

The Features of Agriculture in Adana Prefecture -From the Result of Farm Survey-

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1. Introduction

The report shows some results of the farm survey conducted in Adana prefecture. The aim is to clear the characteristics of agriculture and farm economy in Adana. One main feature of the agriculture is that the irrigated area and the rain-fed area are geographically separated, because the government constructed large irrigation system around lower Seyhan basin and lower Ceyhan basin. Hence, it is useful for our purpose to compare the agriculture and the farm economy between irrigated and rain-fed area.

We also conducted the same farm survey in Konya prefecture, which is located in Anatolia plateau. In the report, we use the data of Konya to clarify the features of agriculture in Adana.

2. Design of Farm Survey

The questionnaires used in the farm survey essentially consist two parts, although the details of each farm survey are somewhat different. One contains the questions about household characteristics, land tenure and cropping pattern, livestock activity, and sales and cost of agricultural activity. The purpose is to clear the features of agriculture and farm management of Adana and Konya. The other contains the questions related to the farmer's perception about climate change and other long-term changes and the change of farm management in long-term. In this report, we mainly use the first part of questionnaires.

The farm survey has been conducted four times in Adana and three times in Konya. The report uses the last three farm surveys for the analysis. The length of each farm survey was from one month to one and half month. In each farm survey, one or two irrigated villages and one to three rain-fed villages were selected from each prefecture. In Adana, the

villages selected for the farm survey belongs to Seyhan, Yuregir, and Ceyhan district except one rain-fed village where belongs to the south part of Aladag district. Then, the data of rain-fed area of Adana does not represent the agriculture and farm economy of mountainous area of Adana, located in the northern part of Seyhan basin. Rather, the data represents the rain-fed agriculture and farm economy of suburbs of Adana city. In Konya, irrigated villages selected for the farm survey belongs to Cumra district, and rain-fed villages belongs to Sarayonu, Altinekin, and Karatay district.

Table 1 Number of villages and sample farmers

		2003		2004		2005	
		Village	Sample	Village	Sample	Village	Sample
Adana	RF	2	51	1	33	3	54
	IR	2	49	2	32	2	51
Konya	RF	2	43	1	32	-	-
	IR	2	41	1	34	-	-

Source: Farm survey, 2003, 2004, 2005 for Adana, 2003, 2004 for Konya. RF means rain-fed area, and IR means irrigated area.

If possible, the random sampling method is desired to keep the representativeness of data. However, the random sampling method was not feasible because we could not get all household data in the selected villages required to select farmers randomly. Then, we randomly asked farmers at cafeteria of the village and adjusted the number of farmers to fit the farm size distribution of the village at the final stage of farm survey.

3. Land Property

First, we will see the structure of land property of the farmers. Table 2 shows the average land size per household for each ownership form. The total managed land of rain-fed (RF) area of Adana is the smallest in our classification (rain-fed area of Adana, irrigated (IR) area of Adana, rain-fed area of Konya, irrigated area of Konya), and the largest is rain-fed area of Konya.

Table 2 Average managed land size

		Unit: da				
		Owned	Rent-in	Shared	Other	Total
Adana	RF	50.35 (73.49)	11.18 (16.33)	6.13 (8.95)	0.84 (1.23)	68.51 (100.00)
	IR	61.96 (42.45)	67.83 (46.48)	16.14 (11.06)	0.00 (0.00)	145.93 (100.00)
Konya	RF	214.97 (73.45)	58.17 (19.88)	18.71 (6.39)	0.83 (0.28)	292.69 (100.00)
	IR	137.91 (69.97)	54.37 (27.59)	2.97 (1.51)	1.83 (0.93)	197.08 (100.00)

Source: Farm survey, 2003, 2004, 2005 for Adana, 2003, 2004 for Konya.
 Figures in parentheses are the proportion of each tenure to the total land.

In both Adana and Konya, land rent market in irrigated area is more developed than that in rain-fed area. Especially, in irrigated area of Adana, the proportion of rent-in land to the total managed land is bigger than that of owned land. The difference between irrigated area and rain-fed area seems to be attributed to the difference of the planted crops (the detail will be discussed later). However, the development of land market in irrigated area of Adana is related to the historical aspect. The large landlord system had been prevailed in the area until 1950s. Some few landowners managed their land using hired labors. However, with the pervasion of agricultural machinery, the landlord system could not be maintained. The landowners rented-out their land to their hired labors and they moved to the city.

The typical land contract in both Adana and Konya is fixed rent contract and not share rent contract. Share rent contract only exists among relatives who share the land property. In general, the farmers using share contract are small farmers because the traditional succession system, that is the division of succession, continues to be exist in part. Then, share contract is utilized to put together the segmented plot to the person who manages the farms.

4. Choice of Cropping Pattern

Table 3 shows the cropping pattern that was expressed by the proportion of each crop to the managed land. The far right cell shows utilization rate of the managed land. Then, irrigated area of Adana utilizes intensively the agricultural land by the practice of double cropping, that the first crop is wheat, and the typical second crop is maize, groundnut, soybean, and more. In contrast, rain-fed

area of Konya utilizes only 64% of the managed land. The area practices traditional fallowing system for keeping the soil fertility. But, rain-fed area of Adana does not conduct the fallowing system. The main reason is that the farmers need to utilize their agricultural land intensively for getting cash from agriculture because of the smallness of the managed land. However, it must be noted that the use of chemical fertilizer enabled the intensive use of the land in rain-fed area of Adana (this topic is discussed later).

The most prevailed crop in Adana and Konya is wheat except irrigated area of Adana. In rain-fed area of Adana, the other main crops are cotton and barley. Some farmers who have access to the irrigated land plant watermelon and other cash crops. In irrigated area of Adana, the most prevailed crop is maize, and the other main crops are wheat, tree crops (citrus), cotton, vegetables and watermelon. In rain-fed area of Konya, the other main crop is barley. In irrigated area of Konya, the other main crops are sugar beet, other field crops (dried bean), and maize.

Although wheat is prevailing in all areas, the role of wheat production on the farm economy is different between each area. In rain-fed area of Adana, the farmers secure the products for self-sufficiency, and after that, sell the surplus products. Barley is planted for feeding livestock, and not for eating and selling. The livestock farmers generally graze animals on the plot before barley puts forth ears. In contrast, the farmers in rain-fed area of Konya generally grow wheat for getting cash and not for eating. Barley is planted for eating in the area, although the residual of barley is used for feeding animals. The difference stems from the agronomic condition, market condition, and the volume of glazing land. The farmers in Adana plant spring wheat and the farmers in Konya plant winter wheat. The productivity of wheat is higher in Adana than that in Konya (Please see table 4). Then, the farmers in Konya give more priority to sell the products of wheat than to eat them. Grazing land in rain-fed area has decreased since 1960s and the farmers confront the lack of green feed. Then, the farmers in rain-fed area of Adana need to plant barley for feeding their livestock.

In irrigated area of both prefectures, the profitability of wheat is low compared to the other

crops. Then, the economic incentive for planting wheat may be also low for the farmers in irrigated area. There are two main reasons that the farmers in irrigated area of Adana continue to plant wheat. One is that wheat is planted during winter season as the first crop of double cropping system with maize, groundnuts, and soybeans, which are planted during summer season. There is no choice other than wheat that can be planted in winter season. Second, because the double cropping system uses the land intensively, it is desired to rest the land every two years. In general, the farmers who conduct the double cropping system choose to plant only wheat to rest the plot during summer season after the year they operated the double cropping system. Third, farmers do not need great deal of labor force for the cultivation and the labor productivity of wheat is the highest in the available crops. Then, the farmers who confront the lack of labor force can easily choose to plant wheat. In irrigated area of Konya, sugar beet is the most profitable crop and the farmers contract with the public company buying the all products of sugar beet in the region. The contract forces the farmers to comply with the rotation system that restricts the planted area of sugar beet. The purpose of the contract is to stabilize the supply and price of sugar, and to keep the soil fertility of land. The farmers can plant sugar beet only once in every four years under the contract. In general, they rotate crops with wheat and sugar beet, since the alternative crops are limited in Konya.

In irrigated area of Adana, the high value crops are citrus and watermelon (please see table 4). However, the ratio of planting these crops is not so high. First, citrus and watermelon need great deal of labor force for the cultivation, and this results the low labor productivity of these crops despite the high land productivity. It is impossible to plant these crops for the farmers who confront the lack of owned labor force and does not have enough financial resource for hiring agricultural labor. In this area, the wage rate of agricultural labor is soaring because migrant labor from east part of Turkey is decreasing despite the high demand¹. Second, the citrus farmers need to secure the land

property in the long term, since citrus is perennial crop. The tenant farmers cannot plant citrus even if they want. As mentioned in section 2, there are many tenant farmers in irrigated area of Adana. This characteristic of land distribution is the main constraint on the advancement of citrus. Third, watermelon and some vegetables have severe replant failure. Especially, watermelon can be planted only once in every five years on the same plot. The farmers need to change the plot every year for continuing to plant watermelon. This is the main constraint for planting watermelon, and also the main reason that watermelon is the main cash crop for the tenant farmers.

The most prevailed crop in irrigated area of Adana is maize. The land productivity is middle-level in the available crops. However, as mentioned above, the area allocable to the more profitable crops than maize (citrus and water melon) is limited. Since maize does not need so much amount of labor force for the production, most of the farmers can plant maize with relatively little effort compared to other more profitable crops. Maize may be the best balanced crops in the alternative crops. Also, the product price of maize is relatively stable compared to the price of citrus and watermelon. Then, maize is the attractive crop for the farmers who want to avoid the risk. Furthermore, as mentioned above, maize can be planted as a second crop after wheat. The farmers can get cash income twice in a cropping season if they conduct the double cropping system, although the profitability of second maize is somewhat lower than that of first maize. Land-owning farmers generally are not willing to operate the double cropping system on the same plot because of the incentive land use. However, the tenant farmers have no any intensive to rest the rented plot, and also they can change their land every year if they need. The tenant farmers generally desire to get cash income more frequently from their rented land, and these farmers are willing to operate the double cropping system continuously.

¹ Recently, there is a movement that daily workers in the city emigrate to the irrigated area for getting jobs.

Table 3 Cropping pattern

		Wheat	Barley	Maize	Cotton	Sugar beet	Other field crops	Water melon	Vegetab les	Tree crops	Total
Adana	RF	75.26	5.67	0.00	6.82	0.00	7.22	2.84	0.92	0.97	99.71
	IR	35.07	0.04	56.67	6.02	0.00	8.29	2.51	4.85	10.97	124.41
Konya	RF	39.68	18.12	0.00	0.00	0.11	5.84	0.00	0.00	0.35	64.10
	IR	50.04	4.36	12.16	0.00	12.59	18.21	0.52	0.70	0.03	98.62

Source: Farm survey, 2003, 2004, 2005 for Adana, 2003, 2004 for Konya

Table 4 The productivity of representative crops

Land Productivity ¹⁾		YTL/da						
		Wheat ³⁾	Barley	Maize	Cotton	Sugar beet	Watermelon	Tree crops
Adana	RF	66.77	16.24	-	53.97	-	-	-
	IR	92.41	-	176.05	154.83	-	210.23	269.59
Konya	RF	40.38	80.94	-	-	-	-	-
	IR	103.05	70.63	139.22	-	313.65	-	-

Labor Productivity ²⁾		YTL/day						
		Wheat	Barley	Maize	Cotton	Sugar beet	Watermelon	Tree crops
Adana	RF	228.32	105.37	-	22.48	-	-	-
	IR	411.32	-	229.97	59.04	-	111.72	46.53
Konya	RF	105.54	186.58	-	-	-	-	-
	IR	227.91	167.85	207.86	-	105.44	-	-

Source: Farm survey, 2004 and 2005 for Adana, 2004 for Konya.

1) Land productivity = (Gross value of products - Cost of Seed, Fertilizer, Pesticide, Manure, and Water) / Land

2) Labor productivity = (Gross value of products - Cost of Seed, Fertilizer, Pesticide, Manure, and Water) / Labor

3) 2004 is the lean year for wheat in Adana because of the severe drought in March. Then the data of wheat in 2004 was not used to calculate productivity.

5. Production Method and Farm Management

The aim of this section is to clear the difference of production method and farm management in each area. For this purpose, we compare the input use for wheat production in each area. Although, because of the difference of agronomic condition and variety of wheat, the precise comparison of the production method cannot be allowed only by comparing input

use for wheat production. However, it will disclose some features of the production method and farm management of each area.

Table 5 shows planted area, yield, and input use for wheat production. Each area has almost same planted area. In both of Adana and Konya prefecture, the yield of irrigated area is higher than that of rain-fed area. Also, in both of rain-fed and irrigated area, the yield is higher in Adana than Konya.

Table 5 Input use for wheat production

	Area	Yield	Input use per area				Input use per products				
			Fertilizer	Pesticide	Manure	Labor	Fertilizer	Pesticide	Manure	Labor	
		da	kg/da	kg/da	YTL/da	kg/da	day/da	kg/100kg	YTL/100kg	kg/100kg	day/100kg
Adana	RF	60.51	347.28	67.59	3.940	81.98	0.495	20.95	1.195	21.26	0.153
	IR	60.91	426.60	51.93	3.912	72.73	0.361	14.62	1.003	18.18	0.116
Konya	RF	65.57	190.66	20.26	0.747	170.02	0.696	12.33	0.633	97.42	0.521
	IR	67.60	401.96	41.78	1.239	11.74	0.793	10.76	0.350	2.91	0.219

Source: Farm survey 2005 for Adana, 2004 for Konya

Input use per planted area shows that the farmers in Adana use more chemicals (fertilizer and pesticide) and less labor than the farmers in Konya. Then, it can be said that the farmers in Adana alternate chemical inputs for labor input and the farmers in Konya are opposite. Input use per products can be interpreted as what amount of each input is needed to get a certain amount of products. The farmers in rain-fed area of Adana need to use the most fertilizer in all areas to get 100kg of wheat products. In contrast, the farmers in rain-fed area of Konya use much amount of manure and labor force to get 100kg of wheat. This is adequate result because more labor input is needed for inputting manure than for chemical fertilizer.

Generally, farmers decide the amount of each input depending on the technology to which they have access and the price of product and each input. The relative price of labor to chemical fertilizer is 49.8 in rain-fed area of Adana, 54.6 in irrigated area of Adana, 44.5 in rain-fed area of Konya, and 47.4 in irrigated area of Konya. The relative price of labor in Adana is higher than that in Konya. Then, if we assume that both regions have same technology for wheat production, it is rational for the farmers in Adana to use less labor force and more chemical input compared to the farmers in Konya². The high price of labor force in irrigated area of Adana may be the main reason that the farmers in the area save the labor force for wheat production. However, it seems there is another reason that the farmers in rain-fed area of Adana use much amount of chemicals.

As mentioned in section 3, the utilization rate of land in rain-fed area of Adana is nearly 100%, while that in rain-fed area of Konya is 64%. This may show that the farmers in rain-fed area of Adana utilize their land too intensively from the aspect of sustainable management. Then, they may be required to use much amount of fertilizer to get and keep the yield of wheat.

In rain-fed area of Adana, the crop rotation system of wheat and cotton had been prevailed until 1980s. The main reasons of the decline of this crop rotation were the increase of labor force for picking

up cotton and the incidence of harmful insect. Furthermore, there was another reason for that. The productivity of cotton in rain-fed area was not so high even at that time unlike with irrigated area. In fact, the farmers needed to grow cotton to keep the yield of wheat. The diffusion of chemical fertilizer and new variety of wheat allowed the farmers to be released from the need of planting cotton. Recently, planting of sunflower is increasing in rain-fed area of Adana, because an oil-processing company constructed in the area buys all the products at high price. However, some farmers adopt the crop rotation system of wheat and sunflower for the purpose of keeping the yield of wheat. Both the past and the recent crop rotation support the view that the present land use in rain-fed area of Adana is not sustainable and the farmers need to use much fertilizer to keep the yield of wheat.

6. Animal Husbandry

In this section, we check animal husbandry of each area. Table 6 shows the number of livestock-keeping households and the ratio of those to all sample households by each livestock, and Table 7 does the number of each livestock. The farmers in rain-fed area of Adana keep cattle mainly. Goat is kept only in mountainous area. The farmers in irrigated area of Adana generally do not keep livestock except cattle for the purpose of stock and self-consumption of milk.

The farmers in Konya keep cattle and sheep. Especially in rain-fed area of Konya, nearly half of farmers keep sheep, and average number of sheep per sheep-keeping household is fairly large. This is because grazing animal is still prosperous in Konya. The ratio of livestock-keeping households in rain-fed area is lower than that in irrigated area in Konya. The reason for this is that farmers in rain-fed area in Konya tend to live in central city to get jobs in winter.

In both Adana and Konya, farmers in irrigated area keep larger number of cattle and smaller number of sheep and goat in average than those in rain-fed area. Sheep and goat need more grazing and therefore more labor force to keep than cattle. Hence, farmers in irrigated area tend to choose cattle which save labor force and land for grazing.

² It is needed to estimate production function of each region and test whether there is no structural difference in technology among each region for concluding the rationality of input use.

This is because of lower productivity of livestock production compared to crop production. Table 8 shows the labor productivity of animal husbandry. From this table and Table 4, it is observed that the labor productivity of animal husbandry is much lower than that of crop production.

With the introduction of irrigation since 1960s, land productivity of crop production increased. After 1980s, farmers started to cultivate various commercial crops that can achieve fairly high land productivity. As a result, farmers in irrigated area concentrate their management resources on crop production, and they stop to keep livestock or shift livestock to keep from sheep and goat to cattle for the sake of saving capital and labor force.

To see the detail in labor productivity, that in rain-fed area of Adana shows the best productivity. In rain-fed villages, especially near the city center of Adana, some of farmers managed intensive livestock farming. About Konya, labor productivity in rain-fed area is lower than that of irrigated area. This is because some of farmers in rain-fed area graze a lot of livestock, mainly sheep and goat, by themselves.

Table 6 Livestock keeping ratio

		Unit: Household			
		Cattle (%)	Sheep (%)	Goat (%)	Any livestock ¹ (%)
Adana	RF	74 (60.16)	21 (17.07)	5 (4.07)	88 (71.54)
	IR	27 (23.08)	3 (2.56)	1 (0.85)	27 (23.08)
	Total	101 (42.08)	24 (10.00)	6 (2.50)	115 (47.92)
Konya	RF	27 (36.00)	33 (44.00)	6 (8.00)	45 (60.00)
	IR	39 (52.00)	27 (36.00)	5 (6.67)	55 (73.33)
	Total	66 (44.00)	60 (40.00)	11 (7.33)	100 (66.67)

Source: Farm survey, 2003, 2004 and 2005 for Adana, 2003 and 2004 for Konya. Figures in parentheses are the proportion to the numbers of sample households. 1) 'Any livestock' means the number of households that keep livestock.

Table 7 Number of livestock

			Unit: Head		
			Cattle ¹	Sheep	Goat
Adana	RF	Number	313	524	201
		Average ² (CV ³)	4.23 (0.65)	24.95 (0.69)	40.20 (0.65)
		IR	Number	152	33
		Average ² (CV ³)	5.61 (1.11)	11.00 (1.50)	20.00 (-)
Konya	RF	Number	110	5245	96
		Average ² (CV ³)	4.06 (0.88)	158.94 (1.04)	16.00 (0.52)
		IR	Number	265	1115
		Average ² (CV ³)	6.78 (1.10)	41.30 (1.45)	5.00 (0.92)

Source: Farm survey, 2003, 2004 and 2005 for Adana, 2003 and 2004 for Konya. 1) Cattle number is adjusted according to feeding standard. 2) Average = Number of each livestock / Number of households that keep each livestock 3) CV shows coefficient of variation.

Table 8 Productivity of animal husbandry

		Unit: YTL/day	
		Labor productivity ¹ (CV ²)	
Adana	RF	11.318	(1.811)
	IR	5.570	(6.282)
Konya	RF	6.727	(5.057)
	IR	8.890	(1.903)

Source: Farm survey, 2004, 2005 for Adana, 2004 for Konya.

1) Labor productivity: See Note 2) in Table 4.

2) CV shows coefficient of variation.

7. Cash Income

In this section, we will see the structure of household income in each area. Table 9 shows the cash income from each activity (crop, livestock, off-farm, and pension). Here, the self-consumption of products for eating and feeding animals is not included in the cash income from crop and livestock activities, and then, it is possible that the calculation of cash income results in negative value³.

The cash income from crop production in irrigated area is much higher than that in rain-fed area, even if we consider that the farmers in rain-fed area consume part of the products by themselves. The farmers in rain-fed area of Konya lose their cash by growing crops. The crop production of rain-fed area of Konya is not sustainable from the aspect of cash income though they are trying to keep soil fertility with the extensive use of land and heavy use of manure⁴.

The cash income from livestock activity in rain-fed area is higher than that in irrigated area. When we see the average income, the profitability of livestock in rain-fed area of Adana is higher than that in rain-fed area of Konya. This reflects the difference in the management of livestock activity. In general, the management size of livestock activity is smaller in Adana than in Konya. However, a few farmers in Adana manage intensive livestock farming, especially in villages near the central city. These

³ When we see the difference of productivity in each area, it is desired to concern the amount and value of self-consumption. However, calculating the value of self-consumption is difficult because the rain-fed area integrates crop activity and livestock activity. Quantifying the value of self-consumption under crop and livestock integration may require the estimation of multi-output cost function.

⁴ From another aspect, the farmers may choose not to use their land intensively because they cannot get cash income from the crop production.

farmers achieve high profitability from livestock activity.

In rain-fed area of both prefectures, the main cash income sources of household are other income sources (off-farm and pension). In rain-fed area of Adana, nearly 60% of households engage in off-farm activity, but the rate of household getting pension is not high. As mentioned above, the selected villages in Adana are suburbs of the central city. Then, the young person in the villages can get a job in the city without migration to the city. Also, they have access to enough agricultural labor market in irrigated area during summer season because summer is agricultural off-season in rain-fed area. However, in the village belongs to Aladag district, depopulation is getting more strained because the

village is far from the city and irrigated area.

In contradiction to the rain-fed area of Adana, only 32% of households in rain-fed area of Konya engage in off-farm activity, but more than 40% of household gets pension. The selected villages are located in mountain part and far from the central city. Then, the young members of household have to migrate to the city center for getting non-agricultural job. The pension system of Turkey is the voluntary reserve system and not the compulsory participation one. The result may show that, in rain-fed area of Konya, there are many farmers who feel the necessity to pay reserve for getting pension because of the low profitability of agriculture and lack of the opportunity for off-farm activity.

Table 9 Cash income from each activity

		YTL							
		Crop	Livestock	Agriculture Total	Off-farm	Pension	Other Total	Total Income	
Adana	RF	Average	899.638	589.687	1,489.326	3,363.609	982.855	4,346.464	5,835.790
		CV ¹⁾	0.532	0.450	0.345	0.149	0.213	0.121	0.134
	IR	Average	15,105.614	-222.086	14,883.528	2,781.571	1,098.812	3,880.383	18,763.911
		CV	0.153	-1.211	0.158	0.250	0.215	0.182	0.136
	Total	Average	7,781.645	196.428	7,978.073	3,081.644	1,039.030	4,120.673	12,098.746
		CV	0.159	0.969	0.156	0.137	0.151	0.106	0.113
Konya	RF	Average	-332.186	218.246	-113.940	1,329.755	1,582.501	2,912.256	2,798.316
		CV	-1.345	1.445	-4.832	0.308	0.168	0.187	0.272
	IR	Average	10,633.189	-118.665	10,514.524	1,017.892	690.602	1,708.494	12,223.018
		CV	0.141	-4.544	0.171	0.295	0.264	0.200	0.151
	Total	Average	5,321.836	44.526	5,366.362	1,168.950	1,122.616	2,291.566	7,657.928
		CV	0.176	7.106	0.199	0.215	0.146	0.140	0.144

Source: Farm survey in 2003, 2004, 2005 for Adana, 2003, 2004 for Konya.
1) CV shows coefficient of variation.

Table 10 The rate of household engaging to the other income sources

		Off-farm	Pension	Total
Adana	RF	59.5%	20.7%	69.0%
	IR	40.4%	21.1%	56.0%
Konya	RF	31.7%	41.3%	60.3%
	IR	25.8%	19.7%	42.4%

Source: Farm survey in 2003, 2004, 2005 for Adana 2003, 2004 for Konya

8. Conclusion

We summarize the features of agriculture and farm economy in Adana.

Rain-fed area of Adana: Monoculture of wheat has been formed since the decline of the crop rotation system of wheat and cotton. Wheat is only a product that farmers can get cash income though the

income is not enough. Because of the small farm size, the farmers need to intensively utilize their land. The monoculture of wheat and the intensive land utilization cause heavy usage of chemical fertilizer and pesticide for wheat production in the area though the amount of input may be rational. Some farmers feel that the monoculture depending on chemicals is not sustainable. Then, the way that enables the farmers to cast off the monoculture of wheat is needed. The crop rotation of wheat and

sunflower may be favoring because the demand for oil in Turkey is expected to increase, at least for next several years. However, the farmers need off-farm income to keep their livelihoods. Unless some crops planted during summer season are introduced in the area, that means no construction of irrigation system, the crop production is not able to keep the livelihoods of household and the rural economy.

Irrigated area of Adana: The farmers enjoy the highest productivity of crop production in the surveyed area and have wide array of alternative crops. Also, unlike the irrigated area of Konya, there are no any institutional or political regulations that restrict the choice of crop to the farmers. However, there are two main factors that constrain the farmers' choice of crop. First is labor constraint, which comes from high labor requirement of the cash crops (citrus and watermelon) and decrease of the labor supply from east part of Turkey. Second is the heterogeneity of land distribution that partly stems from the historical landlord system. Because of these constraints, citrus and watermelon are not

planted so much despite the high land productivity. Under present circumstance, maize and other field crops (mainly, groundnut and soybean) sustain the agriculture because the farmers can easily plant and get decent cash income. The existence of profitable field crops is a necessary condition for keeping the present population of independent farmers. The significant decrease of profitability of maize and other field crops without any relaxation of labor and land constraints may make some marginal farmers, especially small tenant farmers to exit from farm management. It depends on the social and political choice whether that movement is preferable for Adana and Turkey.

Acknowledgement

This series of farm survey was conducted with support from Dr. Onur ERKAN, Dr. Cennet OĞUZ, Mr. Hasan ARISOY, Dr. Mevlüt GÜL, Dr. Ufuk GÜLTEKİN, Dr. Kemalletin TAŞDAN, Ms. Naciye TOK, Mr. Ali YALCIN, Mr. Baran YAŞAR.