

Chapter 1 Problems, Objectives, Methodology, and Major Results of the Socio-economic Sub-group of the ICCAP

Hiroshi TSUJII

1.1 The Problems, the Objectives, and the Methodology

As the IPCC predicts the climate in the end of the 21st century based on its probable 35 scenarios about population, income growth, energy technology, global warming seems to be inevitable in late 21st century. Although temperature increase near the equator is expected to be smaller than in higher latitude areas, the increase will affect agricultural production in Turkey. Many GCMs predict that rainfall will decrease under global warming in Turkey in late 21st century and this will also affect agricultural production. In addition to these factors of climatic change, technological changes, agricultural policy and price changes, changes in endowments of natural agricultural resources, changes in agricultural laws and institutions, inflation and changes in the exchange rate of Turkish lira, and population and economic growth can affect Turkish agricultural sector. These are factors to affect agriculture in the long run, and they can change as fast as or faster than climatic factors. We call these factors extra climatic change variables (ECCVs, henceforth). Some of the ECCVs are exogenous factors that are independent of climatic change, such as inflation and economic growth, and others are endogenous to some extent in the sense that they are influenced by climatic changes, such as technological changes and institutional changes. Farmers, research institutions, and government have responded and will respond to climatic changes to modify or improve agricultural practices, agricultural technology, and agricultural institutions.

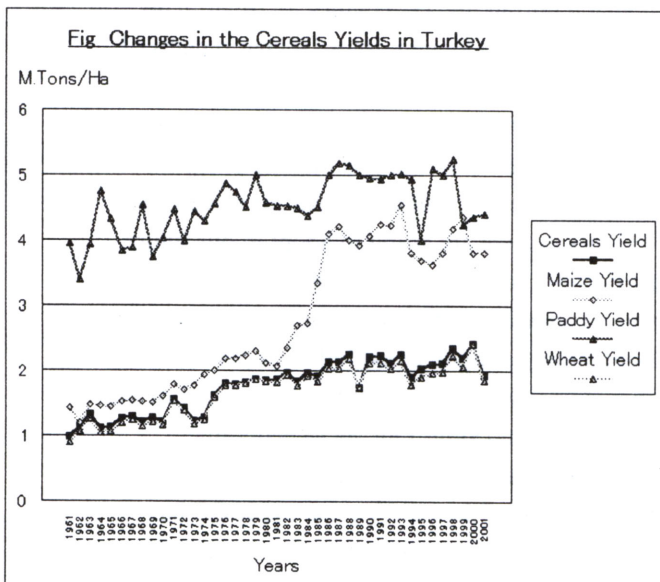
The main objective of the ICCAP project is to estimate the effect of climatic change to agricultural production in semiarid area in 21st century. In order to attain this objective, the socio-economic subgroup will first identify the

past (about 50 years or so) relationships among the climatic changes, the ECCVs, and agricultural production and demand in irrigated area and rain-fed area of Turkey. As I will describe shortly, we plan to do this at the following three levels, namely at farmer level, at agricultural sector level, and at whole Turkey level. Some of the individual socio-economic researches in our sub-group may not consider the climatic change variables explicitly, but try to identify the relation between some of the ECCVs and agricultural production and demand. Even in this case, we like to ask the researchers to be concerned with their evaluation of the importance of the ECCVs of their interest in comparison with the climatic change in their effects to agricultural production and demand, or to identify or to explain the aspect through which the researched ECCVs influence agricultural production and demand. Second, based on the studies of past relation among the ECCVs, agricultural production and demand, and the climatic changes, we will conduct studies on the impacts of climatic changes on agricultural production and demand during the 21st century. In order to do this, we have to assume future scenario paths of the ECCVs as the IPCC itself has done for some of the ECCVs for its estimation of future climatic changes. The A2 scenario is the one of the scenarios the IPCC has assumed for some of the ECCVs that we are going to adopt in our future projection. A2 is a scenario for the 21st century that assumes a multidimensional world where population continue to explode and per capita income growth and technology improvement are diversified and slow. Our socio-economic subgroup shall adopt the same future paths for the same set of the ECCVs that the IPCC has assumed for A2 scenario. Our socio-economic subgroup must also assume future paths of the set

of the important ECCVs that the IPCC has not assumed, and this is critical part of our research.

1.2 Some Indications about Sustainability of Turkish Agriculture

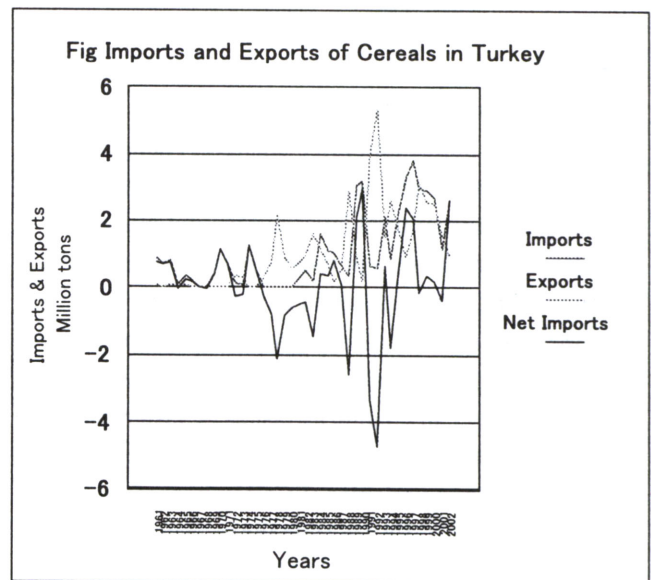
There are several indications that show sustainability of Turkish agriculture is uncertain. Yield of wheat, that is the dominant staple cereal in Turkey, has been stagnant during last two and half decades after it had been increasing rapidly from 1961 to 1985 as the next figure shows. Similar yield stagnation can be seen in the same figure for less important cereals such as maize and paddy. In our intensive farm surveys in Adana and Konya in 2002 and 2003 we have hard many times form the surveyed farmers, government officials and others that fallow year frequency has been decreasing, soil and pasture degradations have been very severe, and underground water resources have been in the process of depletion during last one to two decades. We think that these yield stagnations are caused by climatic changes, population increase and overuse of natural resources, economic and political uncertainties, and changes in the other ECCVs. Such factors as soil degradation, depletion of underground water resources, climatic factors, and economic factors such as very severe inflation, decline in real cereal prices, increase in real input prices are most probably relevant.



Source: FAO data.

Another indication is the recent increase of net cereals imports during the 90's as shown in the next figure. This may indicate that Turkish cereals sector cannot provide for increasing domestic demand for cereals caused by fast population increase.

We would like to identify the causal relationships among the recent cereals yield stagnation, the ECCVs, natural resources deterioration, and climatic changes by economic and econometric analyses of our farm survey data, agloclimatological analysis, mathematical programming analysis, the input-output analysis and new institutional economic analyses. Based on the results of these analyses, we plan to identify important paths through which the climatic changes have important effects to agricultural production in the late 21st century.



Source: FAO data.

1.3 The Five Components of the ICCAP's Socio-economic Sub-group Study

There are five components in the research of the socio-economic subgroup of ICCAP.

- (1) A study of farmers' economy, and farmers' perception and responses to climatic changes, technological changes, natural resource changes, and policy and institutional changes. Tsujii, Erkan, Oguz, Asami, Kusadokoro, Maru, others, and graduate students.
- (2) An econometric estimation of yield and area sown functions of wheat and barley in Adana and

Konya, and prediction of wheat and barley production in Adana and Konya combining the above estimation results and Dr. Kimura's RCM climatic change projection for 2070. Tsujii and Ufuk.

(3) A risk programming analysis of the relation among agricultural products' structure, water use, agricultural policy, and climatic changes in the LSIP area. Umetsu.

(4) Institutional economics analyses of the use of natural resources (commons) such as water and pasture by farmers, pastoralists, and the government. Umetsu, Asami and Tsujii.

(5) An IO analysis of the interactions among climatic changes, agricultural market and policy. Kagatsume.

2. A Study of Farm Economy, Farmers' Perception of and Response to Climatic Change, Socio-economic Changes, and Technological Changes: Tsujii, Erkan, Asami, and the Japanese and Turkish graduate students.

2.1 The Methodology Based on Farm Surveys

2.1.1 The Selection of the villages surveyed

Theoretically surveyed villages must be selected in the representative arid agro-climatic zones of Turkey. Thus they should be distributed properly in Turkey, and must include villages in both rain-fed area and irrigated area in Turkey. But because of the development path of the ICCAP and research logistic reasons the survey villages are limited to those near Adana, Eastern Mediterranean region and near Konya, Central Anatolia region. Representative villages are chosen in both irrigated area and rain-fed area in these two regions. Two farm surveys were conducted both in Konya and Seyhan-Ceyhan Basins of Adana from December 2002 to January 2003 and from October to November in 2003. About 50 farms were selected from one or a few nearby villages by stratified non-random method in both irrigated (IR henceforth) and rain-fed (RF henceforth) areas, and they were interviewed using a questionnaire that is modified from the one used in the farm surveys in Nigeria, Tanzania, Indonesia, and Japan by Tsujii.

The villages surveyed in 2002/03 are Tasci(IR) and Kadikoy(RF) in south of Adana City,

Cicekli(RF&IR) and Yeniyala(RF) in north of Adana City,

Okcu(IR) in south of Konya City, and

Meydan(RF) in north of Konya City.

The villages surveyed in October and November, 2003 are

Beloren(RF), Abdioglu(IR), & Akdam(IR) in south of Adana City,

Kilcili(RF) in north of Adana City,

Beylerce(IR) & Alemdar(IR) near Cumra in

south of Konya,

Karakaya(RF), Cesemelisebil(RF),

Akorenkipla(RF) & Yagllbayat(RF) in northeast of Konya.

The farm size distribution for each surveyed village is given in Appendix 1 of this Report.

2.1.2 Objectives of Our Farm Survey and the Survey Framework

In order to attain the research objectives of ICCAP it is very important to identify farmers' perceptions of climatic change, of changes in natural resources, in technology, in policy and in institution, farmers' responses to these changes, and farm economy responses using our farm survey data in the representative arid agricultural areas of Turkey. In this identification, it is important to differentiate shortrun and longrun responses. The next and important research step is to identify the effects of climatic change to socio-economic and technological aspects of farm households in the complicated changes-perceptions-responses-effects system. We try to do it by various ways that I will describe just below.

2.1.3 Farm Survey Questionnaire and the Methodology in Order to Attain Our Research Objective of Identifying the Effects of Climatic Change to Agricultural Production

A modified questionnaire of the one that has been developed through the farm surveys done by Tsujii on the farmers' economy, farmers' perceptions about key variables, and their responses relating to sustainable agricultural development in Java, Nigeria, and Tanzania during the past five years will be used for our

Turkey farm survey. Using the data collected from the farm surveys, the farmers' perceptions of the climatic, natural resources, technological, social, economic, and institutional changes, farmers' responses to these changes, and actual effects of these changes to agricultural production, its sustainability, and farm economy are identified. In other words, the relationships among farmers' perceptions, responses, and actual effects will be analyzed, and the effects of climatic change to farm economy and agricultural production can be identified by economic and statistical analyses, production economic analyses, qualitative dependent variable analyses, and institutional economic analyses. In the other related research projects, Tsujii we have just completed the farm surveys in semi-arid areas of Nigeria and Tanzania in Africa, in mountainous areas of Java in Indonesia, and northern part of Kyoto Prefecture, Japan using the questionnaire similar to the one used for our farm survey in Turkey. Two English papers coauthored by Tsujii and others based on the analyses of Indonesian farm survey data were already published. Four English papers coauthored by Tsujii and others were also published by international journals based on the analyses of Nigerian farm survey data.

In the near future, we plan to conduct international comparative analysis farm survey data on our research interests among Turkey, Nigeria, Tanzania, Indonesia, and Japan.

Our questionnaire surveys the economy, perceptions, and responses to these perceptions of each surveyed farm household, for their major agricultural plots and for their households from both short run and long run viewpoints. Thus the questionnaire consists of farm survey part and plot survey part, and each of these parts consists of short-run questions and long-run questions. For our farm household survey, our questionnaire covers farm family structure and its changes, family labor use and education, etc., participation with rural organizations and their roles, the structure of farm household incomes and expenditures and its changes, the structures of live stock, capital stock, and managed land and their changes, man/land ratio, credits and their

uses, crop/livestock/household interaction, agroforestry and forest/household economy interaction, soil fertility, crops yield, inputs use and technology, crop damages, livestock diseases and food security. From this household survey we can obtain economic and social characteristics of the surveyed households and their agricultural, economic, and social behaviors.

Our major plots survey has an objective of collecting detailed input and output data and their prices by which we can conduct production economics analyses of the crops produced on the major plots. In addition to current I/O data, more detail farmers' perceptions about long-run changes in land tenure, in land use rule, in weather, in natural resources such as water resources and soil fertility, in policy, and technology, and farmers' responses to these changes such as modification of cropping pattern, changes in chemical fertilizer and manure application, in water use, and in soil/water conservation measures, etc. are surveyed.

Consequently the data obtained from our major plot survey and household survey can be utilized for the analyses of farmers' perceptions of climatic changes, changes in natural resources, technology, policy and institution, farmers' responses to these changes, actual economic, social and technological effects of these changes, and finally to identify the effects of climatic change to socio-economic and technological aspects of farm households in the complicated changes-perceptions-responses-actual effects system at the farm level in the representative arid agricultural areas of Turkey. The methodology for identifying the effect of climatic change to agricultural production and farm economy utilizing the farm survey data and especially through an integration of this farm survey data analysis with agroclimatic study of our socio-economic sub-group of ICCAP are described in Chapter 2 to this Final Report. Closely related quantitative analyses of the relationships among farmers' perceptions of changes in climate and in natural resources, and their impacts to farmers' responses in cropping pattern, water use, chemical fertilizer and manure use, and fallowing, using the farm survey data

obtained in Nigeria and Indonesia were completed, and seven English papers coauthored by H. Tsujii, Dr. J. Chianu, Dr. Ageng H. and others based on these analyses were already published or accepted for publication for international journals and other publications.

2.2 Three Master Theses That Have Just Been Completed Based on the Farm Surveys in Turkey

Three master theses by the graduate students of Kyoto University have been completed analyzing the farm survey data collected in Turkey under our ICCAP in 2002/3 and 2003.

2.2.1 Impacts of credit rationing by Kusadokoro.

A major part of credit to small farmers is provided by a government agricultural credit institution (ACC henceforth). The size of each agricultural credit under ACC is determined by both the value of owned land by the farmer concerned and by a maximum amount that is a little greater than the average value of owned land of all surveyed farmers. Kusadokoro hypothesizes that these credit constraints worse off both large and small farmers, and found some evidences to support this hypothesis from his analysis of the farm survey data. ACC gave its credit to farmers only in kind, such as fertilizer, and resale of the in-kind credit is forbidden by the regulation of ACC. He hypothesizes that agricultural productivity of the farmers who get the credit in kind was lower than other farmers who get credit in cash, and found some empirical support from his farm data analysis. He concluded that the rural credit rationing through ACC worsened farm income distribution because larger farmers can borrow from institutions other than ACC and small farmers dominates rural Turkey, and decreased agricultural productivity, *ceteris paribus*. He also thinks that the roles of rural credit institution are more important in irrigated area than rain-fed area, and the institution must adapt to climatic change as it will require new credit institution.

2.2.2 Animal manure market evolution by Maru

The recent mechanization and a government policy change have decreased number of livestock in the surveyed villages in Konya and

this has decreased the supply of animal manure especially in rain-fed area. But Maru also found that animal manure was input much less than what surveyed farmers thought appropriate based on the analysis of the farm survey data and village surveys in Konya in 2002/3 and 2003. This deteriorated soil profile structure that decreased inherent soil fertility. In irrigated area in Konya and other areas in Turkey, commercial crops and orchards have expanded their areas very much recently and animal manure demand there has increased. These were the reasons why inter-regional animal manure market has developed recently. Manure traders emerged and started to market manure from rain-fed area to irrigated area in Turkey.

2.2.3 Emancipation of female labor by Gulnur

Based on the analysis of female family labor allocation using the data collected using the formal farm survey questionnaire, and a female family labor distribution questionnaire asked to some house wives of the surveyed farms, she found that farm family females were relieved or emancipated more from simple hard agricultural labor work by the substitution of such female work with hired labor, as the income of farm households became greater when more intensive and commercial agriculture was adopted by them as shown in Table 1. She explains this fact by the

Table 1. Relationship among Per Capita Household Income, Hired Labor Input, and Wives' Agricultural Labor Input.

Data	Kilicli (RF)	Beloren (RF)	Kayisli (IR)	Abdioglu (IR)
Income/capita (million TL)	957	1,084	1,547	2,111
Hired labor input days/HH	288.9	160.4	217.6	2341.8
Agricultural labor input days/wife	182.2	183.8	38.6	18.8

Source: Farm household survey in October-November 2003.

theory of backward bending labor supply model.

These three master theses analyzed three important agricultural economic problems in Adana and Konya, but they did not study the effects of climatic change to Turkish agricultural

production directly. As two graduate students, Kusadokoro and Maru will continue to participate Turkey farm survey in 2004 and later, they will try to relate these effects with the effects of the problems of their interest to agricultural production in their studies. Another graduate student, Kondoh conducted a research on the relation among sugarbeet farmers, sugar industry, natural resources such as water, and climatic changes, and also wrote his master thesis on this topic in early 2005. Gulnur will not participate 2004 farm survey. A new graduate student, Kitsuki will participate it, and will try to identify his own problem in our socio-economic group research of ICCAP.

3. A Regional Econometric Study of the Interactions Among Climatic Changes, Agricultural Market, and Agricultural Policy: Tsujii, Gultekin, Kagatsume, Tasdan,.

3.1 Agricultural Economic and Agro-climatological Study of the Relation between Yield and Area Sown of Wheat and Barley and Climatic Change in Konya and Adana Tsujii and Gultekin.

An agro-climatological analysis among yield and area sown of wheat and barley, monthly weather data, and economic and agronomic variables for Adana, Konya, and Turkey was started using the econometric regression analysis by Tsujii and Gultekin when Gultekin came to Japan in 2003. The annual yield and area sown data for wheat and barley are regressed to processed monthly weather data, and relevant economic and policy variables for the period of past few decade for Konya, Adana, and Turkey. Some quantitative results about negative yield effects of higher and lower temperature, and positive effects of rainfall in some months were obtained, but more research will be conducted in 2004 and later by Tsujii, his assistants and Tasdan when he will visit Japan late 2004. Tsujii has done several agro-climatic studies on rice production and its relation with climatic, economic and policy variables for Thai and Japanese Rice. Tsujii (1977), Tsujii (1986), Tsujii and Others (1988).

Regional and time series data such as agricultural production, climatic changes, technology changes, policy and institutional changes, foreign exchanges rates change, and inflation for the econometric study will be collected. Then model formulation, and parameters' estimation will be done, and simulation analyses for climatic changes and policy and institutional changes will be done.

3.2 An Input-Output Analysis of the Interaction between Agricultural Production and Climatic Change

Kagatsume

The objective of this study is to identify the past relation between agricultural production structure and climate factors, and to predict the relation in the 21st century under the condition of global warming in Turkey using the input-output analysis. So far input-output tables are made only for whole country for Turkey, so Kagatsume plans to conduct national level analysis in this study. By deriving the several indicators based on the national level inter-industry transaction tables for 1996, the characteristics of agricultural sectors and the interrelations between the agricultural sectors and the other industrial sectors are discussed.

At the next stage, Kagatsume plans to interporate the I-O coefficients for the agricultural sector between 1990 and 1996 using the RAS method and the 1990 I-O table for Turkey. Then He will try to find out the relation between these time series coefficients and climatic variables using the standard regression analysis. Based on these analyses, He plans to project the impact of climatic change to agricultural production structure and the related economic factors such as agricultural labor demand in the 21st century.

4 A Regional Risk Programming Analysis of the Interdependences Among Crop Combination, Water Use, Agricultural Economy and Policy, and Climatic Change for LSIP Area in Adana Umetsu

In the irrigated area of Adana, Umetsu and others found the following results using their risk

programming model. When water availability would decrease under global warming, the farmers in irrigated area would increase land use shares of higher priced commodities, so that they could use scarcer water more efficiently while at the same time minimizing risk of this diversification of their crops. Exactly speaking, the farmers with near real risk aversion behavior standard would increase the ratio of their land use for watermelon from zero percent in the base case when water is an idle resource to 11% in low water development scenario and 24% in high water development scenario, would decrease cotton land use ratios considerably, and would not change land use ratios of citrus, vegetables, and fruits very much in order for them to obtain desired level of gross revenue and at the same time to restrict risk at an acceptable level when water availability would be reduced by 1 to 5 percent when global warming would take place in 2070.

5 New Institutional Economic Analyses of Management of Commons such as Water and Pasture, and of Agricultural Policy.

Umetsu and Asami.

New institutional economic analyses of management of commons such as water and public grazing land, and of agricultural policy were done based on interviews of farmers, shepherds, government officials, water users' associations (WUA henceforth), and researchers, and on the other related information.

5.1 A Study of the Transfer of Water Authority to and of the role of WUAs in Lower Seyhan River Basin

Umetsu

Umetsu conducted a study of the transfer of water management authority to WUAs and of the role of WUAs in Lower Seyhan River Basin. By 2002, transfer of management reached roughly 2 million ha. The impacts of transferring authority to WUAs were largely

- I) reduction of O&M costs,
- II) reduction of water fee,
- III) increased fee collection rate,

- IV) equitable distribution of water among head and tail farmers.

5.2 A Study of Degradation of and Intrusion to Public Grazing Land

Asami

Asami conducted a study of the factors affecting illegal intrusion to huge area of public grazing land and its illegal transfer to private cropland by farmers. It has been very difficult for the government to monitor each farmer who intruded into the public grazing land. In order to meet the demand for animal products and conserve the public grazing land, the law of pasture (law no. 4342) was enacted in February, 1998. But the purposes of the law were very difficult to attain, and the government by now has recovered only 10% of unlawfully intruded area of the public grazing land. The public grazing land is a free access resource for all the pastoralists, and its overgrazing has been degrading the pasture. It is necessary to create a new institution in order to conserve the public grazing land.

5.3 Impacts of Recent Structural Adjustment Policy to Agricultural Production in Turkey

Tsujii and Erkan

Impacts of recent drastic structural adjustment policy to agricultural production both in irrigated and rain-fed area in Turkey have been studied using the interviews with government officials and researchers, economic analysis, and statistical analysis.

6 Integration of Socio-economic Subgroup Studies

Integrations and syntheses among farm survey analyses, input-out-put analysis, agro-climatological analysis, mathematical programming analysis, institutional economic analyses of the agricultural commons such as pasture and water will be sought. A theoretical thinking for this integration is given in Chapter 2 of this Report.

References:

Hiroshi Tsujii, "Effect of Climatic Fluctuation on Rice Production in Continental Thailand," in K.

Takahashi and M. Yoshino eds. Climatic Change and Food Production, University of Tokyo Press, pp. 167-79, 1977.

Hiroshi Tsujii, "An Economic Analysis of Rice Insurance in Japan," in P. Hazel, C. Pomareda and A. Valdes, eds. Crop Insurance for Agricultural Development Issues and Experience, Johns Hopkins University Press, pp. 143-155, 1986 .

Hiroshi Tsujii with M. M. Yoshino and others, "The Effects of Climatic Variations on

Agriculture in Japan," in M. L. Parry, T. R. Carter and N. T. Konjin, eds. The Impact of Climatic Variations on Agriculture. Volume I. Assessments in Cool Temperate and Cold Regions, Part VI, Dordrecht, The Netherlands: Kluwer Academic Publishers, for International Institute of Applied Systems Analysis (IIASA) at Vienna and United Nations Environment Program, pp. 725-863, 1988.