
| | Lack of labor | 5 | 41.7 | 8 | 61.5 |
| | Costs too much | 0 | 0.0 | 1 | 7.7 |
| | Low profitability | 1 | 8.3 | 0 | 0.0 |
| | Lack of knowledge | 1 | 8.3 | 0 | 0.0 |
| | Living in city | 0 | 0.0 | 0 | 0.0 |
| | Don't want to keep | 1 | 8.3 | 1 | 7.7 |
| | Total | 12 | 100.0 | 13 | 100.0 |
| | Not keep | No space or barn | 5 | 12.5 | 0 |
| Lack of capital | | 2 | 5.0 | 0 | 0.0 |
| Lack of labor | | 10 | 25.0 | 1 | 33.3 |
| Costs too much | | 3 | 7.5 | 0 | 0.0 |
| Low profitability | | 6 | 15.0 | 0 | 0.0 |
| Lack of knowledge | | 6 | 15.0 | 0 | 0.0 |
| Living in city | | 5 | 12.5 | 2 | 66.7 |
| Don't want to keep | | 3 | 7.5 | 0 | 0.0 |
| Total | | 40 | 100.0 | 3 | 100.0 |

Source: Farm Survey in 2006
Note: Multiple answer is possible.

The reasons for not keeping livestock is shown in Table 3. In irrigated area, farmers who have experiences of keeping livestock cite ‘lack of capital’ and ‘lack of labor’ as reasons for not keeping livestock. Farmers who don’t have experiences of keeping livestock wonder profitability in addition to lack of labor. In rain-fed area, most farmers keep livestock or have

experiences. The reason for stop keeping livestock most farmers who kept livestock in the past cite is ‘lack of labor’.

Putting it all together, in irrigated area, some farmers manage animal husbandry for the purpose of ‘avoidance of risk and stabilization in household’ and ‘home consumption’, and most farmers do not manage animal husbandry in consideration of low profitability and its requirement for much labor. On the other hand, most farmers manage animal husbandry according to three purpose: ‘avoidance of risk and stabilization in household’, ‘home consumption’ and ‘income’, and farmers who do not keep livestock cite ‘lack of labor’ as the main reason for not keeping livestock.

From the above, it can be said that the difference between in irrigated area and in rain-fed area is the point that farmers decide whether they keep livestock or not according to the judgement on profitability, and the common reason for not keeping livestock is that farmers consider availability of labor.

Next, based on these results, ‘labor productivity’ and ‘land productivity’ will be checked.

Table 4 Labor Productivity and Land Productivity in Surveyed Area

| | Productivity | Crop Production | | Livestock Production |
|-----------------------|-----------------------|-------------------|---------|----------------------|
| | | | | |
| Irrigated Area | Keeping Livestock | Labor | 27.845 | -0.550 |
| | Not Keeping Livestock | Labor | 113.128 | |
| | | Land | 196.005 | |
| | Rain-fed Area | Keeping Livestock | Labor | 136.161 |
| Not Keeping Livestock | | Labor | 66.244 | |
| | | Land | 42.603 | |
| | | | Land | 48.448 |

Source: Farm Survey in 2006
Note: Labor Productivity (Unit: YTL/day) is defined as [(Production Value - Input Goods Cost) / Labor Amount].
Land Productivity (Unit: YTL/da) is defined as [(Production Value - Input Goods Cost) / Land Size].

From the Table 4, it can be seen that the land productivity in irrigated area is from three to four times higher than those in rain-fed area and that there is a big difference in the labor productivity between crop production and animal husbandry. From this result, it can be thought that agriculture in irrigated area concentrates on crop production because of higher productivity of crop production than that in rain-fed area.

2.3 The Background of the Decision

Here, the background of difference in decision is considered.

There is some constraints in condition of cultivation in the traditional agriculture and therefore farmers grow grains in extensive way. However, introduction of irrigation and accompanying technological progress ease condition of cultivation, and production of commercial crops become prosperous and productivity improves. Consequently, a disparity in productivity between crop production and animal husbandry enhances, resulting in changes in capital allocation between crop production and animal husbandry.

Animal husbandry requires a lot of labor constantly. In the extensive agriculture, animal husbandry is useful to utilize household labor. However, in the area where animal husbandry is not so prosperous compared to crop production, like surveyed area, labor market does not develop enough. On the other hand, commercial crops production needs a lot of labor only in particular period like planting and harvesting. Effective management of agriculture can be achieved by combining production items and hiring labor. Additionally, profitability growth in crop production increases household income, and leads to a rise in opportunity cost of family labor. Consequently, changes in labor allocation between crop production and animal husbandry occur.

From the above, it is presumable that the differences in productivity and profitability cause changes of capital and labor allocation between crop production and livestock production, resulting in a transition from the traditional crop-livestock multiple-farming to commercial crops-focused production.

3. Factor Analysis of Adoption of Crop-Livestock Multiple-Farming and Livestock Keeping

3.1 Tobit Model - Variables and Hypotheses

Here, factors which affect farmers' decision whether they adopt crop-livestock multiple-farming or not is analyzed with econometric approach. In

this analysis, Tobit model is used with adjusted number of managed livestock as a dependent variable. Each independent variable and its theoretical ground are mentioned below.

a) Household Size

Animal husbandry does not have labor market and only family labor is utilized. Therefore, number of household member can be constraint. If the number of family labor is limited, farmers may accord crop production that has high labor productivity priority over animal husbandry. If there are a lot of members, farmers can utilize surplus labor efficiently.

b) Education Level of Household Head

In case education level of household heads are high, it can be judged that they have high management ability. They can manage crop-livestock multiple-farming in consideration of efficient allocation of labor and risk.

c) Self-Owned Land Size

In rain-fed area, land marked is fragile. Even in irrigated area, land market is not perfect because there exist constraints in some crops. Under this situation, it can be thought that farmers with large self-owned land shift the emphases on capital allocations from animal husbandry to crop production. Technical disparity in profitability between irrigated area and rain-fed area must be considered.

3.2 Estimation Result

Table 5 shows the estimation result of Tobit model on decision how many livestock to keep.

Table 5 Estimation result of Tobit Model on Decision How Many Livestock to Keep

| Number of observations: 101, Log of likelihood: -168.495 | | | |
|--|--------------|-------------|---------|
| Variables | Coefficients | t-statistic | p-value |
| Household size | 1.378 | 3.96 | 0.000 |
| Education level of household head | 1.369 | 1.77 | 0.080 |
| Self-owned land size | -0.218 | -2.67 | 0.009 |
| Irrigation dummy | -8.311 | -5.06 | 0.000 |
| Constant | -4.516 | -1.85 | 0.067 |

Source: Farm Survey in 2006

Note: Livestock number is adjusted according to feeding standard.

a) Household Size: Positively Significant

Shortage of the number of household member results in difficulty of keeping livestock. That is, there is a labor constraint. Adversely, farmers utilize surplus labor efficiently in case of lots of household

members.

b) Education Level of Household Head: Positively Significant

The higher education level of household head, the more the head manage crop-livestock multiple-farming in consideration of efficient allocation of labor and risk.

c) Self-Owned Land Size: Negatively Significant

Farmers with large self-owned land shift the emphases on capital allocations from animal husbandry to crop production. To the contrary, farmers with small self-owned land manage crop-livestock multiple-farming for the reason that they can not produce crops stably.

d) Irrigation Dummy: Negatively Significant

In this variable, effects of preference structure and home consumption except technical profitability are to be included in this variable. This means that there exist disadvantage to animal husbandry according to the introduction of irrigation.

From the above result, it is confirmed that the decision of adoption of crop-livestock multiple-farming is affected by availability of labor and land. If the self-owned land sizes are large, farmers center management on crop production and they shift the emphases on labor capital allocations from animal husbandry to crop production. Under the condition, they allocate surplus family labor to animal husbandry in case of lots of available household member. Also, if management ability of household head is high, the head adopt crop-livestock multiple-farming in consideration of avoidance of risk.

4. Conclusion

The introduction of irrigation raised productivity of crop production, and farmers changed allocation of capital and labor between crop production and animal husbandry. Consequently agricultural system shifted from the traditional crop-livestock multiple-farming to the commercial crop production. Animal husbandry is adopted by farmers who do not have enough capital to manage crop production stably, or farmers who have enough household labor for animal husbandry after allocating household labor crop production.

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