

Table of Contents

Acknowledgements	I
Table of Contents	III
List of Tables	V
List of Figures	VI
List of Abbreviations	VII
Chapter 1: General Introduction	1
1.1 INTRODUCTION.....	2
1.2 LITERATURE REVIEW.....	5
1.2.1 Framework conditions of small ruminant production in Ethiopia.....	5
1.2.2 Small ruminant production in Ethiopia.....	8
1.2.2.1 Small ruminant production systems.....	8
1.2.2.2 Reproductive performance of Ethiopian small ruminants.....	11
1.2.2.3 Growth performance of Ethiopian small ruminants.....	18
1.2.2.4 Economic and marketing aspects of Ethiopian small ruminants.....	20
1.2.2.5 Adoption likelihood of small ruminant technologies.....	22
1.3 OUTLINE OF THE THESIS.....	23
Chapter 2: Small Ruminant Production in Two Mixed-Farming Systems of Southern Ethiopia: Status and Prospects for Improvement	24
2.1 INTRODUCTION.....	26
2.2 MATERIALS AND METHODS.....	27
2.2.1 Study area.....	27
2.2.2 Sampling and data collection.....	28
2.2.3 Data analysis.....	28
2.3 RESULTS.....	30
2.3.1 Household characteristics.....	30
2.3.2 Determinants of keeping small ruminants for a specific purpose.....	30
2.3.3 Competition and complementarities: land use and feeding.....	33
2.3.4 Informal insurance and sharing arrangements.....	35
2.3.5 Production problems.....	36
2.4 DISCUSSION.....	37
2.4.1 Purpose of keeping small ruminants.....	37
2.4.2 Challenges and opportunities.....	38
Chapter 3: Reproductive and Productive Performance of Small Ruminants in Mixed-Farming Systems of Southern Ethiopia	41
3.1 INTRODUCTION.....	42
3.2 MATERIALS AND METHODS.....	42
3.2.1 Study area.....	42
3.2.2 Sampling and data collection.....	43
3.2.2.1 Flock monitoring.....	43
3.2.2.2 Case histories.....	46
3.2.3 Data analysis.....	46
3.2.3.1 Reproductive parameters.....	46
3.2.3.2 Growth parameters.....	47
3.3 RESULTS AND DISCUSSION.....	48
3.3.1 Sex ratio.....	48
3.3.2 Distribution of lambings.....	48
3.3.3 Litter size.....	49

3.3.4 Age at first parturition	51
3.3.5 Reproductive problems	51
3.3.6 Annual reproductive rate	53
3.3.7 Flock structure	53
3.3.8 Growth parameters	56
3.3.9 Offtake	59
3.4 CONCLUSIONS	60
Chapter 4: Economic Performance of Small Ruminants in Mixed-Farming Systems of Southern Ethiopia	62
4.1 INTRODUCTION	63
4.2 MATERIALS AND METHODS	63
4.2.1 Enterprise budgeting	64
4.2.2 Net total cash income	65
4.2.3 Factors affecting the sale price of small ruminants	66
4.3 RESULTS AND DISCUSSION	67
4.4 CONCLUSIONS AND RECOMMENDATIONS	75
Chapter 5: The Adoption Likelihood of Small Ruminant Related Technologies in the Highlands of Ethiopia	77
5.1 INTRODUCTION	78
5.2 MATERIALS AND METHODS	79
5.2.1 Feedback workshops	79
5.2.2 Adoption likelihood survey	79
5.3 RESULTS AND DISCUSSION	81
5.3.1 Feedback workshops	81
5.3.2 Determinants of the adoption of feed technologies in Adilo area	83
5.3.3 Determinants of the adoption of household veterinary kit in Kofele area	89
5.4 IMPLICATIONS AND CONCLUSIONS	92
Chapter 6: General Discussion	95
6.1 SMALL RUMINANT KEEPING IN MIXED FARMING SYSTEMS	96
6.2 PERFORMANCE OF SMALL RUMINANTS IN SOUTHERN MIXED FARMING SYSTEMS OF ETHIOPIA	101
6.3 PRACTICAL POSSIBILITIES FOR IMPROVEMENT	102
6.4 THE ADOPTABILITY OF SMALL RUMINANT RELATED TECHNOLOGIES	108
6.5 THE "MARKET-SHED" CONCEPT	110
6.6 POTENTIALS AND LIMITATIONS OF THE METHODOLOGICAL APPROACH	111
Chapter 7: Summary	114
7.1 SUMMARY	115
7.2 ZUSAMMENFASSUNG	118
Chapter 8: References	121
Appendix	140
APPENDIX I. THE QUESTIONNAIRE USED FOR THE DIAGNOSTIC SURVEY	141
APPENDIX II. LIFE-HISTORY QUESTIONNAIRE FOR BREEDING FEMALES	149
APPENDIX III. THE QUESTIONNAIRE USED TO GATHER INFORMATION ON ADOPTION LIKELIHOOD OF TECHNOLOGIES AND INCOME-EXPENSE PARTICULARS.	150

List of Tables

Table 1.1 Age at first parturition of Ethiopian small ruminants	13
Table 1.2 Parturition interval of Ethiopian sheep.....	14
Table 1.3 Litter size of Ethiopian small ruminants	15
Table 1.4 Birth weight, weaning weight and average daily gain of some Ethiopian small ruminants under field and station management conditions.....	19
Table 2.1 Coefficients (standard errors) of logistic regressions for the objectives of keeping sheep and goats in Adilo area.....	31
Table 2.2 Coefficients (standard errors) of logistic regressions for the objectives of keeping sheep in Kofele area	32
Table 2.3 Constraints for small ruminant production reported and ranked by owners, by study area	36
Table 3.1 Number of households and small ruminants at the beginning of the study	43
Table 3.2 Definition of reproductive and growth traits.....	44
Table 3.3 Effect of site, parity and season on total litter size at birth of sheep in two study sites.....	49
Table 3.4 Pre-weaning mortality rates of small ruminants as affected by site and sex.....	53
Table 3.5 Least square means of BWT, WWT and ADG of sheep	57
Table 3.6 Least square means of BWT, WWT and ADG of Adilo goats	58
Table 3.7 Analysis of the annual offtake of sheep in the study sites	59
Table 4.1 Flock dynamics in the two study sites during the one-year study period	67
Table 4.2 Average small ruminant enterprise budget in the two study sites.....	68
Table 4.3 Net total cash income from livestock production compared to other farm activities in the study sites	69
Table 5.1 The definitions of continuous and categorical variables considered in the study	80
Table 5.2 The means and standard deviations of the independent variables used for the adoption likelihood study in the two study sites	83
Table 5.3 The adoption of commercial concentrate utilization among small ruminant keepers in Adilo	84
Table 5.4 The adoption of treating small ruminants through own application of veterinary kits among small ruminant keepers in Kofele.....	89
Table 6.1 Summary of similarities and differences between the two small ruminant production systems	98

List of Figures

Figure 1.1 Conceptual framework of the overall study.....	4
Figure 1.2 Satellite image of Ethiopia and its neighbours	5
Figure 1.3 Poverty, food security and natural resources degradation trap.....	7
Figure 1.4 Small ruminants are important components of the Ethiopian mixed farming systems	8
Figure 2.1 Annual pattern of feed shortage, by study area	34
Figure 3.1 The seasonal distribution of lambings in the study area.....	48
Figure 3.2 Reproductive problems of breeding ewes based on case histories	52
Figure 3.3 The distribution of male and female sheep of different age categories at the beginning of the study	54
Figure 3.4 The age-weight (month-kg) relationship of sheep at the beginning of the study period from newly born lambs to the yearlings (by study area)	56
Figure 3.5 The age-weight (month-kg) relationship of sheep at the beginning of the study period from newly born lambs to the yearlings (by sex)	56
Figure 4.1 The monthly average expenditure of households for their small ruminants ...	70
Figure 4.2 The annual expenditure of households for their small ruminants, by item	71
Figure 4.3 The proportion of household expenditure for different groups of small ruminants.....	71
Figure 4.4 The monthly average sale prices of sheep, by sex (a) and site (b)	72
Figure 4.5 The monthly distribution of sheep sales in the two sites	74
Figure 4.6 The monthly distribution of sheep sales of the two sex categories	74
Figure 4.7 The colour difference in grazing sheep (a) and the fattened animals on the holiday market (b).....	75
Figure 5.1 The utilization of native and exotic fodder trees in wet and dry seasons	86
Figure 5.2 The reported criteria for the choice of fodder tree species	87
Figure 5.3 Types of reported medication for small ruminants provided in the clinic or in the household	90