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Chapter 3
Current Research Status of the Socio-economic Team of the ICCAP and Two Relatively Complete Results of Our Analyses of Farmers' Responses in Soil Fertility Maintenance Using Farm Survey Data and of Our Econometric Analysis of the Impacts of Weather to Wheat Production in Adana and Konya Using Statistical Data.

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1. Introduction

In this paper we like to present the current status of the socio-economic group research in the ICCAP project and some recent developments in the analysis of impacts of weather to wheat production in Adana and Konya.

2. The Five Components of the ICCAP's Socio-economic and Institutional Study and the Current Status

2.1 The five components

There are five components in the ICCAP's Socio-economic and Institutional Study.

(1) An economic analysis of the farm survey data regarding the interactions among farmers' perception of and responses to climatic changes, technological changes, and policy and institutional changes and their impacts to farmers' economy and agricultural sustainability.
Rearchers in charge: Hiroshi Tsujii, Y. Asami, Kusadokoro, Maru, Gulnur, Kitsuki, Onur Erkan, Ms. Cennet Oguz, Gultekin Ufuk, Kemaletin Tasdan, Baran, Ms. Naciye

(2) An input-output analysis on the interrelations among rural industrial structure, agricultural productivities, and climatic change.
Researcher in charge: M. Kgatsume

(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 wheat production, climatic change, wheat price, technology and policy in Konya and Adana.
Researchers in charge: H. Tsujii, Kusadokoro, Maru, Tasdan, and Ufuk.

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 and sent to all the members of the project. Farm surveys were conducted in Adana and Konya by Japanese and Turkish graduate students in 2002, 2003, and 2004, and data were input and analyzed. Three master theses using the results of the farm surveys were written by the Japanese students in February 2003. Many short-period field surveys were conducted by H. Tsujii, M. Kagatsume, Umetsu, Asami, Kameyama, and Hoshiyama in Turkey. Dr. Erkan, Ufuk, and Tasdan have visited Kyoto University for short periods during last three years. Through these research steps we have discussed our research objectives and research methodology, and have arrived at the current status of somewhat integrated research objectives and methodology. But overall integration of the socio-economic research works is not very good.

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Better research integration must be sought in the near future, especially among the five research components of the socio-economic research sub-project, and among the socio-economic subproject and the other subprojects of the ICCAP research project.

An English interim report of the socio-economic team is in the process of editing.

2.2.2 An economic analysis of the farm survey data regarding the interactions among farmers' perception of and responses to climatic changes, technological changes, and policy and institutional changes and their impacts to farmers' economy and agricultural sustainability.

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 questionnaire similar to the one used in Turkey. English papers have been published and accepted in International journals. Some papers from the farm surveys in Nigeria are as follows:

Chianu, Jonas Nwankwo, and Tsujii, Hiroshi, "Missing Links in Sustainable Food Production in West Africa: the Case of savanna of Northern Nigeria." Accepted without amendment (on June 26, 2003) and in press for ***Sustainable Development.***

Chianu, Jonas Nwankwo, Tsujii, Hiroshi and Kormawa, Patrick. in press. "Agriculture in the Savannas of Northern Nigeria: Important Pressures, Transformations, Damaging Coping Strategies and Promising Adjustments." Accepted without amendment (in November 2003) for publication in ***Outlook on Agriculture***

Chianu, Jonas Nwankwo and Tsujii, Hiroshi. in press. "Integrated Nutrient Management (INM) in the Farming Systems of the Savannas of Northern Nigeria: What Future?" Accepted without amendment (in November 2003) for publication in ***Outlook on Agriculture***

Chianu, J.N. and Tsujii, H. "Determinants of Farmers' Decision to Adopt or Not Adopt Inorganic Fertilizer in the Savannas of Northern Nigeria." Accepted (in June 16, 2004) for publication in Nutrient Cycling in ***Agroecosystems***

Papers based on Tsujii's farm surveys in Indonesia using the questionnaire similar to the one used in Turkey are as follows:

Tsujii, Hiroshi, Ageng Herianto, and Siti Sugiah Muchfud Mugniesyah, "A Multinomial Logit Analysis of Agroforesters' Perception of Plot-wise Soil Fertility and Soil Mining - Fast Expansion of Leaf Banana in a Mountainous Village of West java -," in Y. Hayashi, Syafrida Manuwoto, and Slamat Hartono, eds., ***Sustainable Agriculture in Indonesia***, Gadja Madah Univeisty Press, pp.295-316, May 2003.

Ageng Herianto, Tsujii, Hiroshi, Sugiah Mugniesyah, Chianu, Jonas N., "An Econometric Analysis of Agricultural Sustainability in a Mountainous Area of West Java (A Case Study of Kemang Village)," ***Proceedings of the Second Seminar of JSPS-DGHE Core University Program, "Harmonization between Development and Environmental Conservation in Biological Production***," the University of Tokyo, pp. 274-288, 2003.

The farm survey data obtained in Nigeria and Indonesia using the questionnaire similar to the one used for the farm surveys in Turkey were used for the economic analyses of the interactions among farmers' perception of and responses to climatic changes, technological changes and policy and institutional changes that affect the farm economies and regional agricultural sustainability both in the short-run and the long-run. The logit analyses of the factors affecting the adoption of certain technologies that have important relation with sustainability and growth of the regional agriculture, and the standard simultaneous econometric method with farmer's soil fertility perception function and production function were applied in these analyses.

One result of a logit analysis about the farmers' adoption of animal manure in the Nigerian savanna is presented as the variable description in Table 1 and the estimation result in Table 2 just below.

Table 1. Descriptive statistics of variables used in the empirical logistic model

Variable	Expected Sign	Mean	Standard deviation	Min.	Max.
ULFY01D (1=adopted animal manure, 0=did not adopt)		0.56	0.50	0.0	1
HHSIZE (household size)	+	10.11	4.53	3.0	28
HDAGE (age of the head of household)	+	55.79	12.24	30.0	90
HHEDUC (level of education of the head of the household)	+	3.18	1.42	0.0	6
PLTALSZ (% of total land controlled that was cultivated in 2001)	+	89.86	19.90	16.3	100
SP01ULDS (changes in farmer satisfaction with crop performance)	–	0.31	0.46	0.0	1
AA01DS (changes in availability of animal manure)	+	0.41	0.49	0.0	1
MA01DS (changes in market opportunity for animal manure)	+	0.42	0.49	0.0	1
RA01DS (changes in restrictions on access to pasture resources)	–	0.37	0.48	0.0	1
NC01P (total number of different crops produced by household in 2001)	–	4.48	1.82	1.0	11
F01INDDS (change in overall inherent soil fertility)	–	0.61	0.49	0.0	1
RATIO3 (proportion of land cultivated in 2001 devoted to cereal-legume intercrop)	–	0.32	0.37	0.0	1
L01CASH (% of farmer's cash income obtained from livestock in 2001)	+	14.47	12.32	0.0	50
TOPOMIMP (farmer's rating of the importance of animal manure in soil fertility maintenance)	+	1.12	0.77	0.0	2
LSTDYENO (whether or not experienced any livestock disease/pest in the last 5 years)	–	0.78	0.42	0.0	1
GDRHIST (household's history of ruminant keeping)	+	0.55	0.50	0.0	1
TLU (total Tropical Livestock Unit possessed in 2001)	+	1.68	2.26	0.0	14.13
ZONE (1 = Guinea savanna, 2 = Sudan savanna)	–	1.50	0.50	1.0	2
MONELEV (village monetization level)	+	1.75	0.83	1.0	3

Source: Survey data, 2001

Table 2. Logit-model result of factors affecting farmers' adoption of animal manure in the savannas of northern Nigeria

Variables	Parameter estimate	Standard error	Pr>Chi-square
Intercept	4.6569	2.8939	0.1076
HHSIZE	0.2472	0.1244	0.0469**
HDAGE	–0.0401	0.0357	0.2615
HHEDUC	1.5580	0.4751	0.0010***
PLTALSZ	–0.0722	0.0233	0.0019***
SP01ULDS	2.6337	0.9713	0.0067***
AA01DS	2.5112	1.2621	0.0466**
MA01DS	2.5442	1.2652	0.0443**
RA01DS	–2.5818	1.4415	0.0922*
NC01P	0.8053	0.2732	0.0032***
F01INDDS	2.7728	1.1571	0.0166**
RATIO3	10.2560	3.1576	0.0012***
L01CASH	0.0280	0.0465	0.5473
TOPOMIMP	1.3917	0.6911	0.0440**
LSTDYENO	–5.2385	1.8268	0.0041***
GDRHIST	2.8006	1.2935	0.0304**
TLU	0.1565	0.1737	0.3675
ZONE	–26.2231	6.4724	0.0001***
MONELEV	15.4829	3.6455	0.0001***

***, Significant at 1%; **, Significant at 5%; *, Significant at 10%

Level of significance of the model (based on Likelihood ratio): 1%

Association of predicted probabilities and observed responses

Concordant = 97.5%	Somers' D = 0.950
Discordant = 2.5%	Gamma = 0.950
Tied = 0.0%	Tau-a = 0.471
(6300 pairs)	c = 0.975

Results from the logit model have confirmed that farmer characteristics (including perceptions), followed by the conditional variables, play a key role in influencing farmers' decisions to adopt animal manure for soil fertility maintenance. Agroecology and village monetization level (measured by the degree of sales of crop residues, animal manure, and fuelwood in village) are the important village-level characteristics that influence the adoption. Farmer characteristics that increase the probability of adoption are the size of the household, educational level of the household head, perceptions of availability of animal manure, market

opportunity for animal manure, and restrictions on access to pasture resources. The critical conditional variables that influence the decision to adopt animal manure for soil fertility maintenance are farmer's historical experience in ruminant livestock keeping, past encounter with livestock disease/pest outbreak, and his rating of the importance of animal manure in soil fertility maintenance. Based on these findings, some policy prescriptions were proposed.

We think that we should use the farm survey data collected by us in Turkey, and should at least conduct similar analyses that Tsujii and others have done.

2.2.3 The three master theses analyzing the farm survey data in 2003.

The three master theses by the graduate students of Kyoto University analyzing the 2003 farm survey data were completed in early 2003. 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, and

(3) Emancipation of rural female labor by Gulnur.

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 our agro-climatic econometric study during late 2004.

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

Kagatsume recalculated the published Turkey IO tables for 97 sectors to the tables for 34 sectors for 1980, 1990, and 2000. Then Interporation of the recalculated IO tables were done by the FAS method for the years between these years, and the relationship between agricultural production in the interporated IO tables and climatic change is studied by the multiple regression method.

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

A mathematical programming analysis of regional relation among cropping systems, water use, agricultural policy, and climatic changes is to be done by Kameyama. The optimal relation is to be identified. But the model is still to be built, and the needed data are still to be identified and collected.

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 survey of the water users' associations in Adana was done by Umetsu in 2003. and a new institutional economics analysis of the roles of the association is being done in 2004. 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.

2.2.7 Other related studies

Kondoh has conducted a study of the relation among water resources, land market, manure market, and cropping patterns in 2003. He conducted two studies on the relationship between sugar-beat industry, land use, and climatic change in 2004, and he plans to write his master thesis on this topic.

Tsujii conducted surveys on the relationship between policy changes, farm economy and farmers' behavior, and natural resource use in turkey in 2002, 2003, and 2004.

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

H. 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 English papers by Tsujii are as follows:

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 1. Assessments in Cool Temperate and Cold Regions***, Part VI, Dordrecht, The Netherland: Kluwer Academic Publishers, for International Institute of Applied Systems Analysis(IIASA) at Vienna and United Nations Environment Program, pp. 725-863, 1988.

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, "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.

Some results of our econometric study for whole Turkey, Adana, and Konya are presented below.

(1) An econometric and agro-climatological study for whole Turkey

The period of analysis is for 1951 to 1998, and linear function and the distributed lag model are used for the analysis.

The Variable Description for the analysis is shown in Table 3 just below:

Table 3 The variable description for the econometric and agro-climatological study of wheat yield for whole Turkey

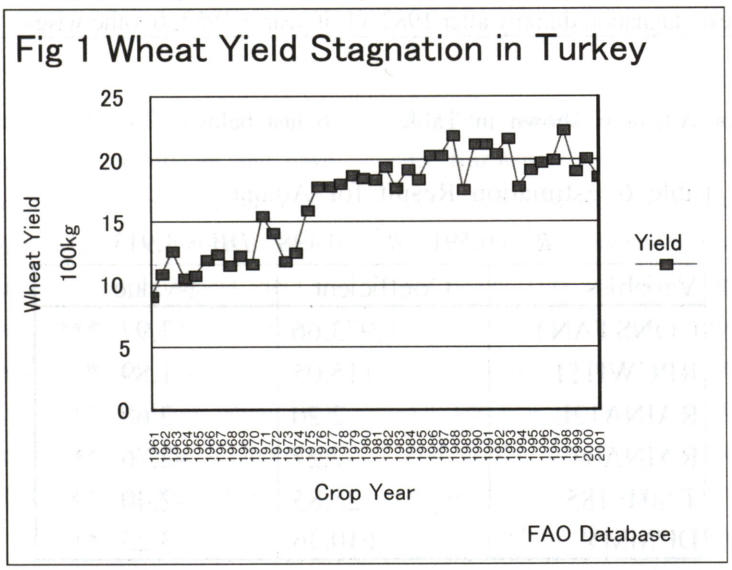
Dependent Variable

YLWHEATT	Average Wheat yield in Turkey	Kg/Ha

Explanatory Variables

YLWHTT_1	Last year's average wheat yield in Turkey	Kg/Ha
RPCWHTL	Last year's real farm gate price of wheat in whole Turkey (deflated by CPI)	
RINT0807	Cummulative monthly rainfall from Augast of last year to July of this year	mm
TMPT1107	Cummulative monthly temperature from November of lasr year to July of this year	C
TT04_150	Monthly temperature in April of this year above 15.0, 0, otherwise	C
DUMMY	Yield stagnation dummy after 1982, (1, if year > 1982, 0, otherwise)	

The wheat yield in Turkey had been increasing from 1961 to 1982, but it has stagnated since then as Figure 1 shows. This is the reason to introduce the dummy variable, DUMMY into our model.



The estimation result for whole Turkey is shown in Table 4 just below:

Table 4 The Estimation Result for whole Turkey

$R^2 = 0.884 \quad \overline{R}^2 = 0.866$

Variable	Coefficient	t-value
CONSTANT	-1,208.10	-2.84 ***
YLWHT_1	0.78	8.82 ***
RPCWHTL	36.55	2.51 **
RINT0807	0.25	2.46 **
TMPT1107	8.09	2.64 **
TT04_150	-8.98	-2.32 **
DUMMY	247.32	2.99 ***

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

The result is good as the R2 is quite high and the estimated parameters are highly significant and have theoretically expected signs. Farmers in Turkey responded to increase their wheat yield to the higher last year's real farm gate wheat price. Wheat yield in Turkey responded positively to the higher cumulative temperature and rainfall. Especially this result also tells us that Turkey wheat yield declines when April temperature become higher than 15 degree centigrade. This reflects heat damage to wheat in Turkey.

(2) An econometric and agro-climatological study for Adana

The period of analysis is for 1971 to 1998, and linear function is used for the analysis.

The Variable Description for the analysis is shown in Table 5 just below:

Table 5 Variable description for an econometric and agro-climatological study for Adana

Dependent Variable

YLWHEATA	Average wheat yield in Adana	Kg/Ha

Explanatory Variables

RPCWHTL	Last year's real farm gate price of wheat in whole Turkey (deflated by CPI)	
RAINA12L	Rainfall in December of last year	mm
RAINA04	Rainfall in April of this year	mm
TA04_185	Monthly temperature in April of this year above 18.5, 0, otherwise	C
DUMMY	Yield stagnation dummy after 1982, (1, if year > 1982, 0, otherwise)	

The estimation result for Adana is shown in Table 6 just below:

Table 6 Estimation Result for Adana

$R^2 = 0.591 \quad \overline{R}^2 = 0.498 \quad DW = 1.913$

Variables	Coefficient	t-value
CONSTANT	1,973.66	3.97 ***
RPCWHTL	115.05	1.89 *
RAINA12L	2.20	2.68 **
RAINA04	-7.27	-2.76 **
TA04_185	-25.85	-2.40 **
DUMMY	610.36	3.25 ***

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

The result is good as the R2 is high and the estimated parameters are highly significant and have theoretically expected signs. Farmers in Adana also responded to increase their wheat yield to the higher last year's real farm gate wheat price. Wheat yield in Adana responded positively to the higher rainfall in December of the preceding year, and negatively to higher rainfall in April of the current year. Especially this result also tells us that Adana wheat yield declines when April temperature become higher than 18.5 degree centigrade. This reflects heat damage to wheat in Adana.

(3) An econometric and agro-climatological study for Konya

The period of analysis is for 1971 to 1998, and linear function is used for the analysis.

The Variable Description for the analysis is shown in Table 7 just below:

Table 7 Variable description for an econometric and agro-climatological study of wheat yield for Konya

Dependent Variable

YLWHEATK	Average wheat yield in Konya	Kg/Ha

Explanatory Variables

RPCWHTL	Last year's real farm gate price of wheat in whole Turkey (deflated by CPI)	
RAINK04	Rainfall in April of this year in Konya	mm
TK05_160	Monthly temperature in May of this year above 16.0 in Konya; 0, otherwise	C
DUMMY	Yield stagnation dummy after 1982, (1, if year > 1982; 0, otherwise)	

The estimated result for Konya is shown in Table 8 just below:

Table 8 estimated result for Konya

$R^2 = 0.423 \quad \overline{R}^2 = 0.323 \quad DW = 1.274$

Variables	Coefficient	t-value
CONSTANT	1,742.60	4.10 ***
RPCWHTL	-33.22	-0.81
RAINK04	6.37	2.08 **
TK05_160	-14.94	-1.83 *
DUMMY	321.21	1.96 *

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

The result is acceptable as the R2 is appropriate and the estimated parameters are significant and have theoretically expected signs. Farmers in Konya did not respond to change their wheat yield to the higher last year's real farm gate wheat price. Wheat yield in Konya responded positively to the higher rainfall in April of the current year. Especially this result also tells us that Konya wheat yield declines when May temperature in the current year become higher than 16 degree centigrade. This reflects heat damage to wheat in Konya.

3. Conclusions.

3.1 Kagatsume's IO analysis has done an analysis of the relation between climatic change and changes in agricultural and nonagricultural production structure for whole Turkey. How to make his analysis regional is the important future step to take. Also the theoretical base to conduct this study must e clarified.

3.2 The new institutional economics analyses of WUAs and of the government pasture use by Umetsu and Asami have made appropriate progresses. Theories or models behind their analyses must be clarified based on the facts obtained from their field surveys and

literature studies. Their studies must also be related closely to the core objective of the ICCAP project, i. e., the impact of climatic change to agricultural production.

3.3 Studies of participating Japanese graduate students in Turkey must relate or compare their research objective, methodology, and results with the impact of climatic change to agricultural production in Turkey.

5.4 Kameyama is expected to formulate his regional mathematical programming model as soon as possible and identify and collect the data needed for his model analysis, and produce some relevant results.

3.5 Final and the most important point is tying or integrating researches of Japanese and Turkish socio-economic subgroups. From last year, some genuine academic integration and a direct contribution of the socio-economic group to the core objective of the ICCAP project, was started in the fifth component of socio-economic sub-group's research, i.e., the econometric and agro-climatological study of wheat production in Adana, Konya , and Turkey, as Ufuk and Tasdan have visited at Kyoto University and started to work with Tsujii. I think letting young participating assistants from Turkey and Japan to write their papers using the data collected from their farm surveys and other surveys is one of the most important steps for this integration.

3.6 The results of the econometric and agro-climatological study (the fifth component) are nearest to the identification of the impacts of climatic change to wheat and other agricultural production in the socio-economic sub-group. For this we need future monthly average weather data and future months and days when temperature will be above and below certain levels in each region. We also need the future peakedness of daily rainfall in certain months.

3.7 We have to conduct the study of farmers' agricultural production behavior responding to climatic and other changes using the farm survey data collected in Turkey by us, as Tsujii and others have done and have published their papers in international journals using the data collected from their farm surveys in Nigeria and Indonesia during the past decade.

Referrence: Elinor Ostrom, 2003, ***Governing the Commons***, Cambridge.