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**Adoption of improved *tef* and wheat production technologies in crop-  
livestock mixed systems in northern and western Shewa zones of  
Ethiopia**

by

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**Submitted in partial fulfillment of the requirements for the degree of PhD**

**in the Faculty of Natural & Agricultural Science**

**University of Pretoria**

**Pretoria**

February 2008

## ACKNOWLEDGEMENT

Above all I would like to thank Almighty God for giving me all the patience and strength to complete my study against all odds.

I wish to thank EIAR for giving me the training opportunity, ARTP for facilitation of the training program, HARC management and the staff of Socio-Economic Division at Holetta (where I am based) for all the support they provided during fieldwork and writing of my thesis. I am also thankful to ILRI for offering me a position of associate Graduate Fellow for one year.

I am highly indebted to my supervisor Prof. Rashid Hassan, director of CEEPA, for his unceasing efforts and persuasion to see me complete this thesis and giving me constructive comments and suggestions to produce quality research work. He has been so kind to provide financial assistance during critical phases of completing this work. I am also grateful to Prof. Kiresten, Head of the Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, for his noble guidance and advice. I thank Dr. Simeon Ehui of ILRI for providing local guidance while he was at ILRI. My sincere appreciation goes to Mrs Dalene DuPlessis for her kind assistance with handling my administrative and financial matters with CEEPA and the University during my studies.

I wish to thank the following in a special way, for their assistance during my stay in Pretoria: Dr. Mulugetta Mekuria for his concern and brotherly encouragement to continue my study and the social support he provided during his frequent visits to Pretoria; Drs. Mesfin Bogale, Terefe Belihu, and Teferi Yeshitila for sharing with all happy and bad times which made my life tolerable at UP, Drs Arega Demelash and Chilot Yirga for academic guidance and brotherhood. I would like also to express my gratitude to Dr. Eshetu Bekele, Pastor Fekadu Tadesse, Aselef Teshome and Bekele Haregewein for their care after my family during my absence.



I am grateful to the staff of the Bureau of Agriculture and Rural Development in North and West Shewa Zone, for providing me with the necessary information for my study and the staff of Degem, Grar Jarso, Wore Jarso, Woliso, Ada Berga, Kersana Kondaltiti, Dendi and Ambo districts for all the kind assistance provided during data collection. I also wish to thank all interviewed farmers for their time and patience in providing the required information to enumerators.

Last but not least I like to thank my wife Birke W/Michael for her prayers for my welfare and success while away from home and for shouldering all the hard family responsibilities during my absence and also thanks to my children Girum, Biruk, Abiye and Hewan for their moral support, encouragement and consoling their mother.

Hailu Beyene Abera



## **DEDICATION**

This work is dedicated to my late brother Bogale Gebtre Egziabher who made every effort to encourage me pursue my post-graduate studies valuing the opportunity he was not fortunate to have and my late niece Fasika Bogale for her unforgettable cares for me. They were eager to see me complete my study unfortunately they passed away during my study program which made my grief for their loss unbearable.



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Degree: PhD

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## **Abstract**

Since adoption is a dynamic process that involves learning about new technologies, static adoption models fail to adequately explore the effects of changes in farmers' perception and attitudes over time. This study analyzed the influences of farmers' learning and risk on the likelihood and intensity of adoption of improved *tef* and wheat technologies in Northern and Western Shewa zones of Ethiopia. The study employed Xtprobit and Xttobit and random effect models and panel data of the same farmers from 1997 to 2001. Separate samples were selected for wheat and *tef* and the study covers the same farmers from 1997-2001. Panel data are better suited to study dynamic changes and the random effect models control for unobserved variability and potential endogeneity.

Comparison of the main features of *tef* and wheat farmers revealed that wheat farmers are slightly younger, more educated, have slightly higher family size and significantly higher family labour than *tef* farmers. While average farm size is similar for *tef* and wheat farmers, farmers cultivated 60% and 30% of their land to *tef* and wheat, respectively. However, *tef* farmers allocated only 20% of their *tef* area to improved varieties due to shortage of desirable varieties whereas wheat farmers allocated 90% of their land to improved varieties from 1997 to 2001. Only three improved varieties were demonstrated and limited quantities of improved seeds were distributed to *tef* farmers whereas six improved wheat varieties were demonstrated and relatively sufficient quantities of improved seeds were distributed to wheat farmers during the study. Besides, similar

levels of fertilizers and herbicide were used on *tef* and wheat. Wheat and *tef* were mainly grown for own consumption as less than half of the produce (48% of all wheat and 46% of all *tef*) was sold in the market.

The study provided evidence of the importance of learning in the adoption decision and area allocation to improved varieties. As farmer's gained more experience from growing the new varieties in previous years, they continued adoption and increased areas under these varieties. The study also revealed that adopters of wheat and *tef* technologies have increased their production by 20% and 39%, respectively, than non-adopters. Results of the analyses indicate that awareness, availability and profitability of the new improved *tef* and wheat varieties enhanced farmer's learning and farmer's experience had positive influence on the likelihood and intensity of improved seed adoption. Improved *tef* and wheat varieties were found more risky than the local varieties.

The study further revealed that younger age of farmer, farmers' learning from previous experience, availability of family labour and credit are key determinants of the likelihood and intensity of adoption of improved seed. Policies and strategies that contribute to timely availability of improved inputs and provision of credit enhance farmers learning from their own experience on adoption. Policies and strategies that focus on farmers' education and provision of insurance for crop failure to reduce risk would help the new extension program (NEP) achieve its objectives which give emphasis to raising smallholders' production and productivity.



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## Abbreviations and Acronyms

ADLI	Agricultural Development Led Industrialization
ADAs	Assistant Development Agents
ADD	Agricultural Development Department
ADDP	Ada Development Program
AISCO	Agricultural Input Supply Corporation
AISE	Agriculture and Input Supply Enterprise
AMC	Agricultural Marketing Corporation
ARDU	Arsi Rural Development Unit
AUA	Alemaya University of Agriculture
CADU	Chilalo Agricultural Development Unit
CBD	Coffee Berry Disease
CEEPA	Center for Environmental Economics and Policy in Africa
CSA	Central Statistics Authority
CIMMYT	International Wheat and Maize Improvement Center
DA	Development Agent
DAP	Diammonium Phosphate
EARO	Ethiopian Agricultural Research Organization
EIAR	Ethiopian Institute of Agricultural Research
ECM	Error Components Model
EMTPs	Extension Management Training Plots
ESE	Ethiopian Seed Enterprise
ESIA	Ethiopian Seed Industry Agency
FAO	Food and Agriculture Organization
FEM	Fixed Effects Model
GDP	Gross Domestic Product
ha	Hectare
HYVs	High Yielding Varieties
IAR	Institute of Agricultural Research



IFAD	International Fund for Agricultural Development
IFDC	International Fertilizer Development Center
ILO	International Labour Organization
kg	Kilograms
km	Kilometer
LR	Likelihood Ratio
ML	Maximum Likelihood
masl	Meters Above Sea Level
MCTD	Ministry of Coffee and Tea Development
MEDAC	Ministry of Economic Development and Cooperation
MPP	Minimum Package Programs
MOA	Ministry of Agriculture
MSFD	Ministry of State Farm Development
mm	Millimeter
NEP	National Extension Program
NFIU	National Fertilizer Inputs Unit
NGOs	Non-Governmental Organizations
NPK	Nitrogen, Phosphorous and Potassium
OPVs	Open Pollinated Varieties
PAs	Peasant Associations
PADEP	Peasant Agricultural Development Program
PCs	Producers' Cooperatives
RELC	Research and Extension Liaison Committee
REM	Random Effects Model
SCs	Service Cooperatives
SFYP	Second Five-Year Plan
SMSs	Subject-Matter Specialists
TLU	Tropical Livestock Unit
T and V	Training and Visit
VIF	Variance Inflation Factor
WADU	Wolayta Agricultural Development Unit

## Curriculum Vitae of the Candidate

Hailu Beyene Abera was born in Addis Ababa, Ethiopia on 20 January 1952. He obtained his first degree in Agricultural Economics in 1977 from Alemaya College of Agriculture, Ethiopia. He was employed as Assistant Research Officer in the Ethiopian Institute of Agricultural Research (EIAR) in 1978 in the Department of Socio-economics Research. In 1982, he was granted an FAO scholarship to pursue a Masters of Science in Agricultural Economics at the University of the Philippines. In 1985, he joined the EIAR and served as Reserch Officer until the end of 1999. He was promoted to Senior Researcher in August 2005. Mr Hailu was Division head and Department head of Socio-economic Research, project leader of Farming Systems Research, member of National task force for African Highlands Initiative and member of Research staff promotion committee. Mr Hailu has published 8 articles in proceedings and co-authored 3 articles in journals, 9 articles in books and 17 articles in different proceedings.

In 2000, he joined University of Pretoria to pursue a PhD in Agricultural Economics. The contribution of his dissertation was to add to literature that adoption is a dynamic process. The study employed a learning model and panel data set to analyze the effects of learning as a dynamic process using Xtprobit and Xttobit models, which are appropriate to analyze farmer's decisions over time. The results revealed that farmer's learning is one of the key factors in the adoption and intensity of use of improved *tef* and wheat technologies and increase production.