

A Progress Report of the Socio-economic Sub-group of the ICCAP Project

Socio-economic Sub-group

1. Introduction

In this paper we like to present the current status of the socio-economic group research in the ICCAP project, the approaches through which we can analyze the impacts of pseudo-warming to cropping pattern, land use and water use in Adana and Konya, and some results.

2. The Five Components of the Socio-economic Sub-group Study and Their Current Status

2.1 The Five Components and Their Relationship

There are five components in the socio-economic sub-group research.

- (1) An economic analysis of the farm survey data regarding the farmers' perceptions of climatic changes, technological changes, and policy and institutional changes, farmers' agricultural responses to these perceptions, and the impacts of these responses to land and water use, cropping pattern, and farmers' economy.

Researchers in charge: Tsujii, Asami,

Kusadokoro, Maru, Kondoh, Kitsuki, Erkan, Oguz, Ufuk, Tasdan, Baran, Naciye

- (2) An input-output analysis on the interrelations among rural industrial structure, agricultural productivities, and climatic changes.

Researcher in charge: M. Kagatsume

- (3) A mathematical programming analysis of regional relation among cropping systems, water use, agricultural policy, and climatic changes.

Researcher in charge: H. Kameyama.

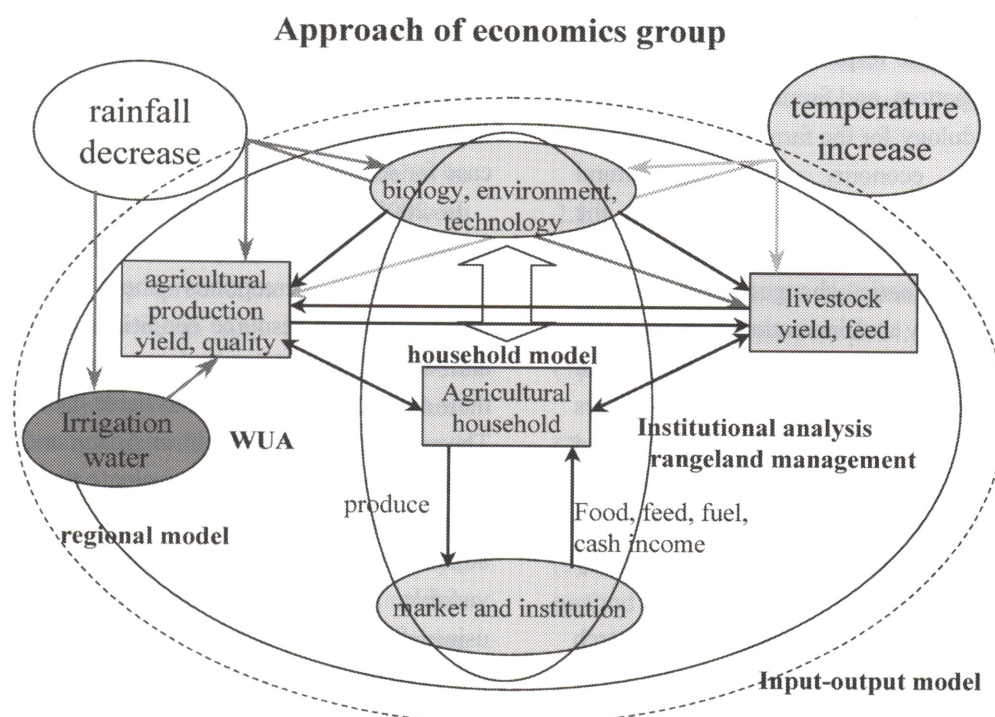
- (4) New institutional economics analyses of the use of commons such as water and soil by farmers, and pastoralists.

Researchers in charge: Y. Asami, Umetsu, Kondoh, and Tsujii.

- (5) An econometric agro-climatological study of the interactions among cropping pattern, climatic change, technology, input and output prices, and policy in Konya and Adana.

Researchers in charge: Tsujii, Kusadokoro, Maru, Tasdan, and Ufuk.

These five components are related as shown by the following diagram.



2.2 Current Status of the Socio-economic Research and its Five Components

2.2.1 Overall status

Two methodological papers for the ICCAP socio-economic research project were written by H. Tsujii in 2003 and 2004. Farm surveys were conducted in Adana and Konya by Japanese and Turkish graduate students in 2002, 2003, and 2004, and data were made to a dataset and analyzed. Three master theses using the results of the farm surveys were written by the Japanese students in February 2003, and another master thesis was written in February 2004. Dr. Erkan, Ufuk, and Tasdan have visited Kyoto University for short periods during last three years. An English interim report of the socio-economic team was published and distributed in February 2005. Through these research steps we have discussed our research objectives and research methodology, and have arrived at the current status of somewhat integrated research activities and results.

2.2.2 An economic analysis of the farm survey data regarding the farmers' perceptions of climatic changes, technological changes, and policy and institutional changes, farmers' agricultural responses to these perceptions, and the impacts of these responses to land and water use, cropping pattern, and farmers' economy.

The methodology for the farm survey approach to farmers' economy and agricultural sustainability by economic analysis of the interactions among farmers' perception of and responses to climatic changes, technological changes and policy and institutional changes has been developed through the research projects of Hiroshi Tsujii based on the farm surveys conducted in Nigeria, Tanzania, Indonesia, and Japan using the farm questionnaire similar to the one used in Turkey. English papers by Tsujii and others have been published and accepted by international journals.

The final objective of our farm survey research is to develop the farmer's behavior model under the condition of climatic change and to assess the

impact of climatic change to farm economy, cropping pattern, land and water use in Adana and Konya. We have investigated the farmers' agricultural decision making under weather change, using farm survey data. There are many aspects in farmer decision making when climate changes. Farmers can change kinds of crops to grow, variety of each crop to grow, cropping pattern, input-output combination, land and water use, livestock and crops integration, etc.

There was a severe drought in 2004 in Adana and Konya. Applying the variable parameter production function model to farm survey data for 2003 and 2004, Kusadokoro and Asami showed that farmers tried to mitigate the negative impact of drought on wheat yield by inputting more fertilizer. But, this response was not optimal from the aspect of profit maximization. Now, theoretical explanations are being sought for farmers' this suboptimal behavior, using some econometric methods. Completing this, knowing the probability of drought in 2070 from pseudo-warming runs, and knowing the values of the other variables of the estimated production function for the same year, we can get farmer's wheat production in 2070 in the cases of drought and normal years with probabilities for each cases for Adana and Konya. If we can estimate numbers of wheat farms for these two areas for 2070 based on our common socio-economic scenario of the ICCAP, then we can estimate the total wheat production for drought year and normal year with probability attached to each case for Adana and Konya in 2070.

In 2003 and 2004 farm survey conducted in Adana and Konya regions, we surveyed livestock farmers their perceptions about changes in weather, natural resource conditions, technology, and economic and institutional conditions, and their agricultural responses to these perceptions. There was a severe drought in Adana and Konya in 2004, and Maru tried to evaluate the effect of drought to milk production through farmers' adjustments in concentrate use by estimating variable parameter milk production functions using farmers' perception and response data collected in 2003 and 2004 farm survey data. And he compared the results in farmers' concentrate

use adjustments from this production function estimation study with the results of the analysis of relation between farmers' perception of changes in rainfall and temperature and their concentrate use responses to their perceptions from our farm surveys. From this comparison he found that the farmers' perception and responses in concentrate use in the case of drought were consistent in the case of Adana, but not consistent in the case of Konya. The reasons for this difference are left to further study. The data from the pseudo-warming runs can be used in the similar fashion to the case of drought impact study for wheat mentioned just above.

So far we have investigated the impact of drought to wheat and milk production in Adana and Konya using our farm survey data and considered the method by which we can utilize the data from the pseudo-warming runs and estimate wheat and milk production for Adana and Konya in 2070. Climatic change occurs not only in drought but also in many other weather variables. As mentioned just above, farmers' responses to climatic change are also multi dimensional. In our farm survey approach to ICCAP research objective, we have to develop a methodology by which we can analyze the impacts of some important aspects of pseudo-warming in addition to drought to some major elements of farmers' agricultural responses, in addition to wheat and milk production.

In this fiscal year, we will build farm household behavior models and estimate econometric models based on these behavior models that explain interdependences between animal husbandry and crop production in Adana and Konya. Crop production and milk and livestock production, as well as utilization of pasture land, grass, crop residues, and manure are especially treated in these models. We think these complementary activities between livestock production and crop production will mitigate adverse impacts of climatic change to agriculture and farm economy in Adana and Konya. Combining the estimated econometric models with the data generated from the pseudo-warming runs, we will predict the future interdependences between animal husbandry and crop production in

these regions in 2070.

Pasture grazing and barley production are competitive activities in Adana and Konya. Intrusion into the government pasture area by farmers and crop production there, especially in Konya are related with climatic change in the long run.

2.2.3 The four master theses analyzing the farm survey data in 2003 and in 2004.

The four master theses by the graduate students of Kyoto University analyzing the 2003 and 2004 farm survey data were completed in early 2003 and 2004. They are

- (1) The impacts of credit rationing to farmer's behavior in Adana by Kusadokoro,
- (2) The development of animal manure market in Konya by Maru,
- (3) Emancipation of rural female labor by Gulnur, and
- (4) Resource economics of sugar beat in Konya by Kondoh.

The topics of these theses are important agricultural problems in Adana and Konya, but they are not directly related with the main theme of the ICCAP project, i. e. the impacts of climatic change to agricultural production in the semi-arid area. This relation will be sought by Kusadokoro and Maru as they will be the members of the socio-economic subgroup of the ICCAP project in 2005, and they have been assisting Tsujii's agro-climatic econometric study during last few years.

2.2.4 Impact of climatic change to agricultural and national economy by the IO Analysis

In this research, the following analyses were carried out during the year 2004.

- (1). Generation of Agriculture based IO table in 3 time point (1985, 1990, 1996)
- (2). Industry Structure Analysis
 - (i) Influence & Responsive Degree Coefficient,
 - (ii) Inducement Coefficient, (iii) Skyline Analysis
- (3). Prediction of Input coefficient by RAS method
 - 1). Estimation of R (substitution change coefficient) & S (processing degree change coefficient)

2) Prediction of Input Coefficient and Impact of Climate Factors on Agricultural Productivities

(4) Implications at this stage

From the above analysis, the following points are observed.

(i) For grain, fruit, livestock product, forestry and fisheries, temperature in Konnya (+) and Adana (-) affect significantly but differently.

(ii) For vegetable, climate change in both area does not affect significantly.

(iii).Temperature affects most significantly on livestock products, secondly on fruit. Next, forestry, fisheries and grain follow in this order.

(iv).Precipitation in both areas does not affects for any rural industries significantly.

(v).For all cases, Temperature in Konnya affects more significantly than those in Adana.

(vi).For all cases, significant trend effects are observed

The point to be tackled in this year.

Research on impacts of regional limited resources (including the climate factors) on Agricultural productivity (or profitability) in Konnya and Adana through the filed survey and its statistical manipulations.

2.2.5 Regional and Seasonal Mathematical Programming Agricultural Sector Model for Adana and Konya

A regional agricultural production model was built and a test run was done, focusing on land use by crops and to apply for assessing the impact of climate change. PMP (Positive Mathematical Programming) is used for calibrating the land allocation in Adana province. As the impact of Climate Change, only the yield reduction of the wheat (-15%) is simulated.

As the result, it leads the change to land allocation by crops. Wheat reduces 0.27%, maize reduces 1.57%, cotton reduces 3.3%, where as, groundnut increases 0.90%, soybean no change, water melon increases 6.11%.

As the further research, regarding seasonal change of rainfall, this model can simulate the impact as this model incorporates the water

effective rain and irrigation water required. Regarding seasonal change of temperature, however, this model does not directly simulate the impact, this model would rather use indirectly the crop yield change collaborated with crop scientist group using the data set of pseudo warming run from meteorology group.

2.2.6 The new institutional economics analyses of the roles of the water users' associations (WUAs) and of encroachment of the government pasture by farmers.

a. The work done by 2004

Based on the interview survey in 2003 and additional information collected in 2004, the efficiency of water users' associations in LSIP was compared with merging options.

The analysis revealed that some WUAs are suffering from unfavorable management practices and there is a scope for major reorganization. In 2005-2006, I am planning to review water policies of Turkish government and its impact on LSIP.

b. The methodology to evaluate the impact of global warming to water use and water policy

In 2005, in collaboration with the irrigation sub-group of ICCAP, the impact of water shortage on the allocation of irrigation water in LSIP will be assessed using DEA analysis and/or simulation analysis with mathematical modeling. Also I am planning the review of water policy of Turkish government and how it may be affected by global warming.

c. Assessment of first run

The impact of 1st run of crop group will be assessed.

A new institutional economics analysis of overuse of and encroachment into the government pasture by farmers, and pastoralists was done by Y. Asami. He has conducted surveys of pastoralists, farmers, government officials, and experts in Konya, and has done an economic analysis of the process of overuse of and encroachment into the government pasture by the farmers and pastoralists. The problem is how to integrate these studies with climatic change and test run of global warming.

2.2.7 An econometric and agro-climatological study of the interactions among wheat production, climatic change, wheat price, technology and policy in Konya and Adana.

Tsujii, Ufuk, Tasdan, Kusadokoro, and Maru have been conducting an econometric and agro-climatological study of interactions among wheat production, climatic change, wheat price, technology and policy in Konya and Adana last few years. This study follows the methodology used in the past studies of H. Tsujii on the similar topic. Tsujii has conducted econometric studies on the relationship among agricultural production, weather variables, and other variables in Thailand and Japan during the past few decades. Tsujii has published some English papers as well as Japanese papers from these studies.

The results of our econometric study for whole Turkey, Adana, and Konya show that heat damage in certain months, monthly rainfall and temperature, as well as real wheat price were significant factors to determine wheat yield in Adana, Konya, and whole Turkey. Based on this results, and combining these results with the data from the second pseudo-warming runs, and projected real wheat price based on the ICCAP socio-economic scenario, Tsujii has shown the methodology for predicting wheat yield for Adana, Konya, and whole Turkey in his personal progress report in 2005.

Separately, and in the near future, we have to estimate models of wheat planted area for Adana and Konya explained by past real prices of wheat and competing crops and of agricultural inputs, and weather data. Obtaining these planted area models, we will combine the estimated planted area models with the pseudo-warming data and

the hypothesized real wheat price based on our common socio-economic scenario for 2070, and we can predict 2070 wheat planted area for Adana and Konya. Then, multiplying the yield and planted area data we can obtain heat damaged and normal wheat production for Adana and Konya in 2070 with probabilities attached to each case.

In order to analyze the effects of the pseudo-warming runs to cropping system in Adana and Konya, we not only have to estimate the models for wheat in these areas, but also we have to estimate yield and planted area models for other important crops in Adana and Konya, duly considering the interdependences between these crops. Successfully estimating these models, then we will simulate with the estimated models the impacts of global warming to the farmers' and crops behavior concerning cropping pattern, land use and water use given our common socio-economic scenario for 2070. Ufuk's visit to Japan from May 2005 and his joint study with Tsujii at Ishikawa Prefectural University is planned to conduct this research challenge.

In 2005, we will conduct similar study using the district level time series data on weather variables, economic variables, and institutional and social variables. After that, we can calculate district level crops yields using the climatic change data from the pseudo-warming runs for 2070. And then, we will compare our result with the result of crop simulation model that will be developed by the crop sub-group.

2.2.8 Gender in Agriculture

Women's roles in agriculture and their relationships with global warming are to be studied by Hoshiyama.