

**ASSESSMENT OF SOIL FERTILITY STATUS IN AGRICULTURAL  
LAND OF GUMA BLOCK IN WEST-CENTRAL BHUTAN**



**YADUNATH BAJGAI**

**MASTER OF SCIENCE  
(AGRICULTURE)  
IN AGRICULTURAL SYSTEMS**

**ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่**

**Copyright © by Chiang Mai University**

**All rights reserved**

**THE GRADUATE SCHOOL  
CHIANG MAI UNIVERSITY**

**APRIL 2006**

**ISBN 974-9892-00-3**

**ASSESSMENT OF SOIL FERTILITY STATUS IN AGRICULTURAL LAND  
OF GUMA BLOCK IN WEST-CENTRAL BHUTAN**

**YADUNATH BAJGAI**

**A THESIS SUBMITTED TO THE GRADUATE SCHOOL IN  
PARTIAL FULFILLMENT OF THE REQUIREMENTS  
FOR THE DEGREE OF MASTER OF SCIENCE  
(AGRICULTURE)  
IN AGRICULTURAL SYSTEMS**

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่

Copyright © by Chiang Mai University

All rights reserved

**THE GRADUATE SCHOOL  
CHIANG MAI UNIVERSITY**

**APRIL 2006**

**ISBN 974-9892-00-3**

**ASSESSMENT OF SOIL FERTILITY STATUS IN AGRICULTURAL  
LAND OF GUMA BLOCK IN WEST-CENTRAL BHUTAN**

**YADUNATH BAJGAI**

**THIS THESIS HAS BEEN APPROVED  
TO BE A PARTIAL FULFILLMENT OF THE REQUIREMENTS  
FOR THE DEGREE OF THE MASTER OF SCIENCE (AGRICULTURE)  
IN AGRICULTURAL SYSTEMS**

**EXAMINING COMMITTEE**

..... CHAIRPERSON  
Asst. Prof. Dr. Chanchai Sangchyoswat

..... MEMBER  
Assoc. Prof. Dr. Attachai Jintrawet

..... MEMBER  
Dr. Kanjana Chuenpichai

24 April 2006

© Copyright by Chiang Mai University

## Acknowledgements

This is to pledge my sincere gratitude to the Royal Government of Bhutan for providing me the opportunity to learn for this masters' degree, the Thailand International Development Cooperation Agency (TICA) for the financial support, and all the institutions and individuals involved for enabling the study happen.

It is a privilege for me to have Asst. Prof. Dr. Chanchai Sangchyoswat as my thesis advisor and I am highly indebted to him for his enthusiastic, invaluable and professional guidance and encouragement for this study, even at odd hours. He also lent me some important study materials. I am grateful to Assoc. Prof. Dr. Attachai Jintrawat, the member of my thesis advisory committee for his invaluable guidance and support through out this study. Further I would like to express my sincere gratitude to Dr. Methi Ekasingh for his support on the use of GIS and for providing valuable comments and suggestions. I would like to thank Ajarn Phrek Gypmantasiri, the former chairman; Assoc. Prof. Dr. Benchaphun Ekasingh, the new chairperson of the Agriculture Systems program and my academic advisor, Dr. Jirawan Kitchaicharoen for their continuous support and guidance. I am thankful to Dr. Kanjana Chuenpichai, my external examiner for valuable comments. Thanks are to due to all administrative staff, especially Ms. Woraluck Suteerawantana (Khun Om) for providing a homely environment and timely logistical support during the course of study.

For my field works, a number of institutions and individuals deserved a rightful mention. I am thankful to the Director-General of Department of Agriculture, Mr. Sherub Gyelthsen and his staff for their support during the course of my fieldwork. I would like to thank Dasho Dzungda, District Agriculture Officer and the RNR staff of Punakha *dzonkhag* for supporting my fieldwork in Guma *geog*.

In particular, I would like to thank Mr. Gaylong, ADAO; Tshering Dema, agriculture EA and Kinzang, forestry EA for their help during the questionnaire survey and soil sampling. I would like thank *Gup, Mangmi, Tshogpas, Chuipons* and all the three RNR EAs for their participation in AHP workshop. I sincerely thank all the farmers and *Tshogpas* for the time, help and responses to the questionnaire survey and soil sampling.

The Program Director of the National Soil Services Centre (NSSC) in Semtokha, Mr. Chencho Norbu provided me suggestions to improve my questionnaires. The Chemist, Mr. Jamyang and his team of technicians of SPAL under the NSSC who analyzed my soil samples are thankfully acknowledged. Mr. Tshering Dorji and Ms. Yeshey of the NSSC provided me with relevant study materials. The Program Director of RNR-RC Bajo, Mr. Sangay Duba supported me by providing access to soil augur for soil sample collection and by provided me with valuable comments. I am thankful to Mr. Doley Tshering, Program Officer for letting me use the GPS device of his office for my field survey. Thanks are due to Mr. Dungkar and Mr. Sonam Penjore at the GIS unit PPD, Mr. Nidup of NCD, MoA, for providing me with Guma geog GIS digital data and/or helping me download my GPS data to computer. Mr. Karma Tshering of Agromet Unit, CoRRB provided me the climate data. I am indebted to their support.

Thanks are also due to all AGS friends - seniors, mates and juniors: Rasmey, Bhim, Dophu, Kailash, 2 Ducs, Peires, Kumudu, Wattana, Ha, Bhuwani, Hasta, Rajendra, Khaing, Thanid, Sieng, Poch, Long, Manjula, Han, Wilawan and Soe Ma Ma for their friendliness and cooperation. I am thankful to my parents, my wife Dhan, all brothers and sisters, all in-laws, relatives and friends in Bhutan for their support and encouragement. This thesis is dedicated to my father Sri Tika Ram Bajgai and to my mother Sri Naina Kala Bajgai. I wish to thank everyone whose names could not be mentioned individually.

Yadunath Bajgai