Addis Ababa University
School of Graduate Studies
Regional and Local Development Studies

SOCIO-ECONOMIC FACTORS INFLUENCING THE PRODUCTIVITY OF CROSSBRED DAIRY COWS: the case of small farmers of Chencha Woreda, SNNP region, Ethiopia

By: Tesfaye oyida

Approved by Examining Board	Signature
Dr. Bekure W/semait Advisor	----------
Dr. Muluneh W/tsadik Examiner	----------
Dr. Tesfaye Taffese Examiner	----------

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V List of Acronyms

AI	Artificial Insemination
AFRDA	Agriculture and Fishery Development Authority
DA	Development Agent
ETB	Ethiopian Birr
FAO	Food and Agricultural Organization
FSS	Ethiopian Food Security Strategy
FGD	Focus Group Discussion
GDP	Gross Domestic Product
HCDP	Highland Community Development Project
ha.	hectare
ILRI	International Livestock Research Institute
IFPRI	International Food Policy Research Institute
MA	Masters of Art
m.a.s.l	meters above sea level
MoFED	Ministry of Finance and Economic Development
MoA	Ministry of Agriculture
N	Nitrogen
PA	Peasant Administration
RDCO	Rural Development Coordination Office
SNNPR	Southern Nations and Nationalities Peoples' Region
SPSS	Statistical Package for Social Science
US$	United States Dollar

VI List of Definitions

Adapt	Acclimatize, become accustomed to
Adopt	Implement improved livestock technology
Appropriate technology	Technology that use local resources and affordable by local capacity
Bull Scheme (station)	A place where bull put and to serve cows
Concentrate feed	Byproduct of such as brewery factory;use as supplementary feed for animals
Crossbred	A breed found by crossbreeding of local bred with exotic bred
Dairy	Related (concerned) with producing milk
Herd	Group/ flock of animals
Intensification	to raise exotic blood as well as management level of dairy cow
improved technologies	Consists of improved breed, improved grass, forage and fodder, improved veterinary medicine
Smallholder	A subsistence farmers who were with diverse livelihoods.
Zebu	local cows, with out exotic blood
Zero grazing	stall-feeding of milking cow while it is in shed

VII Abstract

This thesis was designed with the objective of identifying the socio-economic factors influencing the productivity of crossbred dairy cows in Chencha Woreda. Together with this, the challenges and opportunities of dairying, traditional animal management practices and the likes were also assessed.

Crossbreeds were found to be concentrated at Chencha town and in peasant Keble administrations (PKAs) near the town. Of 110 households reported to have crossbred, it was feasible to include 100 households in the sampling frame. Already existing strata in the Woreda were used as strata in this study too, since one stratum vary from the other in such aspects as livelihood, experience in animal management and the likes. Using simple random sampling technique proportional to the population of the strata, 58 households were selected from the list of 100 households and covered in the survey and analyzed using SPSS (Statistical Package for Social Science) for window 12.

Although crossbreeds have been introduced to Chencha area before two decades, these years were not enough to achieve a minimum yield the government intended to attain (5 litters per cow per day) even in Chencha town where production is higher.

The study revealed that market and human assets (physical as well as mental assets such as labor, experience in dairying and educational background) together with marketing access were found to constrain crossbreed dairy production in the area. In general, in this study both 'farm land size' and 'income status' of a household related to amount of milk yield inversely. A widely existing thought that farm land size and income status of the households constrained the crossbreed production in the area found to have no ground in this study.

Population characteristics of households with crossbred have different structure than that of average for the district. Households with crossbred have more males and more working forces. The study has shown that crossbreed dairying has a potential to absorb labor force in excess of land in the area.

To increase the contribution of crossbred dairy production to local economic development, existing milk cooperatives need to be strengthened and small milk cooperatives (milk groups) have to be created in the area where there is no cooperative. Training and on- farm assistance in the area of animal management, record keeping and organic farming strongly needed. For fruitful intervention a household with larger labor size, traditionally experienced in dairy production and whose head is literate and younger can be targeted during training and service provision. The service delivery efficiency and way also needed to be improved.

CHAPTER ONE: Introduction

1.1 Background

Livestock sector contributes 12-16%, 30-35%, 12-15% and 33.3% of the total GDP, agricultural GDP, total export earnings and rural population employment respectively in Ethiopia (MEDaC, 1998; Ayele *et al.*, 2003). It provides food, inputs for crop production and soil fertility management, raw materials for industry, cash income, fuel for cooking, social functions etc. In the mixed farming system of Ethiopian highlands, on average sales of livestock and livestock products account for 83% of the total cash income of a household per year (Gryseels, 1988).

Most writers indicated that livestock play key role in poverty alleviation. Among these, World Bank (1996) mentioned that the life of poor are closely tied with livestock. Adams and He (1995) as cited in IFPRI (1999) also found in their study that about 25% of the incomes of the poorest 20% of the rural households in their sample come from livestock. However, the richest 20% received only 9% of their income from livestock. This is because, as to Adams and He, poor farmers prefer to invest in livestock than in anything else, particularly in dairy animals as a means to improve their asset and income situation. Rearing of livestock viewed as a form of investment with offspring as interest since the poor have limited access to financial institutions. Live animals act as food stores, particularly when risk of cropping is high. When crop yield is not enough to meet family needs, animals can be sold to buy additional food (Devendra *et al.*, 2000).

Dairy cow play an integral role in smallholder farm. Milk is produced every day and gives a sustainable income and its production is highly labor intensive to provide employment opportunity (deJong, 1996; Schlans, 1999). It is a source of high quality protein, minerals, vitamins and micronutrients essential for balanced growth. Milk is important in preventing malnutrition, since it is concentrated source of amino acids which is not found in vegetable protein or frequently eaten staple foods such as cereals (Tangka, *et al.*, 2002). Manure applied to farmland

improves soil texture, increases absorption of moisture, reduces run off and prevents crusting of the soil surface. Manure not only substitutes inorganic fertilizer, but also replace particularly on nutrient poor sandy soil with a low buffering capacity, where inorganic fertilizer cannot bring marked difference. As to deWit et al (1996) cited in IFPRI (1999), reduction in livestock due to the shrinkage of grazing land resulted in nitrogen deficiency that range from about 15 kg per hectare per year in Mali to more than 100 kg per hectare per year in the highlands of Ethiopia.

Ethiopia has 17% of Africa's cattle population. In spite of such a huge number, actual benefit to the owner as well as to national economy was exceptionally low. It provides only 5.1% of total African milk production (Adugna, 1990). This is because 90% of the Ethiopia's farmers are engaged in traditional livestock farming activities that based on local cow (of inferior genetic potential) and low input use (Alemu, 1982)

Among the Ethiopian cattle population, 73% is found in highlands. This is because of good soil condition, temperate type climate, evenly distributed rainfall and low disease incidence. However, the highland of Ethiopia is one of the poorest regions in the world, with per capita income of a little over US$ 100 (World Bank, 1996). The incidence of food poverty is 52%. Food production is less than a third of minimum calorie requirement per adult per day. Protein and energy malnutrition are widely distributed and affecting up to a third of all children and perhaps a higher share of pregnant or lactating women. They do not have sufficient resources to produce or the income to acquire quantities and qualities of food to ensure active and healthy life (FSS, 1996; Alem, 2005).

High number of population together with obsolete livestock management system resulted in degradation of highland fragile Environment. This is because, in traditional extensive system without supplementary feeds, about 39 kg of typical feed would be used to produce one kilogram of milk. However, the estimates in

peri-urban area showed that using Holstein-zebu crosses the amount of typical feed required per k.g of milk would be about 3 kg (Azage *et al.*, 2001). Hence, in extensive management system, over grazing has resulted so far in loss of plant diversity, reduced yield of pasture biomass, compacted soil texture, loss of soil organic matter, less water storage capacity and soil erosion. As to IFPRI (1999), the highland resources are totally utilized and hence exhausted. It cannot carry further growth of population. Similar conclusion from AFRDA, before three decades (in 1978) indicated that even the doubling of production of natural pastures for animals over the highlands would not produce enough extra feed to fill the present gap.

So far government has keen interest on development of Crossbred dairying. The official policy over the past decades has been promoting crossbreed cattle and complementary feed technology for small farmers to achieve milk yield of 5 to 15 liters per day per cow. This is on the basis that crossbreeds are more productive than the indigenous animals and that they lead to a more rapid increase in milk production. As to the objective nowadays, numerous crossbreeds (of indigenous cows with exotic Holstein Friesian and/or Jersey bulls) are made to exist at different parts of the country. However, the history of crossbreeds has been disappointing and the process of technology transfer has been so weak. The productivity levels achieved on the experimental stations are seldom achieved on smallholders' farms (FSS, 1996; Devendra *et al.*, 2000).

Although different factors are expected to contribute to the problem, as Kiwuwa et al (1983) hypothesized on their studies, socioeconomic and institutional factors such as land size, income, access to markets, population growth, land tenure policy, access to credit and extension programs play a key role in affecting the dairy cow productivity. This thesis is also designed to see which of these factors affect dairy productivity in Chencha highland.

1.2 Statement of the Problem and justification to the study

In Ethiopia, there is wide spread prevalence of protein and energy malnutrition affecting up to one third of all children and perhaps a higher share of pregnant or lactate women. This is because people subsist on diets that are almost entirely made up of starchy staple. Although the country has ample number of cows their productivity is very less to fill the gap.

As to information from Chencha Rural Development Coordination Office (RDCO), the productivity of crossbred in the Woreda was very low. The local government and non governmental organizations had been working to increase the productivity of crossbreed cow. Some of the works were: breeding program which was started in the area in 1990, the RDCO AI program which had been providing its service to local cows since 2003, crossbred heifer distribution (by HCDP project and World Vision Ethiopia) which had been promoted for about 7 years and establishment of more than four demonstration and multiplication sites of improved varieties of grasses, forages and fodder trees. Despite all these, crossbred productivity could not be improved. Farmers of the area were complaining that crossbred was only cost-sink. A wide body of literature mentioned that among other thing, the productivity is constrained by socio-economic factors (Kiwuwa *et al.*, 1983; Devendra *et al.*, 2000).

The official policy of government on dairy development over the past decades has been promoting crossbreed cattle for the reason that they are more productive. As to the objective, nowadays different varieties of crossbred were made to exist at different localities of the country including Chencha. However, it was reported that many early crossbred dairy development attempts failed because they were not appropriate in either technical or economic terms (Malcolm, 1999). But the case of Chencha has not yet been studied.

Highlands cover only 40% of total land area in Ethiopia. But it hosts about 88% of the human and 73% of the cattle population of the nation. It contributes about 95% of the regularly cultivated lands and 90% of the countries economic activities (World Bank, 1996).In Chencha, as part of Ethiopian highlands, due to such over pressure the fragile ecosystem has been degraded (Abera, 2006). Hence, for future, a means has to be devised to minimize herd size and then to sustain human population with reduced number of animals.

Due to its favorable climate, the high land provides suitable condition for introduction of exotic breeds (Holloway and Ehui, 2000). As to the report of Chencha RDCO, the disease and acclimatization were not as such a problem in the area. Hence, appropriate design, which considers socioeconomic suitability, is needed to exploit the opportunity.

Rapid increase in per capita income, urbanization and high income elasticity of demand for livestock products have increased in per capita consumption of animal products including milk. In order to meet the growing demand in Ethiopia, milk production has to grow at least at rate of 4% per annum. Nevertheless, the current growth rate is 1.4% per annum (Williams, 1995; Azage *et al.*, 2001). Towns close to Chencha, Arba Minch and Wolita Sodo, are growing at a faster rate and their demand for milk and milk products are also increasing at higher rate than the current supply in the areas. For example, half a litter packed milk, Shola and Mamma milk, costs 3.00 and 3.50 ETB respectively at Arba Minch.

Hence, bridging this wide gap calls for the design of appropriate and sustainable dairy development strategies based on socioeconomic, institutional and agro ecological circumstance. Besides these, smallholder conditions need great emphasis to make them able to be benefited from the growing opportunity.

1.3 Objectives of the study

General objective

General objective of the study is to assess and identify socioeconomic factors influencing the productivity of crossbred dairy cows and to draw conclusion for future interventions.

Specific Objectives

To assess animal management practice in general and dairy cow (both local and crossbreeds) management practice in particular.

To assess household characteristics, livelihood, traditional situation in relation to crossbred management

To assess practices of organic agriculture.

To assess milk yield of crossbreeds cow and zebu cows.

To assess challenges and opportunities of dairying.

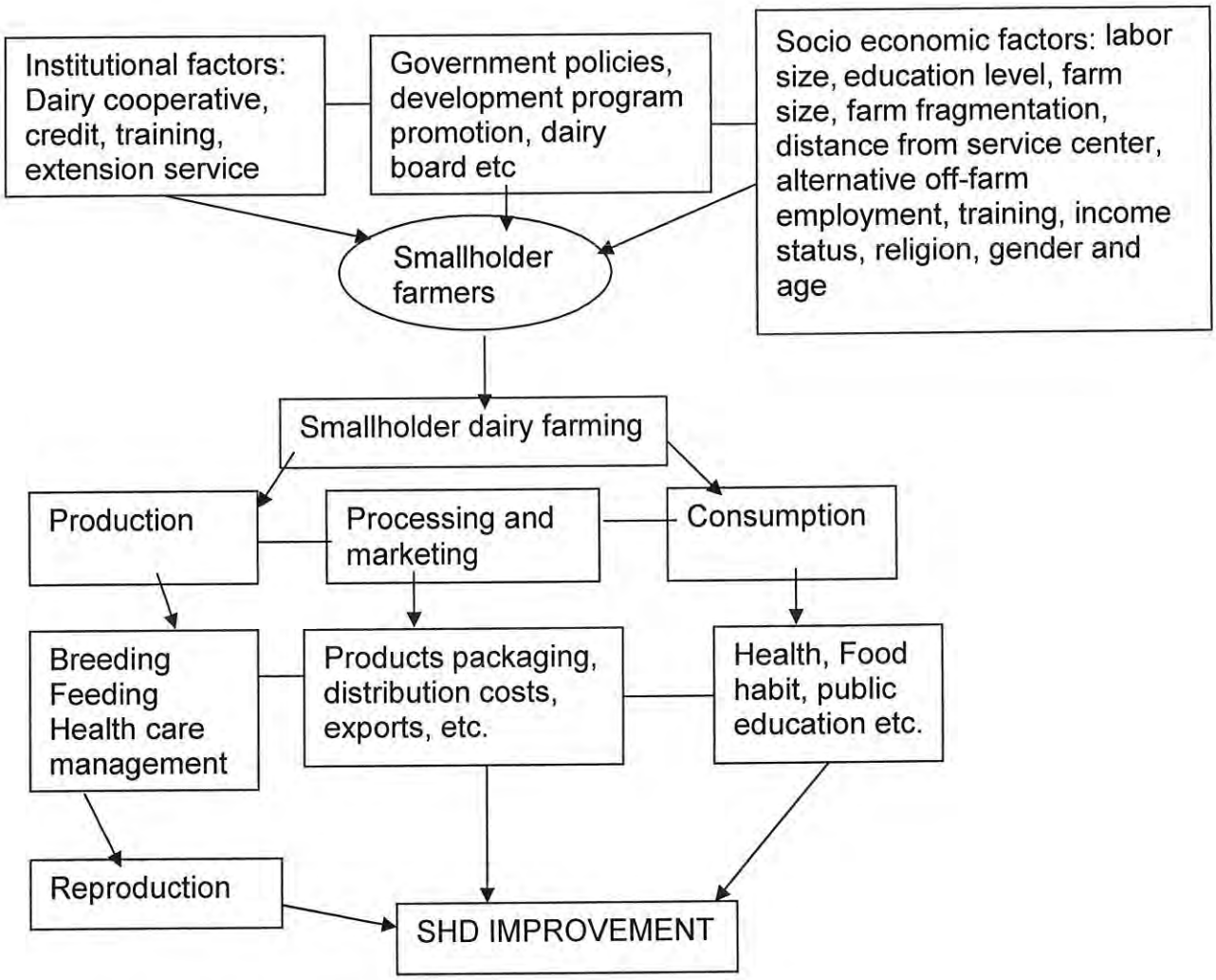
To see benefits of crossbred dairying.

To assess breeding situation in the area.

1.4 Conceptual Framework

Socio economic factors; household labor size, household head education level, farm size, farm fragmentation, distance of a household from service center, membership to milk cooperative, alternative off-farm employment, training, household income status, religion, household head gender and household head age influence a dairy farmer's decision whether to improve dairy operations. As shown in figure 1.1, if socioeconomic and institutional factors are conducive for a dairy farmer, a farmer will be able to improve the management level provided to his/her dairy cow. This means that the farmer can have access for: dairy inputs, services such as training, veterinary medicine, market for outputs. In such situation, a farmer expected to be equipped internally in such areas as income status, knowledge and experience, education and the likes. If such conducive situations are accompanied by conducive consumption culture,

then the over all result will be improved small holder dairying. Otherwise, the situations go in reverse direction. The farmer becomes less capacitated (less capital, less land size...), non-innovative (due to illiteracy, bad attitude and traditions...) and increases cost of inputs. It also reduces milk and its product prices, return to labor and capital which sum in under development of small holder dairying.



Adapted from Chantalakhana (1999)

Fig. 1.1 linkage of socioeconomic, institutional and policy factors with smallholder dairy improvement.

Having this concept as a ground, It is hypothesized that these selected 12 socioeconomic variables (household labor size, household head education level, farm size, farm fragmentation, distance of a household from service center, membership to milk cooperative, alternative off-farm employment, training, household income status, religion, household head gender and household head age) have influence on crossbred milk yield (dependent variable). Hence, the directions of influence of these socioeconomic variables up on crossbred milk yield are hypothesized as follows:

Productive household labor size is positively associated with the dairy cow productivity: this is expected because a household can allocate enough labor to manage the cow.

Household head education level is positively associated with the cow productivity: this is expected because educated person has better exposure to wider source of information and innovation and can process training and information knowledge in to practice in better way.

Farm size is positively associated with the cow productivity: this is expected because the farmer with bigger land can allocate larger land for grazing and planting of forages, fodder and grass.

Farm fragmentation (number of plots) is negatively associated with productivity of the cow: This is expected because it increases the idle time of family labor in traveling from one plot to the other.

Distance from Chencha town (service center) is negatively associated with the productivity of the cow. This is because the farthest farmer has less chance of getting access for dairy input from urban and has less marketing opportunities.

A membership to cooperative is associated positively. This is because cooperative has guarantee for stable market, price, and members share

experience from each other and utilize local resources of government and non-governmental organization in training and visiting programs.

Off- farm employment can positively associated with cow productivity. This is because if the dairy owner has other employment opportunity, the farmer will not be liquid cash constrained.

Training is positively associated with cow productivity: this is because it equips the farmer with knowledge of handling the innovation at hand.

Household income is associated positively with the cow productivity: this is because costs of keeping crossbred is significantly higher than local animals and hence farmers with better income is expected to invest more on the inputs needed for dairying.

Religion is negatively associated with the cow productivity: this is because crossbred cows disseminated from protestant church leaders at Tollola area and hence the followers of this religion might better exposed to the innovation.

Household head gender is negatively associated with the cow productivity: This is because females are usually poor in most of the socio economic aspects and hence they might not afford to manage the cow.

Household head age is negatively correlated with the cow productivity: This is because the oldest farmer is expected to be reluctant in adopting relevant livestock technology.

1.5 Methodology and Sampling techniques

1.5.1 Preliminary survey

Informal interview was conducted with the purpose of obtaining information for; development of the formal questionnaire and to be acquainted with the values of local people. There were no formal questionnaire posed on discussion, rather, interview was incited by the researcher and followed by discussion made by the informants on the issue under consideration. This was done a month before the formal survey.

1.5.2 Sampling area and sample size determination

Since the 7 strata slightly differ from each other in such aspects as livelihood, traditional livestock management, religion, language etc..., the existing strata was directly used as it was in this study. Of 110 households reported to have crossbred cows in the Woreda, 10 were locate in inaccessible areas and hence were not possible to include them in population to be sampled. Out of 100 household heads included in the population to be sampled, 54 household heads were in Chencha town, 17 in Doko, 11 in Sulla and 18 in Dorze(See table 1.1 and fig 1.2). Following this, total sample size was determined using the formula in (Cochran, 1977 as cited in Belayneh, 2005).

Accordingly, from the list of households 31, 10, 10 and 7 households selected from Chencha town, Dorze, Doko and Sulla respectively using simple random sampling technique, proportional to the population of strata. Respondents in the study were household heads together with its spouse and in cases where they were missing, other randomly selected household heads and its spouse were substituted. For analysis, household heads will be used.

Table 1.1 Distribution of study samples

Strata	Total households with crossbred	Total samples allocated	Proportion sampled (in %)	Kebles received samples	Female house hold head respondents	Average distance of households from town(travel time in minutes, one way)
Dorze	18	10	56	Holloo(6), Ayra (2), Laka(2)	6	60
Doko	17	10	59	6(Shaye) 4(Losha)	2	100
Sulla	11	7	64	Mafonazolo (7)	2	120
Chencha town	54	31	57	01(3) 02(15) 03(13)	4	30
Total	100	58	58	58	14	

1.5.3 Methods of Data Collection

Data for this study came from primary and secondary sources. A combination of methods was used to collect relevant data. These include field observation, informal interview, focus group discussion and semi-structured interview. Most of the methods were employed simultaneously and thus, clear boundary cannot be drawn between different methods used.

Data obtained from secondary sources also used to supplement the data in order to bridge information gap from primary sources. Secondary sources of information used for this study hence include published materials such as

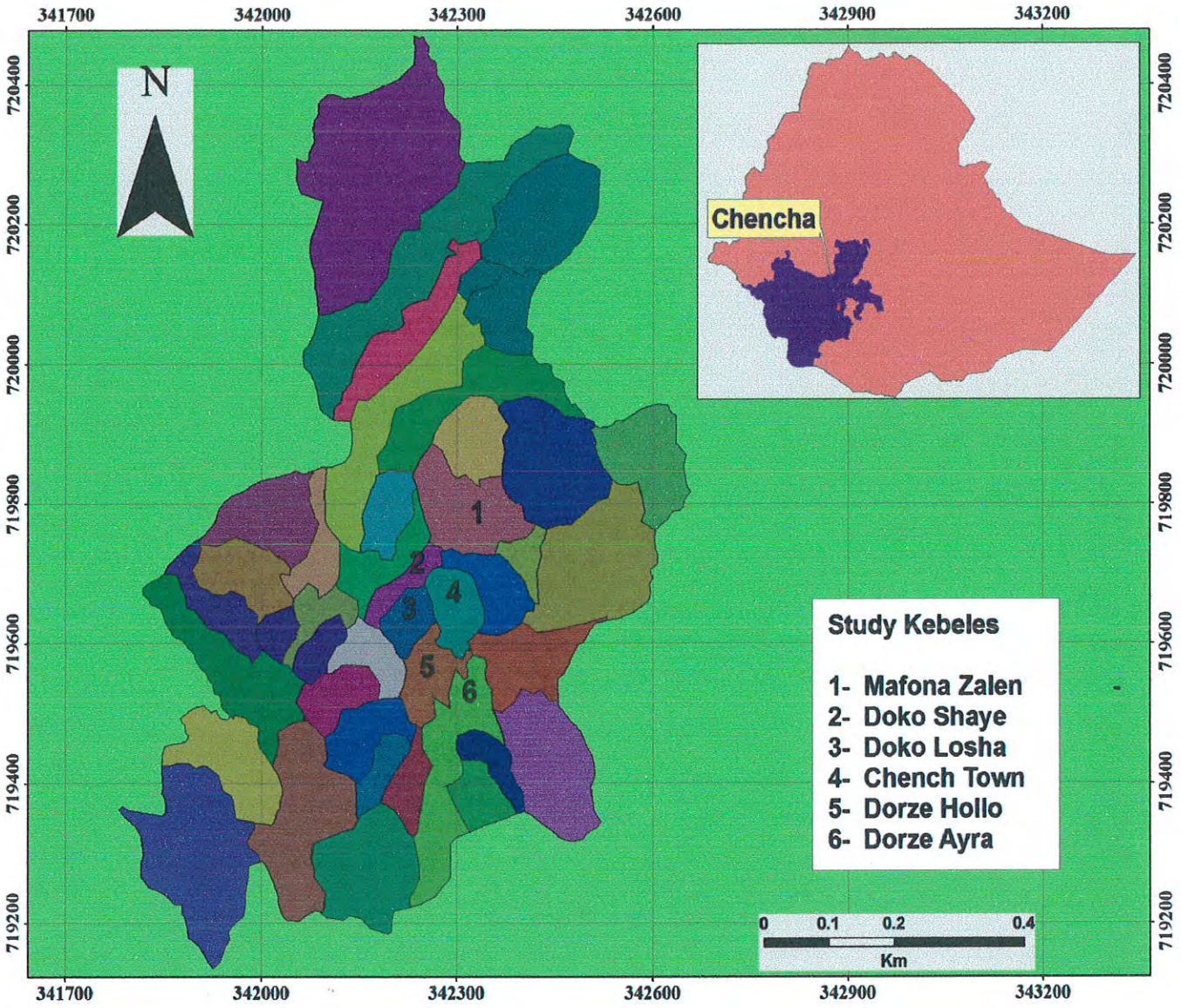


Fig. 1 2 Location of the Chencha wereda and sample Kebeles

Note that the current Dorze Laka is splited from Dorze Hollo PKA

reports, plans, official records, census records, project reports, research papers and internet/ web pages.

Semi- structured interview was the most important tool of data collection in this research. On the bases of information obtained from techniques discussed above and literatures, questionnaire was developed. Prior to implementing the survey, the questionnaire was used to train enumerators and tested for their clarity. Questionnaires that were found not clear to the local people and enumerators during training and testing were modified. The survey questionnaire covered a wide range of information which included household characteristics, farming system and local as well as crossbred husbandry and institutional issues from 4 areas of Chencha Woreda; Dorze, Doko, Sulla, and Chencha town.

1.5.4 Methods of Data Analysis

By the use of statistical package for social science (SPSS) for windows 12, descriptive and stepwise regression techniques will be used in the analysis.

The stepwise regression procedure hence, starts off by choosing an equation containing the single best socioeconomic variable, most correlated with crossbred milk yield, and then attempt to build up with subsequent addition of socioeconomic variable one at a time as long as the additions are worth while. The order of addition is determined by using the partial F-test values to select which variable should enter next. Eventually, when no variable in the current equation can be remoded and the next best candidate variable can not hold its place in the equation the process stops. Hence, the stepwise model chosen because (in such process) it extract out the strongest socioeconomic factors in influencing crossbred milk yield. Hence, factors which have policy implication can be easily identified. The model also can display two sources of variations in crossbred milk yield, i.e. regression (information about the variation accounted for by the model) and residuals (information about the variation that is not accounted by the model).

The regression equation takes the form

$Y=b_1x_1+ b_1x_1 + \ldots b_nx_n + c$

Where **b's** - are the regression coefficients, representing the amount (in litter) the crossbred milk yield changes when the corresponding socioeconomic variables changes in 1 unit.

X's- are the independent variables which include: productive household labor size, household head education level, farm size, farm fragmentation, distance of a household from Chencha town, membership to cooperative, alternative off-farm employment, training, household income, religion, household head gender and household head age.

Y- the milk yield of a crossbred cow in litter per day (dependent variable).

C- is the constant, where the regression line intercepts the y-axis, representing the amount the crossbred milk yield in litter per day will be when all the socioeconomic variables are 0.

After describing the model to be used, there is also a need to verify two of the selected socioeconomic variables. These are productive household labor size and farm size.

In the case of productive household labor size, from own experience on Gamo highland, the researcher categorized the age 20 up to 65 as able to contribute full labor needed from single average person while the rest ages, 15 to 20 and above 65 is considered as a half labor each. In Chencha case, the labor force at about 15 years of age and about 65 years of age participate in activities of agriculture, weaving (such as winding tread) and the likes and hence cannot be taken fully dependent. On the other hand, people at about 15 are physically weak, mentally not so developed and does not have enough accumulated experience to contribute labor needed from an average person. Similarly, people at age above 65 years of age are physically weak to practice heaver work on the ground even if they may be used as consultant for other workers. They can involve only in lighter works, which is not enough to consider them as a full labor. Other studies

in agriculture have taken age limit between 15 to 65 years and others go down to age 10 (Askalech, 1998). Nevertheless, in this study the researcher paid attention to the age at which the labor get full strength since dairy management is laborious than common crop production or local cow husbandry. After knowing the age of all the member of the households and calculated on the manner mentioned, the aggregated sum, 'productive working force', is used in this study.

The measurement of farmland size in Chencha Woreda is stated in Timad meaning the area of land ploughed in a day with a pair of oxen, which is determined by many factors like soil texture, slope, climate of the area, the strength of the oxen and the farmers etc. McCann (1995) and other scholars have taken 4 Timad as one hectare and the researcher has adapted this measure to show the farm size in rural sample Kebles. In the regression model, Chencha town households with no farmlands will be considered as if their farm size is 0.

1.6 Scope and Limitations of the study

The study is based on micro level analysis of the crossbred dairy production introduced to Chencha Woreda, Gamo Gofa zone of SNNP region before two decades. The findings of the study can be extended to other areas exhibiting similar agro-ecological and socio-economic situation may be with certain level of adjustment.

Generally, dairy production was affected by many factors like physical factors (such as climate), biological factors (such as disease, genetic make up...) and socioeconomic and institutional. The physical and biological factors are out of the scope of this study and are not included.

Data obtained may suffer from inaccuracies in some aspects of measurement. For example, farmers were reluctant to respond to questions related to income they get.

1.7 Organization of the Paper

This thesis is organized in five parts. The first part introduces the core of the thesis, raises the problem the paper tries to address together with the significance of the study and the objectives the paper expects to achieve by the end of the study. It also presents methodologies used to collect and analyze the data. The second part presents literature review. This part raises issues in relation to crossbred dairying: its accessibility to the poor, socioeconomic situation of developing countries with respect to the technology, its past history and the future and export and import status of Ethiopia in the sector. It also summarizes some previous socioeconomic findings. The third part describes the study area and issues related to climate, socio-economic situation and the likes of that particular area. The fourth part presents the result of the study. The paper ends at fifth part by presenting conclusion and recommendations drawn from the study.

CHAPTER 2: Literature Review

There are different thought whether the poor can be benefited from improved livestock development. There are also doughts whether crossbred dairying can be sustainably integrated in to smallholders mixed agriculture particularly in sub-Saharan countries.

2.1 Access to improved Dairy technology

Some 800 millions people in developing countries now suffer from malnutrition and hunger due to low production, unequal distribution, lack of market for inputs and out puts and lack of income to acquire adequate quantities and qualities of food (Mohammed, 1995). This situation is worse in Ethiopian highlands (World Bank, 1996). But temperate climate in the highlands allow the cross breeding of local cows with European dairy breeds which brought opportunity for smallholder farmers engaged in mixed agriculture and with less productive dairy breeds (Holloway and Ehui, 2000).

There is great debate whether economic gains brought by technological change and commercialization in agriculture work their way to the poor. Von Braun, (1995) mentioned that commercialization of agriculture has mainly negative effects on welfare of the poor. Waijenberg et al (1999) and Legwater et al (1991) also mentioned that improved livestock technology is accessible only to relatively wealthy people.

On the contrary, Devendra et al (2000) argued that the poor who have no diverse choices of livelihood prefer to invest in dairy animals as a means to improve their assets and income situations. Haan (1995) also stated that dairy development often benefits the poor and helps to reduce rural income inequality. Both Devendra et al (1995) and Haan (1995) agree that wealthier usually exceeds in

adoption since crossbred needs some resources to procure and establish but this is rarely followed by long-term commitment in management.

2.2 Socioeconomic, cultural and institutional situations of developing countries

The situation of developing country is diverse (with respect to socio economic and agro ecology) and hence it is not possible to draw consistent formula for different localities (Chantalakhana, 1999). However, farmers of developing countries in common have limited physical and financial resources (limited funds, subsistence production and limited education). They often do not have luxury of being able to select the basal diet for their animals. Hence, they use whatever available at no or low cost. The available resources are indigestible forages such as tropical pastures (both green and mature), corn stover, wheat straw, banana peel, sugar cane tops and other crop residues which are generally low in protein. When cereal crop residues are fed alone (with out pretreatment), it cannot create an optimum rumen environment for efficient utilization of feeds. This is due to its low and imbalanced mineral content (Leng, 1999).

Component technology interventions in the area of feed resources have been attempted but farmer's adoption has been poor. Numerous projects working in livestock improvement in developing countries deliver related technologies such as raising improved grass, pasture and fodder together with livestock. But farmers do not adopt the practice as a 'package', rather as individual components (Metz et *al.*, 1995).

Dairy is the primary and usually the only commercial activity of women. In households where intensified dairying is associated with zero grazing, the extra labor burden falls disproportionately on women. Some authors reported women as contributing 85% of the total labor to the zero grazing units of small holder farmers in western Kenya (Belavadi and Niyogi, 1999; Tangka *et al.*, 2000). How ever women are rarely targeted for livestock related training and extension

services. Information and training programs are generally directed to men. This is because; first, information given to men is expected automatically to pass to their wives. Second, women are less literate than men and will not understand the proposed technology and third, women are much occupied with house works and lack extra time to attend the training (Paris, 1992). Generally, obstacles such as lack of capital, access to institutional credit, lack of technical skills and access to extension services may affect women more than men and further limit women's participation and efficiency in improved dairy production (Tangka, *et al.*, 2000).

Crossbreds are more susceptible to disease and hence need higher quality service. On the contrary, service condition of developing countries, especially sub-Saharan Africa with respect to veterinary and medication are disappointing. Ineffective deliveries of veterinary services are major impediments to effective disease control. Resources allocated are limited in terms of both staff and therapeutic drugs. There are seldom sufficient numbers of veterinarian working in the region (Mohammed, 995; Phuket, 1999).

Smallholders do not pay attention to keep good records, which is basic for livestock protection as well as improvement. They do not have enough knowledge and they did not exposed to effective training and extension service to carry out such career. Some ambitious extension programs copy complex dairy record format from western dairy nations to confuse farmers instead of beginning with simple systems (Alumlamai, 1999).

The component of infrastructure surrounding agriculture such as: transport and communications net works, rural credit markets and organization and regulation of agricultural input and out put market are often seriously deficient (Williams,1995). In most developing countries lack of developed credit market for smallholders and the high cost of alternative source often make it uneconomical to invest in capital intensive dairying. This impedes investment in improved animals, new technologies and equipment. Problems with collateral, high cost of

loan portfolios and risks not easily covered by insurance all lead the investment on improved breed costly (Boer, 1999). With regard to credit provisions to farmers, procedures and interest rate levels tend to dominate as a major issue of credit program design, which the prerequisites for the sustainable, low cost and appropriately directed credit delivery systems with major farmer involvement were seldom, received low priorities at best. Mechanisms for participatory planning and involving potential credit recipients are either non-existent or poorly developed (Belaradi and Niyogi, 1999).

Smallholder dairying is labor-intensive activity. Utilization of it increased labor requirements, which some times compete with crop production, particularly in peak planting, sowing and weeding seasons.

Land price continue to escalate faster than general price level and faster than the value of the milk. This made acquisition of farmland to be used for dairying beyond the reach of smallholders. The price of concentrate feed has been rising over the last few years while the quality and availability of it have been declining. In the same manner, seeds of improved forages are also scarce and their prices are also high (Boer, 1999; Tangka *et al.*, 2002).

With respect to the market position, small producers of developing countries have weak position in the market. This is because, among other things, the perishable nature of milk. The dairy cooperative, which are expected to facilitate marketing in developing countries on the behalf of small dairy holder, are not very strong in business operations. Hence, dispersed rural dairy producers remain disconnected from the potential urban consumers and/or they are exposed to the exploitation of intermediaries (Chantalakhana, 1999; Devendra, *et al.*, 2000).

2.3 Experience with breeding and crossbred

Experience with crossbred has been uniformly disappointing in the circumstances of most smallholder dairying systems. The short term advantages of crossbreds are often not sustained after the promotion phases of associated development programs. The reason may be that the incremental benefits of crossbreeding do not always compensate the additional costs and risks associated with their introduction and management with out subsidy of the associated programs. These reservations apply particularly to smallholder subsistent production systems, where capital is limited relative to labor and/or land. Generally the genotype of imported crossbred found incompatible with the environmental conditions and with the available resources, including the knowledge and skills of the farmer (Egan 1999; Perera, 1999; Azage *et al.*, 2001).

From the Asian experience, as to Phuket (1999), several problems and difficulties were encountered in the implementation of livestock development projects and the results have not been as expected in most cases. Out of 10 post-evaluated projects related to crossbred dairying in Asia, eight were deemed not to have met appraisal targets of economic viability, while only two were considered to be partially successful. The reason was import of high producing breeds that are unable to adjust to local conditions.

In Ethiopia too, many of the crossbred animals distributed on credit to smallholder farmers are gradually transferred to larger commercial urban dairy herds (Azage *et al.*, 2001).

The major operational problems of cross breeding program in the villages are poor control of breeding process, shortage and non-replacement of exotic bulls, inconsistent and non-designated AI services and lack of supervision of the intended genetic progress. As the result of these, the goal of stabilizing blood level in the crossbreeds between 50 and 75% has not been achieved. Under

these circumstances, the advantage of cross breed cows cannot be sustained and hence the introduction of potentially more productive crossbreed cattle in smallholder herds does not necessarily lead to genetic improvement (Azage *et al.*, 2001).

So far, efforts have been stretched in developing countries to improve smallholder dairying, but its productivity has remained at relatively low level (Chantalakhana, 1999).

2.4 Reasons for over ambitious crossbreeding

On the face of population pressure and continuous shrinkage of resources, the low production potential of the indigenous cows cannot be tolerated any more as it was in the last times when the resources were abundant. (Belavadi and Niyogi, 1999). Developing countries have nearly 2/3 of the world's livestock but produce only about a fifth of its milk. In Africa, milk yield is almost 10 times lower (Ehui and Shapiro, 1995). Ethiopia comprises 17% of total Africa's cattle; however, it produces only 5.1% of Africa's total milk (Alem, 1985). Despite the importance of livestock growth in number, the growth in output has been slow in relation to potential in many developing countries (Williams *et al.*, 1995).

Crossbred cows, because of the higher potential to produce milk; have the capacity to respond to better feeding by increasing milk yield. However, indigenous breeds use higher proportion of the feed available for its maintenance rather than for milk production. Because of the natural conditions under which they evolved, indigenous breeds respond to better nutrition by accumulating fat in their body reserves (Azage *et al.*, 2001).

The absences of performance recording and poor spread of AI in most developing countries are the major limitation of selection programs for

improvement of indigenous cattle breeds for milk production. Besides, improving indigenous cows takes too long time. Assuming an animal genetic gain of 1% per year, it would take approximately 100 years to double the milk production of a herd with an average lactation yield of 1000 k.g (Taneja, 1999).

2.5 The future of dairy production

Shrinkage of agricultural and grazing land due to re-division of plots among one's heirs has been increasing pressure on already degraded grazing resources and this is inducing farmers to replace their local stock with a fewer number of animals of improved breeds (Williams *et al.*,1995). Rapid increase in per capita income of the demand, urbanization and high income elasticity of demand for livestock products have increased in per capita consumption of livestock product. Hence, the combination of higher demands for livestock products, greater number of people and less space (decreased grazing resources) is urging the transformation of the livestock sector in many developing countries.

Traditional resource based animal production systems in which remote pastures, grasses and indigestible by humans are converted in to high value animal products are being substituted by input intensive, science based animal production systems. The introduction of crossbreed cows and the utilization of complementary feeds and management technologies hence found to have the potential to raise growth rate of out put and cash incomes, improve food security and reduce environmental degradation (Holloway and Ehui, 2000).

The intensification of dairy production is nowadays a strategy being advocated to support smallholder dairying in mixed farming. The future will rely on continued adoption of management techniques to suit markets, environment and socioeconomic situations (Falvey, 1999).

2.6 Productivity of Cattle and Marketing situations

Ethiopia has by far more cattle but has less milking cows(Table 2.1). As to Mohammed saleen (1995) the country has up to seven million work oxen and there are 3 to 4 times more cattle than this, for oxen replacement. Work oxen provide farm power but are used for only 8-10 weeks in the year. All these compete on the same communal feed resources with other livestock.

Table 2.1 Cattle population, number of milking cows and yield per head in some regions and countries of Africa in 1994

Country/Region	No of Cattle Average $*10^3$	No of Milk cows Average $*10^3$	Milk yield kg/ head/year Average
North Africa	7,417	3,927	759.9
West Africa	39,438	4,780	242.7
East Africa	90,142	19,314	366.2
Central Africa	14,237	1,028	328.8
South Africa	41, 235	5,371	734.9
Ethiopia	29,450	3,534	208.8
Kenya	12,500	4,250	489.4
Somalia	5,000	1,350	407.4
Sudan	21,750	5,300	480

Adapted from ILRI (2000)

Productivity per head in Ethiopia is less than a half of that of Eastern Africa countries. Despite the large number of cattle, national and per-capita production of cattle products, export earnings and per capita food consumption from cattle origin in comparison to other African countries has been low and declining (Assegid 2000) as cited in (Ayele *et al.*, 2003). Since long ago, Ethiopian smallholders' dairy farm has not enjoyed benefit of economic development.

The country remained damping site for dairy products from developed countries (see Table 2.2). Existing production and rural marketing system cannot respond readily to the rising demand. On the other hand improvement in dairy technology in exporting (developed) countries provide better chance for consumers in tropical countries whose wealth is growing to have access to less expensive dairy products from those countries(Malcolm, 1999). Local governments of importing countries have resorted to an easy option of importing milk and milk products from developed countries either as food aid or commercially. Thus, a market force that could have been used for increasing the productivity of rural live stock sector has actually helped the live stock economy of developed countries at the cost of local producers (Belavadi and Niyogi, 1999).

Ethiopia remained inferior on the sector of export of animal products in general and dairy products in particular. The country could not be competent and cope up with the changing situations. The rapid economic growth in the countries importing Ethiopian livestock and livestock products has enabled their consumers to look for high quality product with adequate quarantine of food safety. On the other hand, supply conditions in Ethiopia remained virtually unchanged to meet rapidly changing market conditions in those countries. A major problem for exports from Ethiopia is that they have little knowledge about the market structure, rules and regulation as well as consumer tests and preference in the recipient countries. On the other hand, alternative suppliers who were better prepared and able to meet the market demand and conditions entered the market gradually replacing Ethiopia as a supplier (Ayele *et al.*, 2003).

Smallholder dairying in the tropics has not been a popular area for investment by multilateral and bilateral development agencies. Although much of this unpopularity is said to be related to the high level of protection afforded by the dairy industries in both tropical and temperate countries, there are also some suggestions that the lack of interests from financing bodies has been related to

Table2.2Export and import of milk and milk products in us $ in some regions and counties of Africa.

country/ Region	Total milk in liquid milk equivalent 1990-1992 $\times 10^3$ us$		Export of fresh milk 1990-1992 $\times 10^3$ us$		Butter 1990-1992 $\times 10^3$ us$		Cheese 1990-1992 $\times 10^3$ us$		Concentrated milk 1990-1992 $\times 10^3$ us$		Dry milk 1990- 1992 $\times 10^3$ us$		% of 1995 world Milk production (FAO estimates)
	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import	-
North Africa	639	601,449	190	3,430	249	214,341	3,876	72,267	112	67,980	337	530,797	-
West Africa	1,671	248,129	43	12,123	583	21,337	41	8,772	1,355	88,987	273	146,920	-
East Africa	587	51,187	71	1,327	263	4,370	19	1,929	37	3,328	469	46,442	-
Central Africa	26	43,469	0	2,194	0	4,528	0	5,548	18	17,910	1,3547	23,013	-
South Africa	32,904	161,386	1,923	25,710	3,331	15,389	1,247	33,536	16,741	34,037	0	92,260	-
Ethiopia	0	5,518	0	12	9	100	0	57	0	20	366	5,486	0.16
Kenya	475	1,507	63	0	254	1,167	12	0	36	124	0	1,382	0.46
Somalia	0	2,530	NM*	30	0	300	0	0	NM	0	NM	2,500	NM
Suddan	-	17,983	NM	Nm	0	290	0	40	Nm	17		17,967	0.59

Adapted from (ILRI, 2000)

* NM not mentioned

the export interest of more developed countries (Falvey, 1999). It is true that the dairy sector in developing countries does not always suffer because of comparative disadvantage but because of damping by developed countries. Appropriate policies are required to support suitable production environments (Sansoucy *et al.*, 1995).

2.7 Policy issues

Livestock sector in Ethiopia have been suffered from policy intervention due to anti-agricultural policy adopted by the most developing countries. Total annual expenditure of the Ethiopian government on agricultural research was about 0.25% of the then estimated GDP of Ethiopian Agriculture while the standard, as suggested by World Bank, is 1-3% of the agricultural GDP and with in agriculture, the service is concentrated exclusively to crop improvement but livestock improvement was entirely omitted from agents' regular work. Dairy animals play an integral role in complex smallholders' farming systems, however the institutional arrangements in Ethiopia have been treating livestock and dairy production as if it were an independent enterprise (AFRDA,1978; Ehui and Shapiro, 1995; Belavadi and Niyogi, 1999; Alem, 2005).

The current Ethiopian government clearly indicated, in food security strategic plan of 1996 and later on renewed in 2002, that promotion of crossbreed cattle and complementary feed technology for small, semi-market oriented farmers is among the strategy to insure food security and poverty alleviation. Azage *et al* (2001) also stated that the current government policy on dairy development is promoting crossbreed cattle for the reason that they are more productive than the indigenous animals and that they lead to a more rapid increase in milk production.

The common, accessible way to have crossbred is crossbreeding of local cow with exotic bulls. However, there are problems in developing practical policy

guidelines to ensure consistent approach with respect to crossbreeding policies. It is not well defined and is uncoordinated with regard to the control of level of exotic blood in crossbreeds at farm level (Devendra *et al.*, 2000). As the result of these, the goal of stabilizing blood level in the crossbreeds between 50 and 75% has not been achieved (Azage *et al.*, 2001).

Williams et al (1995) mentioned the cause of primary policy failure in developing country as promotion of inappropriate technology. These policy often target level of technology such as imported dairy cattle or rapid upgrading of local breeds, which cannot be supported by appropriate policies and other inputs such as feed and animal health care or by current level of farm management skills. Animal or necessary inputs were often supported by subsidized loan packages.

2.8 Influence of socio economic factors on improved dairy husbandry

Benin *et al* (2002) mentioned that direct and parallel relationship exists between the decisions to adopt a crossbred animal, the decision to produce surplus milk and the decision to marketable quantities. Hence, in this, summary factors stimulate smallholder farmers to adopt crossbred cow and/or improved livestock technologies and hence help to enter into market are assumed to be factors stimulating smallholder farmer to produce more milk.

The study of Benin *et al* (2002) on northern high lands of Ethiopia showed that increased household labor, improvement in access to markets, access to own land, male household head sex and increased participation in credit and extension program targeting livestock have had significant positive impacts on adoption of improved livestock technology.

Distance to market causes marketable surplus to decline. This is because distance is highly correlated with quality and as the distance increase quality of milk declines rapidly. As to the finding, for each one hour reduction in return time to walk to the milk group, marketable surplus increased by about 3.5 litters.

Education and visits by extension agents cause marketable surplus to increase. As to Benin et al (2002), for each additional year of formal schooling of decision maker in the household, daily marketable surplus increase by about 0.3 litters and for each additional visit by an extension agent, increases by almost 1 litter. Hence as Benin *et al* (2002) concluded: for increased milk production institutional innovations should be accompanied by infrastructure, knowledge, work experience in dairy, market and asset accumulation in the household.

The existence and short distance to cooperative or milk group has positive impact on adoption of improved livestock technology. Because it is capable of pooling very small deliveries, one or two litters, of milk from individual smallholder dairy farmers. It also offers an assured market and attractive price by eliminating the intermediaries (Belavadi and Niyogi, 1999). Malcolm (1999) mentioned that key principles underlining the establishment and operation of marketing cooperatives are to do with bargaining power and economies of scale in activities. It effectively reduces transaction costs. It also gives other services than milk sales such as animal breeding, health care, feed and credit facilities in Kenya (Devendra *et al.*, 2000).

Nicholson *et al* (1999) finding showed that loss of animal due to disease and perception of additional work and management complexity were some of the reasons for lack of interest on adoption of improved livestock technology by farmers.

Waaijenberg (1994) studied adoption of improved livestock technology with respect to location, availability of off-farm employment, experience in dairying, availability of farm labor and farm size. As to the study: households located in the higher rainfall climate zone in Kenya are less likely to adopt the technology, perhaps because of the higher agricultural potential of this zone allows greater flexibility in the choice of agricultural enterprises, of which dairying is one. In the same manner, the availability of off-farm employment also limits interest in the

new technologies; migrants from the other part of Kenya who are experienced in dairying had a higher probability of adopting, probably due to greater exposure to the technologies in Kenya highlands from where many of the migrants originated. Crossbreed animal require more time of man power for care and feeding than local cattle; the probability of adoption increased as land farmed increased, although the effect of an additional acre of land was relatively small. This seems to indicate that the amount of land does not markedly constrain farmers wishing to adopt improved animals.

Nicholson *et al* (1999) finding indicated that inappropriateness of technologies suited to the current household strategies and objectives. In the finding, it was also mentioned that most of the adopters of the dairy cattle were relatively wealthy and able to employ hired labor.

CHAPTER THREE: Background to the Study Area

Chencha Woreda has diverse physical and socio-economic attributes. As highland, it is suitable for many crops and animals including crossbreeds. This part is dedicated to describe those attributes.

3.1 Physical Attributes

3.1.1 Location

Chencha Woreda is one of the 13 Woredas in Gamogofa zone, SNNP regional state. Geographically it is located between 37^0 29' 57" to 37^0 39' 36" to the east and 6^0 8' 55" to 6^0 25' 30" to the north (see Fig. 1.2). The Woreda is bounded by Arba Minch Zuria Woreda in the south, by Kucha Woreda in North West, by Ditta Woreda in the West, by Boreda Woreda in North east and by Merab Abaya Woreda in the east direction. Together with neighboring Woredas, Chencha makes Gamo highland which is a continuation of Ethiopian central highlands that extends to southern Ethiopia through the Western escarpment of the rift valley.

3.1.2 Climate

Traditionally, a climate is classified in to three in Ethiopia. These are Dega, Woina Dega and Kolla zone. This classification is based on altitudinal differences. Most writers take the area which is below 1500 m. a. s. l as Kolla, between 1500 and 2400 as Woina Dega and the areas above 2400 m.a.s.l as Dega (Alemneh, 1990). According to this classification and as to the information obtained from Chencha Woreda RDCO, the Woreda consists of two traditional climatic zones, namely Woina Dega and Dega. The Dega part is comprised of 37 peasant keble administrations (PKAs) and 3 town Kebles of the total 50 Kebles. It hence contributes for the largest part (82%) of the total land area, where as the

remaining 8 PKAs and 2 town Kebles (18%) are categorized under the Woina Dega agro ecology. Generally, the altitude extends from 1600 to 3200 m.a.s.l. The minimum and maximum temperature is 4 and 21 degree centigrade, respectively. The Woreda receives an annual rainfall of 900 mm. to 1200 mm. and the rainfall has bimodal nature. Hence, the Belg that extends from February to mid June has short rains and Meher that extends from mid of June to September is the main rain season.

3.1.3 Vegetation, terrain and soil

The natural forest except in sacred places has dwindled due to population pressure that caused increased demand for arable land, fuel wood and other uses. The dense forest that covers the hill (particularly in areas which have worship value) and big trees sparsely scattered on farmland provides a rare glimpse of what Chencha highlands must once have looked like before they were transformed by hoe and horn. As to the survey of RDCO in 2003/4, of a total of 45000.8 hectare of land, natural, cooperative, state and private forest covers 6186.05 hectares (13.75%) (Table 3.4).

The study also indicated that only 3% of the Woreda land is of gentle slope, 17% is hilly, 65% is of undulating nature and 15% is rugged. Hence, highly rugged and undulating nature of the land has forbidden the community to extensive modes of agriculture for decades.

The soils are developed on highly weathered volcanic rocks (basalts) and they are shallow to moderately deep and reddish brown in color. Very shallow and unproductive, lithosols are confined to the severely eroded steeper parts of the Woreda (Teshome, 1999) as cited in (Abera, 2006).

3.1.4 Traditional classification of the Woreda

The Woreda has 50 Kebles of which 45 are rural peasant keble administrations (PKAs). Traditionally the Woreda has about 7 sub areas (strata) of which one stratum is slightly differ from the other in some of the socioeconomic aspects such as: livelihood, tradition of animal management, culture, language etc. These areas are Dorze (10 PAs), Doko (14 PAs), Aezo(8 PAs), Shama (4 PAs), Gema (5 PAs), Sulla(4 PAs) and the rest 5 were town kebles (see Fig. 3.1). Crossbreds were concentrated in Chencha town and strata close to the town. This is because all the crossbreeding program, AI service and crossbred heifer distribution by NGOs were concentrated only in town and PKAs close to the town. Even if it differs in some aspects, people inhabiting all the strata belong to Gamo ethnic group. Among the seven strata, four which are close to the town briefly described below (See also fig. 3.1 and note on the map that the name of most keble in Dorze, Doko and Aezo are preceded by the name of stratum).

Dorze: comprises of 10 PAs and 1 town Keble. Their livelihood bases are weaving and agriculture. They are Orthodox Christianity followers. Although bull station (cross breeding scheme) is on their land and they were close to it, they were very late in adoption of improved livestock technology. Traditionally they were not good in livestock management.

Doko- they are agriculturalist and additionally doing trading activity.
Sulla- they were dominantly agriculturalist. Both Sulla and Doko were Protestants.
Chencha town- most of the crossbred cows of the town were found in Tollola, sub area found at the eastern periphery of the Chencha town. Tollola community was more diverse in culture and better exposed to innovation (might be due to foreign church missioners since they were around the missionery camp). They established Tollola milk producers' cooperative, Chencha fruit marketing

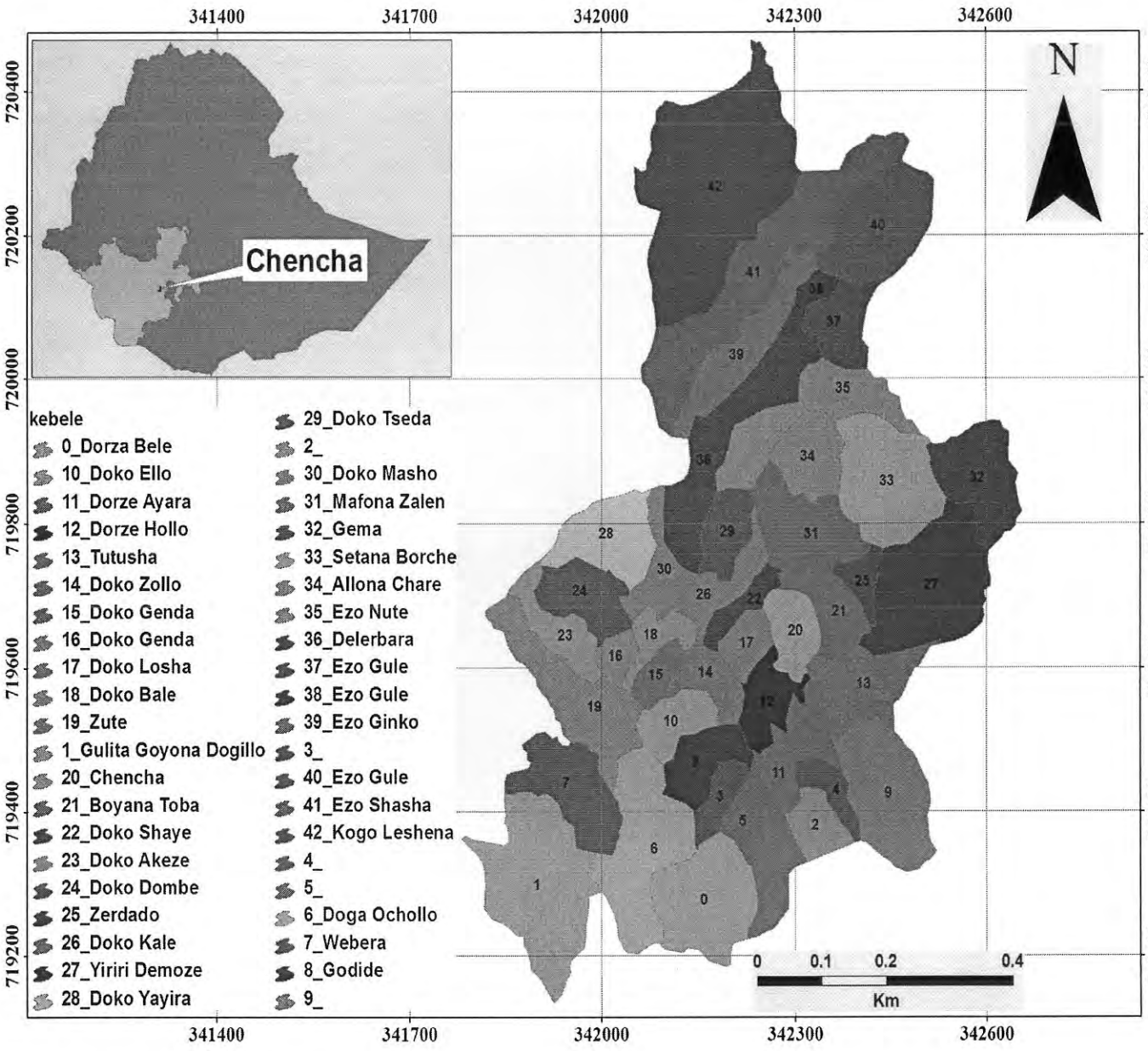


Fig. 3.1 Kebles of Chencha Woreda

Note that most Kebles of Chencha wereda are preceded by the name of stratum

cooperative and the bull station. Households in Tollola received about 90% of the service from the Church project.

Most of the households in Chencha town were organization employees. Chencha town has totally 3 Kebles and Tollola lies in both 02 and 03 Kebles.

3.2 Socio-economic attributes

According to 2003/04 survey of the RDCO, Chencha has a population of 106,450. Of these, 45% is male and 89.15% is rural, with population density estimated at 1.95 persons per hectare.

3.2.1 Demographic Characteristics

In the Woreda, 62% of the population is at the age less than 19 (Table 3.1).

Table 3.1 Population, age and sex category of Chencha Woreda

Age category	no of population		Total	% of each age category
	male	female		
0-9	16781	20495	37276	35%
10-19	12945	15806	28751	27%
20-30	4078	4965	9043	8.5%
31-50	11987	14635	26622	25%
51-60	1198	1449	2647	2.5%
above 60	958	1153	2111	2%
Total	47947	58503	106450	

Source: Chencha RDCO

As the table shows, there are more people in lower age group and the number decrease as age increases (except in the case of the age class between 20 and 30). Higher number of population in lower age and lower number of population in higher age is common phenomenon of underdeveloped countries where birth

and death rates are higher with relatively low life expectancy. In the coming few years, this people need school accommodation and other social services like that of their elders. In addition, those who are coming to adult hood are going to reach marriage age and will need their own land in the near future which will aggravate the demand for land.

The age group 20-30 is almost missing. At this age family members cannot secure cultivable land from their parents. Traditionally, male member of a family can not secure farm land unless his father gets died or he gets married. Hence, until the time of inheritance reach, he migrates away from the area to where wage labor is quite better. For females too, this age is too early to get married and employment opportunities in the area are not enough to make them stay there. Hence they descend to low land in search of opportunity. As social experts of the area revealed, works of lowland which do not demand expertise knowledge such as traditional fishing at Lake Chamo, weeding agricultural crops, fence making etc. at and around Arba Minch town were fully dominated by the highlanders.

In the Woreda of the total 106,450 people, 55% are female and hence the sex ratio of female to male was 82:100, which do not balanced. If the specific cases of Kebles observed, as the information found from Dorze (Holloo), Doko (Shaye) and Sulla (Mafonazollo) Keble administrations indicated, the number of female is much greater than male in all Kebles but the difference is much more in Dorze(Table 3.2).

Table 3.2 Sex ratio of Sample Kebles

Keble	Male	Female	Total	No of households	Sex ratio(female to male)
Dorze, Holloo	380	682	1062	350	56:100
Doko, Shaye	865	899	1764	266	96:100
Sulla, Mafona zolo	855	947	1905	371	90:100
town(03)	3182	3476	6659	874	92:100

Source: Keble Administrations

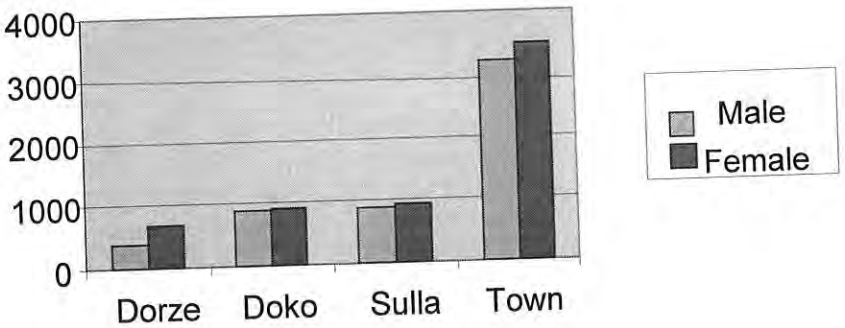


Fig 3.2 Sex distribution of sample Kebles

The sex ratio of female to male in Dorze Keble is 56:100 (Table 3.2). In Dorze area except wage employees or student, an adult man rarely stays. They migrate to Addis Ababa or Shashemene where there is better market for their 'shema' (different garments produced by weaving). Besides lack of market for 'shema' on which they are inherently skilled, the reasons for migration are diverse. Some are: shortage of resources such as small land size, lack of knowledge in modern agriculture, unawareness and low usage of agricultural inputs such as fertilizes and improved seeds, low productivity of; land, livestock, labor, and higher size of unproductive family. Although they have diverse basis of livelihood, none of

these were productive to sustain their family.

As to the key informants, Doko and Sulla people also migrate but do not go far as Dorzes. They usually migrate to Chencha town and Dorze areas in search of wage labor and return to home in planting and sowing season. Generally on average, agricultural production from own land covers only about quarter of food need of a household and hence households should search for other means to cover the gap (Table 3.3). Note also on the table 3.3 that wage labor contribute 15.2% and livestock and its product contribute about 27.7% of the livelihood.

Table 3.3 Share of income from different livelihood basis of Chencha Woreda

Source of livelihood	**Rank**	**%**
Food crop production	1	25
Cash crop production	5	11.2
Sales of live stock	2	15.2
Sales of livestock products	4	12.5
Wage labor	2	15.2
Petty trading	6	7.8
Petty commodity production (honey, clothing, Tej, Tella)	7	5.3
Firewood and charcoal production	8	3.5
Food aid	9	2.8
Loans and remittances or food gifts from friends	10	1.5

Source: World Vision Chencha ADP

3.3 Crop and Livestock production

3.3.1 Land use and management

i) Land use

The land reform of 1975 has put all land under the ownership of the state with each and every peasant, who is on the land and cultivating it, given usufiuctory right up to a maximum of ten hectares. Government can redistribute the farm land whenever needed and each member of PA is expected to secure land through PKA. However in Chencha Woreda, land ownership for all rural Kebles is secured from inheritance through family line. All male members of a family have right to claim land when ever they get married or his parents die.

As documented by the RDCO in the year 2002/3, the total area of the Woreda is about 45000.8 hectares. Of these, 27523.05 hectares of land is under agricultural crops. From the land covered by agricultural crops the coverage of; root crops 8%, stem crops 6%, cereals 15.7% and leguminous crops 6% etc.

Table 3.4 types of land use in Chencha Woreda 2004/5

Type of land use	Area (ha)	Percentage distribution
Annual crops	24420.54	54.27
perennial crops	3102.51	6.89
Grazing area	3446.85	7.66
Natural Forest	2510.5	5.58
Cooperative Forest	1668.7	3.71
State forest	695	1.54
Private forest	1311.85	2.92
Rugged areas	7137.85	15.86
Others	707	1.57
Total	45000.8	100

Source: Chencha RDCO

ii) Fragmentation and land holding size

As to the tradition, one used to inherit land from the paternal and the maternal line. While sharing the land among family members, the equity both in size and quality of land (such as fertility and terrain situation) is need to be maintained, i.e. each member of a family is expected to receive from each kind of land at different places. Due to such division and re-division, farmlands owned by each family member (peasant) were fragmented and scattered.

In the Woreda, 74.5% of the total farmers owned less than or equal to 0.5 ha land size, 6.5% owned 1-1.5 ha land size, 3% owned 1.5 – 2 ha land size and the rest 16% own land of size more than 2 hectares.

3.3.2 Crop production

Farmers in all sample Kebeles produce twice a year; however it is known that in some areas of the Woreda, with higher altitude, farmers produce only once a year. Two seasons, the Belg, short rainy season support 35% of the annual total production and the long rainy season (Meher) contribute the rest 65%.

Although the rainfall starts at its normal time, the amount at its start, in most part of the Woreda, is inadequate to plant crops. While at its mid season, erratic and excessive nature of the rain affects the performance of the crops. In some years, the cessation of season's rain is also elongated. For example, the Belg rain some times extends up to the end of May and this has negative effect on the performance of crops.

i) Types of Crops produced

As the area has dominantly Dega agro ecology, it is suitable for the production of crops such as barley, wheat, sweat potatoes and the likes.

Table 3.5 main crops and land productivity per hectare

Crop type	**productivity per hectare, in quintals**
Barely	8
Potatoes	50
Wheat	8
Sweat potatoes	45
Teff	4
Maize	10
Peas	6
Millet	8
Beans	6
Carrot	150
Telba	3
Onion	210

Source: Chencha RDCO

ii) Traditional method of fertilizing the soil

Farmers traditionally adapted soil fertility maintaining mechanisms such as fertilizing the soil with manure, inter cropping, crop rotation and the like. Traditional method of preparing and using manure is laborious. Manure alone is usually not enough for vast agricultural crops since manure from local cattle is inferior in both amount and quality. To increase the volume, manure usually mixed with grasses and leaves, which are used as beddings for animal.

Before using, manure has to stay up to 4 months until it looses its stickiness and get dried. Then it is scattered on farmland during sowing or planting. Dried manure is also comfortable to transport to plots at far. Farmers, whose plot is near to communal grazing land but far from home, collect manure from the communal grazing field instead of carrying it from home.

If the manure is wet but to be used, it is spread on surface and given to sunshine few days before sowing or planting. Dried manure is sold as any other item in Chencha area. Urine is not prepared and given to crops as manure. But its channel dug from animal shed (usually they share common hut with humans) to garden. Usually inset is the main recipient of urine.

Land is not left fallow unless it is needed to put under grazing. This is due to smaller size of the land. Instead of fallowing, different mechanisms used to maintain land fertility. Rotation of cereal crops with inset is among those mechanisms. Inset needs much more manure through which the land has access to get more nutrients. Other crops such as potato that demand more manure is also used in rotation with cereals.

iii) Usage of modern agricultural inputs

The types and amount of agricultural inputs were very much limited both in terms of coverage and type of provision. For example in 2006, as information from Chencha Woreda World Vision ADP indicated, only 5.5 quintal improved maize seed with 22 quintal DAP fertilizer as a package was given for few extension Kebles. However, as to RDCO report, the farm land highly responds for the use of inputs such as fertilizer.

The diseases and pests such as barely flies, late and early blight of potatoes and bacterial wilt of inset are the main constraints of agricultural production. Farmers do not have tradition of using pesticide and herbicide and other inputs such as chemical fertilizer due to shortage of supply at the time they need it and lack of affording capacity. There was no favorable credit access for farmers to purchase agricultural inputs.

3.3.3 Traditional livestock production

i) Types of Livestock raised

Some of the important livestock of the Woreda are cattle, donkey, sheep, goat, horse and mule.

Table 3.6 the number of important animals of the district.

Animals	TLU*
Cattle	30954.7
Ox	4536.7
Ox calf (Woifen)	6125.2
Cow	12356.4
Heifer	52365.4
Donkey	58
Sheep	3662.3
Goat	611.3
Horse	4171.2
Mule	311.2

*Conversion factor used into TLU was: Sheep & goats, 0.1; Horse, 0.8; Donkey, 0.5; all cattle, 0.7 (Jahnke, 1982 in Habtamu, 2006)

Source: Chencha RDCO

More number of sheep in the area than other livestock (Table, 3.6). Rearing of sheep is viewed as a form of investment, which is ready for use whenever needed since there is limited access to financial institutions. Sheep acts as food stores or bankbooks, which will be used particularly when risk of cropping is high. When crop yield is not enough to meet family needs or in any emergency cases, it can be sold. Sheep is also needed for its manure of high nutrient value. As the focus group discussion (FGD) revealed, a person may be said rich in community: if he has 1.5 to 2 hectares fertile land of which part of it close to stream, 2 milking cows, able to produce 5 quintal per year, 4 oxen for ploughing and up to 50

sheep. Oxen for ploughing were not numerous as other animals. The reason is the terrain, which has undulating nature, and hence uncomfortable for oxen ploughing and farmland was very small which made oxen use uneconomical. Instead digging hand tool called "*Tsoyle*" is widely used. Horses used for manure transport to plots. As indicated by the RDCO report, outputs of animals per annum were: milk in litter 1,890,600; butter in kg 290,826 (crossbreeds' and local cows' milk and butter aggregated together); Animal skin in number 700.

ii) Dairy cow productivity

Even if the number of dairy cows is very high, their productivity is very low. There are about 17,652 cows of which about 300 were expected to be crossbred. The average milk yield per annum per cow hence estimated to be 107.1 litters. Local cows on average give milk nearly for 6 months and hence the average milk yield per cow per day is hence about 0.6 litters(if calculated on 10 months basis thinking the case of crossbred cows, the average per day would be much less). The presence of about 300 crossbred cows and higher daily productivity in Chencha town due to better production inputs and management might raise the average. Otherwise, local cows in the Woreda had been giving an amount less than 300 ml per cow per day.

The low productivity is due to low input for cows. They were usually tethered on grazing land whether there were enough grasses or not. Otherwise they would join to free grazing group where cattle of a "gott" graze together and the responsibility to keep is given in turn to members. Usually, community land and bush land are grazing spot. They get drinking water only once a day.

However, dairy cow in its milking season is treated in better manner. They stay most part of the day at home (zero grazing). It shares human's food such as potato and inset tuber and leaf. Inset leaf is chopped and treated by bole or maquado (salty soil found at the shores of Lake Abaya) and given to cow. Bole or maquado is also mixed in water and given to it.

According to Mc Dowell (1985) as cited in Adugna (1990), both Bole and maquado supply: inadequate amount of Phosphorus (P), adequate amount of Potassium (K), Cupper(Cu) and Zink(Zn) excess amounts of Calcium(Ca) and extremely excess amounts of Sodium(Na), Iron(Fe) and Manganese (Mn). (Enyew *et al.*, 2000) also said that non-conventional feeds can be mixed with basal diet or other ingredients (mineral supplements) to complement nutrient deficiencies since nutrition of such dairy farm is usually based on low quality hay/crop residues.

iii) Access to grazing land

Access to grazing land (both private and communal) has continually been reduced due to the fact that: private pasture lands are being converted to farm lands due to over population and heritage of lands in a large family. Communal grazing lands have been used for construction of such as farmers training center, schools and other public institutions. Reduced access to grazing land shifted pressure to the remaining land, which is now over grazed. Not only the size of grazing land but the quality and number of livestock were also decreasing. The reasons, as the researcher understood from different sources were:

- Poor pasture quality and reduced access to grazing land forced farmers to sell their livestock.
- Farmers' poor management style
- Animal diseases, like black leg, internal and external parasites (though not exaggerated).

3.2.4 Institutional resources linked to livestock in the Woreda

In Chencha Woreda, there are many governmental sector offices, NGOs and social institutions. The Woreda RDCO Veterinary medicine section was among resource-starved sections and its services cover only 10% of the district's

livestock. Its annual budget was about 22,000 birr for about 100,000 animals in the district. The section had only one vet doctor, one vet assistant and one breeding technician for the whole Woreda.

Apart from vet medication, the office has been giving Artificial Insemination (AI) service. From the right establishment, October 2003 up to now, the service has been given to 219 cows and 38 cows calved. Of these 18 were females. These were not included in the survey for they were not yet calved and this might be due to low management level to which they had been exposed.

The church development program owned HCDP (Highland community development project) and a bull station. From 1990 until 2006, the station gave service for 1706 cows. From these cows 424 calved male while 639 were females and for the rest 643, no information is documented. In the 16 years of age, the station used 16 different bulls for service. It also distributes crossbred heifers for farmers in the package.

World vision Chencha ADP and Arial Safety net program were also involving in such livestock development program.

Besides, there were two milk producers' cooperatives. They were young (the oldest one is established in June 2005) and struggling a lot to stand on their own feet.

With respect to credit facility besides commercial bank, Wisdom and Omo microfinance institutions exist in the district. The wisdom microfinance gives credit for small enterprise at 12.5% interest rate and for agricultural investment at a rate of 15%. This is due to the fact that in the agricultural credit, the loan is paid back at the harvesting season after a year. Credit for micro enterprise is usually disbursed for shorter period.

The staffs of the wisdom institution teach farmers on the concept of investment at their respective Kebles. Farmers then required arranging themselves, in-group of about 6. The group members are used as collateral for one another. The Keble was also required to write supporting letter for each member claiming the type and amount of resources (such as land, cattle…) each member has.

Groups from some Kebeles such as Mafona Zolo are not allowed to borrow money from the Wisdom MFI for their senior groups were not trusted in paying.

The discussion with the office revealed, as the business institution, it is not worth to stay in the area. People overall do not have the idea of investment and fear to be indebted.

Generally; shortage of land, lack of income generating means and bad attitude toward credit remained challenge for crossbred dairying. On the other hand, presence of supporting institutions (cooperatives, credit institutions etc…) and better labor wealth found to be opportunity for crossbred dairying. Besides, crossbreds already adapted to climate and hence acclimatization and other ecological factors such as disease were not the big problem for dairying in the area.

CHAPTER Four: Results and Discussion

4.1 Results

This part is dedicated for assessment and analysis of household characteristics, animal husbandry practices, challenges and opportunity of dairying (crossbreds), condition of organic agriculture and crossbreeding program all with respect to surveyed households and their respective areas.

4.1.1 Age and sex distribution

Age connotes 'labor' which is the main inputs to crossbred dairy production. Most of the heaver activities in dairying left to stronger member of the family. The other members of the family participate in the rest of dairy activity in accordance to their age and efficiency.

Table 4.1 Age and Sex category of sample Kebles

strata	Age category				Male (in %)	Female (in %)	No of surveyed households
	<15 (in %)	15-20 (in %)	21-65 (in %)	>65 (in %)			
Dorze	27.1	27.1	41.7	4.1	52.1	47.9	10
Doko	37.7	24.5	32.1	5.7	67.9	32.1	10
Sulla	55.6	11.1	33.3	0	37.5	62.5	7
town	37	17	44	1	51	49	31
sum	36.9	19.4	41.5	2.2	51.9	48.1	58

The age class 21-65 was more than the rest age classes in Chencha town and Dorze whereas in Doko and Sulla it was exceeded by the age class <15. Comparison with in the sample Keble shows that when distance from the Chencha town increases, the number of population in this age class decreases.

This is for the reason that farm land is not enough to hold all the productive labor force and no other opportunities than agriculture to be employed in Sulla and Doko. These together with chronic famine push this age group not to stay in the area. As the discussion with FGD both in Sulla and Doko revealed, the situation is becoming worsened because land size getting smaller and smaller but number of population is increasing at faster rate.

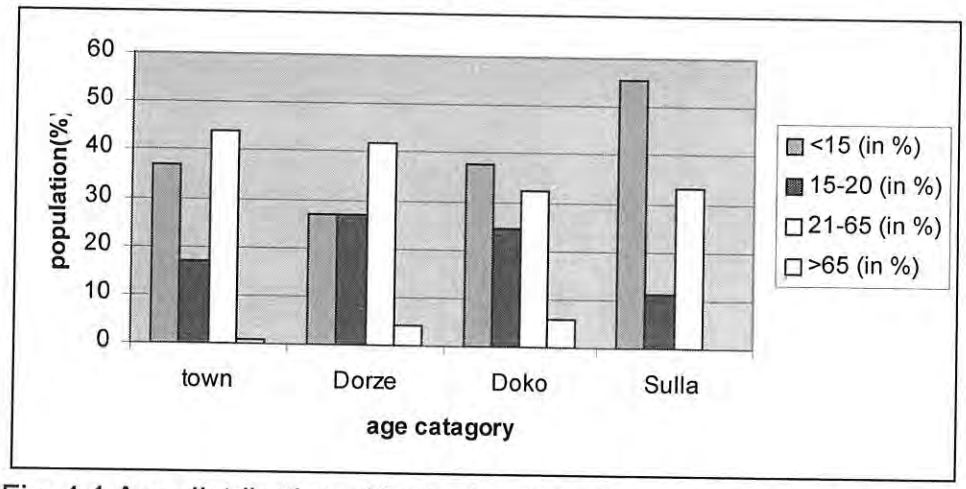


Fig. 4.1 Age distribution of household members in sample areas

Hence, when compared to the Woreda's data, (62% of the total population is of age less than 19; table 3.1), households with crossbred seem to have better labor wealth. As the discussion with milk producers cooperative head at Tollola indicated, the households with crossbred differ from households with out in that the former hire wage laborers (More than two third of surveyed households in Chencha town responded so) to help with the increased workload. As it was found, most of the hired laborers came from surrounding communities such as Sulla and Doko. The financial benefits of dairying were thus shared among both owners of the crossbred cows and others in the local communities.

Table 4.2 Household size versus productive working force

stratas	surveyed HHs*	Average household size(AHHS)	productive working force(PWF)	Ratio: PWF to household size
Dorze	10	6.1	3.2	54.1%
Doko	10	6.63	3.6	40%
Sulla	7	6.4	2.6	36.6%
Urban	31	6	3.8	66.2%
sum/average	58	6.28	3.3	48.8%

*Households

The dependency ratio in sample Keble was 47.5% and average household size (AFS) was 6.28. AHHS was higher than the report of RDCO 2003/4 for the district that was 5.

With respect to sex composition, male population is slightly more than that of female in households with crossbred, except in Sulla (on average 51.9%)(Table 5.1 and Fig. 5.3). However, the aggregate data for the whole population of PKAs indicated that female population was by far more. For example, the aggregate data of Dorze Holloo Keble showed that 64% of the population of the Keble was female(Table 3.2). Hence, it seems that the crossbred brought an adjustment in traditional household structure both in aspects of age as well as sex.

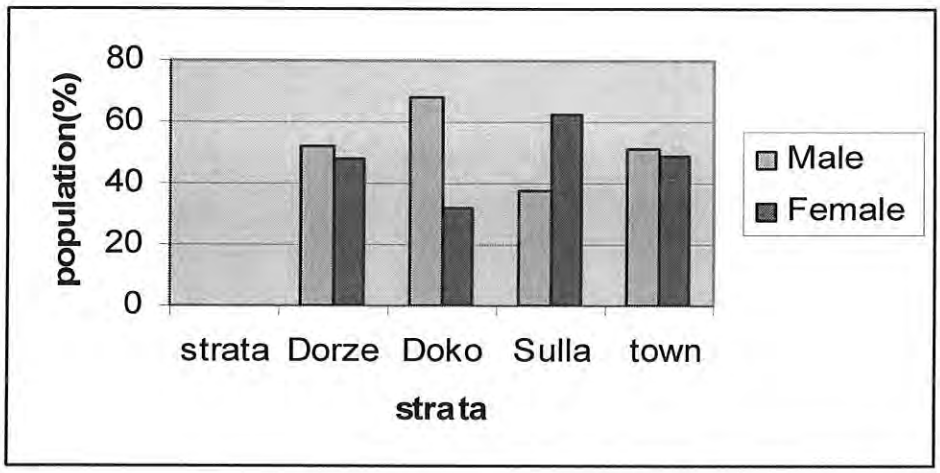


Fig. 4.2 Sex distribution of households in sample areas

4.1.2 Organic agricultural practice

Land size is too small to leave it fallow. Manuring was hence the widely practiced method of increasing agricultural production. The manure of cattle, horses and sheep were commonly used.

The available quantity of manure was not enough to supply farm crops. Hence farmers used to make compost. However, 60.34% of households surveyed did not make compost. The reasons for not making, as responded, include labor shortage, lack of knowledge, lack of material and preparing it is tiresome

In Chencha, households should have at least a kind of livestock for manure. This was because depletion of soil fertility was a major constraint to agriculture, since the use of inorganic fertilizer was low. Besides, in the area agricultural land was more of nutrient poor sandy soil and hence even when the inorganic fertilizer was applied, crop yield does not maintain under continuous cultivation. One of the household head (surveyed) in Sulla mentioned that he received crossbred cow from his friend to keep and share the benefit as per local agreement. Hence, the owner and the keeper were taking a half share of butter and milk each. Besides, from two consecutive borne calves, only half of one of the calf belongs to the keeper households and the rest one and a half belong to the owner. As the wife of keeper man mentioned, benefit from the cow were not compensating the cost incurred on it but keeps it merely for manure.

In most cases, animals graze freely or tethered along roadsides and fallow land. This made collection of manure difficult, which reduces integration of animals with cropping. use of manure for fuel and selling were also remain as obstacle for integration. Only one household from Chencha town found selling manure but all households use cow dung as fuel for cooking at least during dry season.

Anyway the integration of crop production and animal rearing could be clearly observed even if it was weak. Crops provide a range of residues that used as a feed for animals; improved forages, fodder trees and grasses planted at farm boundary, around fence and on terraces (used for soil conservation) provide feed for livestock (although it is very little). Livestock also provide draft oxen for land preparation and manure to maintain and improve soil fertility. Income from sales of livestock and livestock products were used to purchase agricultural inputs. Except 4, none of the surveyed households were using modern agricultural inputs.

4.1.3 Livelihood, off-farm employment and income

Although the Woreda RDCO report recorded some how optimum amount of agricultural production per hectare for each type of crop (Table 3.5), which at least could support larger proportion of annual need for subsistence, the reality on the ground did not justify that. Chencha is food insecure Woreda and surveyed households cover only 3 to 6 months from own produce.

Copping mechanism, to cover food deficit months of the year, vary with in strata. Working as wage laborer (Doko and Sulla) and weaving (Dorze) were typical for males where as females mostly practiced petty trading (Dorze and Doko) and firewood and charcoal selling (Sulla). Hence, diversification into non-farm activities is a survival strategy in the area. Households rely on diverse activities to meet basic needs. Among the surveyed household heads, 31, 8, 3 and 2 had off-farm employment opportunities in Chencha town, Dorze, Doko and Sulla respectively (table 4.3).

Table 4.3 Employment alternatives of surveyed households

Areas	Crop production	salary based employment	Horticulture production	Animal raising	Weaving	Petty trading	Self * employee
Dorze	10	-	6	10	4	3	1
Doko	10	-	10	10	1	2	
Sulla	7	-	7	7	2	-	-
Urban	-	24	24	31	4	-	3

* includes such activities as woodworking, distilling areke and Tella (local drinks) making.

During sowing and planting time all households in rural keble administrations were quite occupied by agricultural activity and in the other season they are intensively doing their other businesses.

4.1.4 Farm and grazing land

The total area of cultivated land owned by the sample households was about 33.98 hectares, from 27 households surveyed in three areas. The average land holdings of sample households was 1.7 ha. in Dorze, 0.9 ha. in Doko and 1.14 ha in Sulla. This assures that crossbred might need better-off farmers with respect to land holdings since the average for the Woreda is about half a hectare. All sample areas fully depend on rain-fed agriculture. Mixed farming systems that include crops and animals practiced and major crops include barley, wheat, sweat potatoes, beans and peas.

With respect to farm fragmentation, farm was more fragmented in Sulla and then at Dorze. Nevertheless, farmers at Dorze relatively travel shorter distances to reach to their plot than the farmers in the rest of areas (Table 5.4). As FGD with farmers at different areas revealed, fragmentation has advantages as well as drawbacks. From the drawback sides, it reduces farm owner's productive time while walking from one plot to the next. Difficulty in control and supervision increase with plot number, since wild animals and theft were the main constraints of the production in the area. It need labor and time to transport manure from

home. From its advantage side, FGD at Dorze mentioned that more plots might have more wastelands around plots, which could be used as alternative for grazing.

Table 3.5 main crops and land productivity per hectare

Table 4.4 fragmentation and time taken to travel to farthest plot from home

kebeles	Number of plots			Time taken to travel from home/minuts		
	maximum	Average	minimum	maximum	Average	minimum
Dorze	5	3.3	2	25	10.3	<5
Doko	4	2.6	1	35	30	15
Sulla	8	4	2	40	20	15

With respect to grazing land, on average surveyed households' private grazing land were of size 0.23 hectare in Doko, 0.13 hectare in Dorze and 0.29 hectare in Sulla

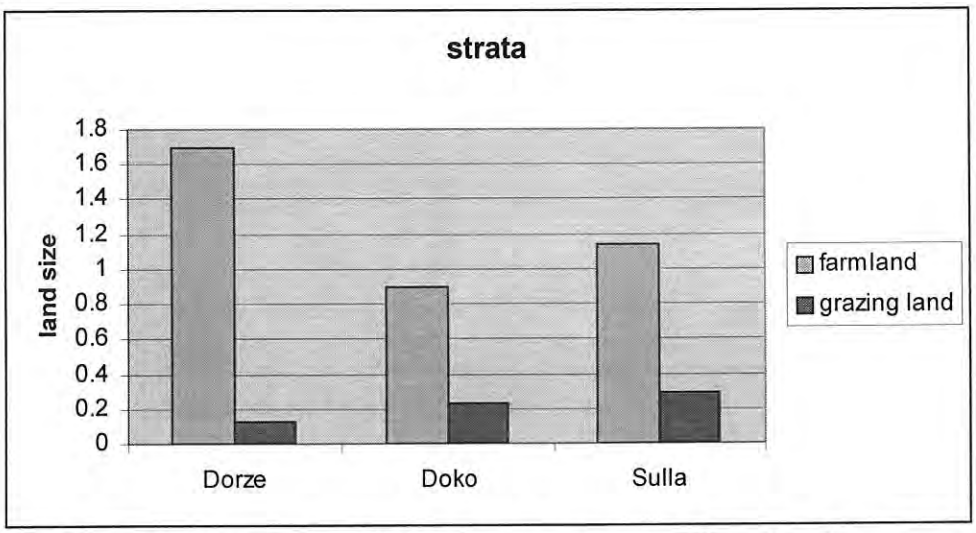


Fig 4.3. Proportion of private grazing land to total farm land

Although Dorze farmers have relatively larger farm lands they allocate less lands for grazing. They have larger communal grazing land than other areas and hence extensive grazing systems were commonly practiced. Among the surveyed households, 5 were sending their cattle to the 'Gott' grazing group and contributing money for wage laborer who take responsibility of keeping. On the

other hand, in Sulla and Doko where communal grazing land was smaller, households used to tether their cow on private lands (see Table 4.5).

Table 4.5 Traditional systems of crossbred management

Kebles	HHs* stall feed	HHs Tether	HHs Extensively graze	HHs stall feed & tether
Dorze	10%	10%	50%	30%
Doko	20%	50%	10%	20%
Sulla	20%	60%	10%	10%
Chencha town	45%	6.5%	35.5%	20%

* Households

Most of the grazing lands were degraded since they were under heavy pressure. As FGD revealed, let alone for the crossbreeds, the size and productivity of grazing land cannot support the local cows. Planting of *Eucalyptus* trees for fuel wood on such small grazing land worsen the situation. Of course, fuel wood was another serious problem in the area as grass since there were no natural forest in the near by.

Attitude toward livestock also remained as one of the bottleneck for livestock husbandry. If a household allocates its good farm land for grazing (particularly in Sulla), the head was understood by the community as lazy and weak. To leave farmland for grazing, it has to be used for many years and proved not productive. But nowadays, the situation is becoming difficult to maintain such tradition. Every household needed to have at least a kind of plot for grazing. Otherwise, could not find place to tether its animals. The size and productivity of communal land was decreasing and grazing on communal land was usually forbidden three months before "Meskel" holiday. This was for the reason that the land would have some time to restore its production capacity. Bylaws concerning communal grazing land were strong and enforced by penalty, 5 birr for small animals (such as goat

and sheep) and 10 birr for larger animals (cow ox...). During the time of surveying, it was observed that farmers were interested to negotiate to improve the bylaws because in June, July and August all the rest lands were under agricultural crops.

Concerning planting of improved varieties of animal feeds, only one household in each of Doko and Sulla and 3 in town planted at the farm boundary, on terraces and around fence. A lot of demonstration sites exist in the town and at its vicinity with high biomass yielding varieties of grass and fodder. In the last few years the HCDP project made improved grass planting as mandatory for those who included in its heifer package. Despite all these, the adoption rate was very poor.

4.1.5 Management practice of crossbreed dairying

Households which were said to be good in crossbred husbandry found to stall-feed their crossbred for most of the day while the rest tether or extensively graze. No households fix themselves in any of the single practice (stall-feed, tether or extensively graze) rather mix of the practices commonly used. The practice used for most hours of the day was presented in figure below as households responded.

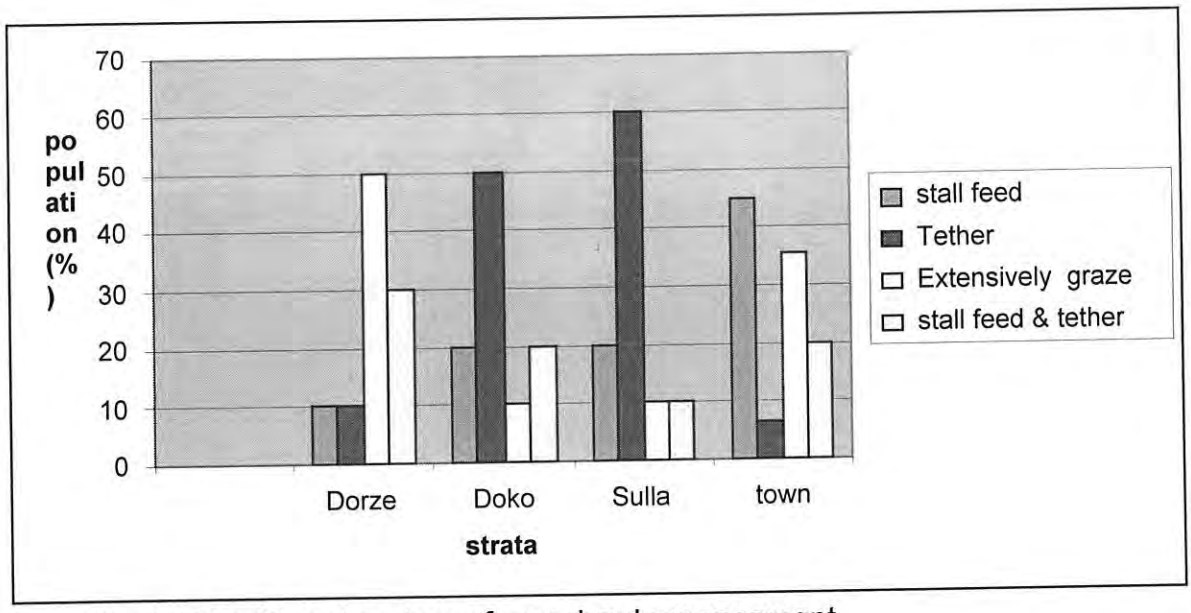


Fig 4.4 Traditional system of crossbred management

In Chencha town, 45% of the farmers stall-fed their animals for most hours of the day. It is amazing to see 35.5% of households join their crossbreeds to 'woddie'(local grazing group). Only 10% of the surveyed households at Dorze stall-fed their crossbred.

With respect to concentrate feeds as FGD revealed, its price was escalating whereas its quality was deteriorating from time to time. Among the surveyed households, 51.6%, 10%, 20% and 20% in town, Dorze, Doko and Sulla were buying concentrate feeds to their dairy cow respectively. For the rest, the reasons for not buying include, among other things, lack of affording capacity and lack of access.

As observed, farmers were shifting from holding more local cows to holding one or two crossbred cows. Among the surveyed households, 30%, 60% and 35% in Dorze, Sulla and town found to have both crossbred and local cow.

The milk yields of zebu cows living together with crossbreds were found to be higher than the average for the Woreda, 0.6 litter per day per cow(Table 5.6).

The reason, as mentioned by households, was zebu cows were sharing feeds of crossbreeds.

Table 4.6 Milk yield per cow per day in surveyed households

Strata	Average milk yield per cow per day (crossbred)	average milk yield per day per cow(zebu cow)
Dorze	2.97	1.2
Doko	3.86	-
Sulla	4.27	1.44
town	4.91	1.8

With respect to amount of milk yield, crossbred at town give more milk. These households had better access for concentrate feed, better and stable income source, had better access for veterinary medicine and dairy inputs such as 'attella'(resdues of local drink, 'areke'). Households at Sulla had no as diverse off-farm employment opportunity as households at Dorze and town. Hence even if they were at distant place, their crossbreds received more attention and were yielding better.

With respect to milk and its product market, 80.6% and 30% of the surveyed households at town and Dorze respectively submit their milk to cooperative. But this figure at Doko and Sulla were 70% and 57% respectively. Doko and Sulla households sell butter besides milk but households in town and Dorze sell milk alone. Generally as households at sulla responded, they prefer to sell butter(particularly non-member of cooperative) since it is more convenient to handle up to market.

With respect to record keeping, except 2 households in town, all the rest households surveyed did not keep records and hence did not follow up the performance of its crossbred cow. Except these 2, no households know foreign

blood level of its crossbred cow. Hence, it was possible to know only cross level of the crossbreds.

Table 4.7 Cross level of crossbred cows surveyed

Areas	Cross level			
	First crossbred	Second crossbred	Third crossbred	With unknown cross level
Chencha town	16	14	1	-
Dorze	4	4	1	1
Doko	7	1	1	1
Sulla	4	1	1	1

Note that first crossbred is the offspring found by crossing of an exotic bulls with zebu heifer or cow. Second cross is the offspring found by crossbreeding of first cross heifer or cow with an exotic bull and third cross is the offspring found from crossing of second cross heifer or cow with an exotic bull.

Generally, management level that had been provided to crossbred cows was much less than needed. Among the surveyed households: 90%, 80%, 71.4% and 58% in Dorze, Doko, Sulla and town respectively treat their crossbred as they treat their local cows. Respondents did have different reasons for not treating crossbred better than they treat their local cows.

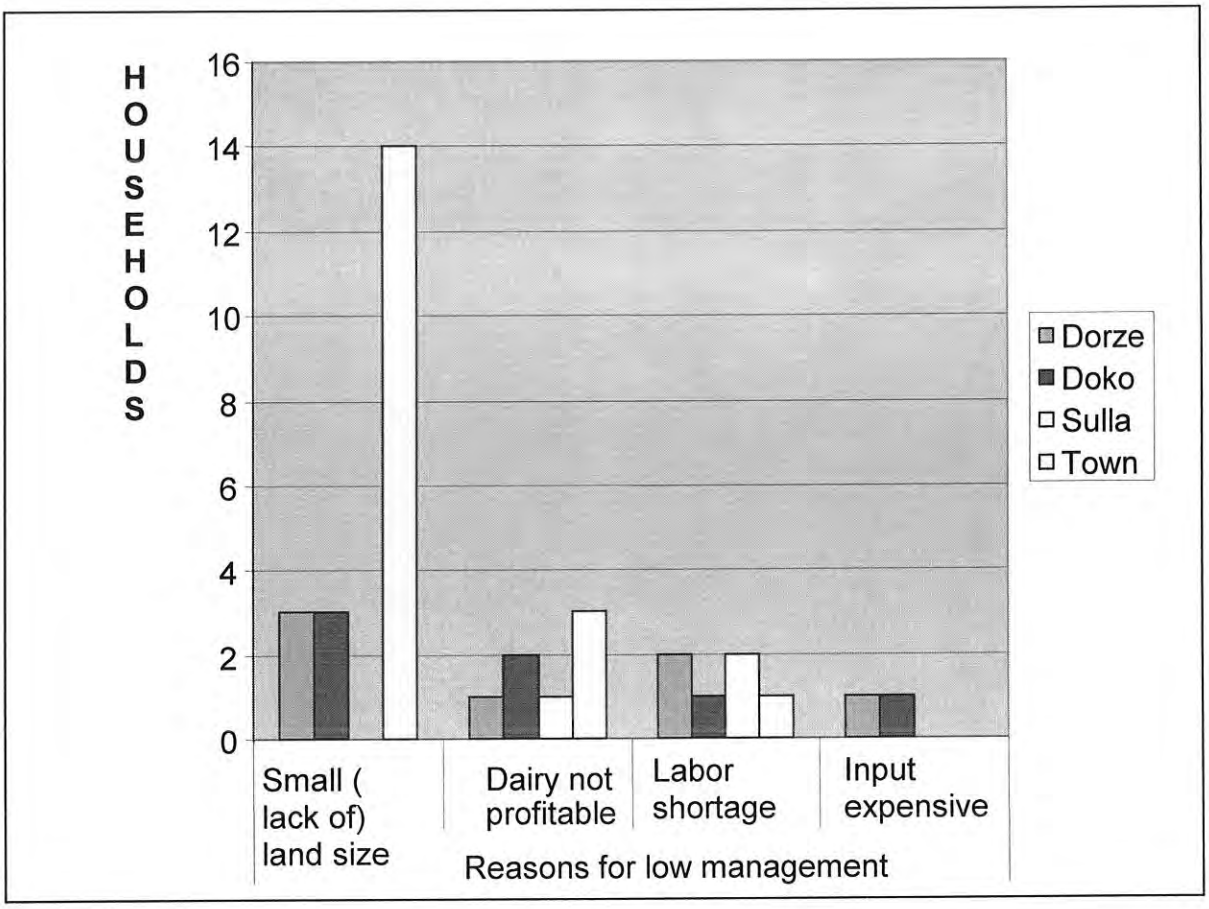


Fig 4.5. Reasons for inferior management to crossbred cows in Chencha areas

These are only the main reasons and some of the households not included in Fig. 4.5 have mix of two or more of the reasons. Crossbred that receive the same treatment level as local cows eat from the same trough with local cows, drink from stream or river, graze in tether or on the field and live together with other animals in human's hut or isolated shed.

Most of the crossbred holders had not been exposed to training and extensions related to dairy cows. As the result they even did not make isolated shed from people's home. It was observed that in Sulla, Doko and Dorze only 28.6%, 20% and 30% households respectively had isolated shed. These households apply for crossbred the usual practice that was even unfit for local cows. As observed,

most farmers promoted to crossbreds without proving its management ability best fit to local cows.

Generally, traditional management system did not help the community to utilize crossbreds' potential appropriately.

4.1.6 Economic rationale of dairying

The revenue from livestock in all areas, except in Dorze, was more than the expenditure on the livestock (Table 5.8). Traditionally farmers in Dorze hold large herd size, which produces less per head. The resources they have (grazing land, capital for inputs, labor...) diluted over larger herd size. They strive to have more number instead of intensifying production from one or tow cows. As observed during the survey, most households adopted only crossbred but not related technologies at Dorze. Hence, the return from crossbreds was less which could not compensate the cost.

Table 4.8 Income from livestock and expenditure on it in study areas

Kebles	Proportion of livestock income to total income	Proportion of expenditure on livestock to total expenditure
Dorze	8.5%	17.4%
Doko	18.9%	15.25%
Sulla	12.2%	9.1%
Chencha town	29.3%	16.23%

With respect to the rest communities (town, Doko and Sulla), there was no tradition of reinvesting the revenue obtained from dairy for the expansion of dairy component even if they had better experience and skill in animal husbandry..

Most people at Chencha town (77.4%) were organization employee and were buying grasses or land on contract basis. Grass was expensive and its price had

been escalating. A hectare of grassland in Dorze area costs up to 2,000 ETB depending on its location, land quality etc. (Instead of signing on buying or selling basis, the agreement usually done on the name of contract for up to 25 years, just to secure the interest of buyer against the national law).

From Tollola a woman with two crossbreed cows put the costs and revenue as follows. On average, the cows were giving 7 litters per day each, for 10 month lactation period.

Table 4.9 Rough cost- revenue estimate of two crossbreds belong to a household at Tollola

Cost item	Unit of measurement	Cost for a month(ETB)	Cost for a year(ETB)
Concentrate feed(Frishka and Fagullo)	k.g	136(50 k.g Frishka, 71 ETB and 50 k.g Fagullo, 65 ETB)	1632
Grass	Bundle	375(1.25 for a day, costs 12.5 ETB)	4500
Wage	Man-a-day	195(6.5 ETB a day)	2340
Bole(salty soil from shore of lake Abaya	-		30
Medication	-		100
Total			8602

The selling price of a litter of milk was 2.16 birr and hence revenue from milk was 9100. The selling price of 8-month-old female calf was 1500 birr and that of the male was about 400 birr. The cows were stall-fed and hence their manure was

used for vegetables including apples. The women and other FGD members mentioned that involving in crossbreed business is not profitable, even if it is by far better than the local cows. They keep it merely for need of manure.

Before the crossbreeds, the woman had 3 cows of which, two were local. She had been feeding and treating all of them equally. However, the crossbred had been giving up to 10 litters a day and the locals never exceed 3 litters a day.

With respect to weaving as FGD members mentioned, an adult man can make 3 to 5 'Gabi' per weak and the price of each in local market was 40 to 60 birr. The cost of raw material to make one 'Gabi' was estimated to be 35 birr. Hence, FGD members at Dorze concluded that dairying has no charming incentive to shift time and other resources to it.

The knowledge about credit was very weak among all communities surveyed. People fear to be indebted and hence have not ever asked to take credit. Except two households in urban who took credit from MFI wisdom two years ago, all the rest did not need to take it. Some mentioned that they were not allowed to take credit by the scripture in the Bible which says 'one who borrows will be the slave of its lender'.

4.1.7 Milk Marketing, training, extension and other services

Except 13.8% among the surveyed households (6.5%, 20%, 10% and 42.9% in town, Dorze, Doko and Sulla respectively), all the rest had not been exposed to formal training. Some Chencha town dwellers who had not been attended formal training found to have more knowledge in relation to crossbred than trained rural farmers, however they were not considered as trained in this study. It was also found that only farmers attended training were responded that they had access for extension service and dairy inputs. Hence, 'the access to dairy inputs' and

'extension service' were not considered in this study and instead they were represented by 'training'. Generally the service delivery by RDCO (in such areas as vet medicine supply, extension service etc.) were very poor in surveyed areas as responded by farmers.

Of the total surveyed households, 67% (30%, 70%, 57% and 80.6% in Dorze, Doko, Sulla and town respectively) were member of the cooperative and sell their milk to the cooperative. The rest of the households, which were not member of cooperative, found at Doko and Sulla were selling butter and 'arera' (milk separated from butter, 1.2 birr per litter). But those at Chencha town who were not member of cooperative submit their milk to shops whose price was raised from 52 to 70 ETB by the time of survey for 30 litters of milk. As it was reported, the price increase was due to the establishment of cooperatives.

The distance away from Chencha town had adversely affect some of households from getting access to services such as access to buying concentrates and joining milk groups. Generally, as FGD members revealed, remoteness resulted in reduced milk and its product prices, return to labor and capital, and increased input costs. This in turn reduces incentives to engage in dairy production and result in subsistence rather than market oriented production.

4.1.8 Crossbreeding situation

Except in Doko, a crossbred(inappropriate for service) was observed in each of the rest surveyed areas. A bull at town (other than bulls at HCDP scheme) was owned by the prison and bought for such purpose while the bulls at Doko and Dorze rose for land cultivation. All were serving local cows. They had no documents on background information and on beneficiaries receiving the service. Diagnosis on bulls for transmittable disease had not been carried out.

The bull station, owned by the HCDP project was better in some of the aspects (Appendix IV). The genetic backgrounds of all the bulls were known. However, 7 out of 10 bulls which was chose randomly were born in the compound. Besides, except two bulls, all stayed more years in the compound than they really had to stay (two and a half to three years, Fred, 2001). Hence, it is possible to conclude that precaution taken to prevent inbreeding was poor.

Generally most households surveyed carried out animal rearing duty as tertiary business due to animal's weak position in the livelihood. Farmers were too poor and hence rush to satisfy their current poverty instead of investing for tomorrow's return. They try everything but none of the opportunities was as such productive. Land size was very small but expected to supply family food need, fuel wood, grasses and fodder for animals and had to generate income, but supply none of these sufficiently.

Farmers were motivated and replacing local cows by crossbred cows but the process was too slow since there was no appropriate training, poor service delivery, lack of enough market for milk and milk products. Most of the farmers had been learning through trial and error.

4.2 Regression results of crossbred dairy production

The average milk yield of cows(both crossbred and local) in the district, as documents of the Woreda RDCO revealed, was 0.6 litter per day per cow which is by far lower than the minimum amount the government intended to maintain (5 litters per day per cow). This implies that constraints should be removed if dairy has to contribute its part to local economic development.

In identifying the factors that could have effect on dairy production and productivity in Chencha Woreda, 12 socio economic independent variables were

used in this study. These variables included: productive household labor size, household head education level, household farm size, farm fragmentation, distance of a household from service center, membership to cooperative, alternative off-farm employment, training, household income, religion, household head gender and household head age. The milk yield of a crossbred cow in litter per day was dependent variables used to measure dairy cow productivity.

Membership to either of the cooperatives was represented by dummy variables and hence members are represented by 1 and others by 0. Off-farm employment is represented by dummy variables and hence household heads with off-farm employment opportunities were represented by 1 and others by 0. Training was represented by dummy variable and household heads who did not attend any formal training or no professional background related to dairying were represented by 0 and others by 1. Religion was represented by dummy variables and protestant Christianity followers were represented by 1 and orthodox Christianity followers by 0. Household head gender was represented by dummy variable and male household heads were represented by 1 and female household heads by 0.

As a principle in stepwise regression, a model with higher R2 , regression and F-value but with less residuals is chosen as a best model. Table 4.10 shows the value of R2, regression, F and residuals at each step until the process terminate.

Table 4.10 The steps and criteria in sorting out for best model

			sum of squares			
Model	R	R Square	Regression	Residuals	F	Sig.
1	0.533	0.284	42.447	106.817	22.253	000
2	0.643	0.413	61.637	87.627	19.343	000
3	0.705	0.497	74.209	75.055	17.797	000
4	0.758	0.574	85.685	63.58	17.857	000
5	0.792	0.627	93.569	55.695	17.472	000

The stepwise regression procedure hence, starts off by choosing an equation containing the single best socioeconomic variable, most correlated with crossbred milk yield, and then attempt to build up with subsequent addition of socioeconomic variable one at a time as long as the additions are worth while. Eventually, when no variable in the current equation can be remoded and the next best candidate variable can not hold its place in the equation the process stops.

Hence, as it is shown in table 4.11 it starts by education (as most related to crossbred milk yield) and at the last ends in the fifth model that contains education level attained in formal school by household head, membership to cooperative, productive labor size of a household, age of a household head and distance from service center of a household. The coefficient of multiple determination of the model (R2=0.627) indicates that the model explained about 62.7% of the variations in crossbred milk yield.

Table 4.11 The process to attain at the best model chosen and its value at each step

Coefficients		Unstandardized Coefficients	Std. Error	Standardized Coefficients		Sig.
Model		B		Beta	t-value	
1	(Constant)	2.952	0.344		8.579	000
	EDUCATION	0.172	0.037	0.533	4.717	000
2	(Constant)	2.4	0.352		6.81	000
	EDUCATION	0.132	0.035	0.41	3.75	000
	COOP	1.296	0.374	0.379	3.471	0.001
3	(Constant)	1.164	0.526		2.211	0.031
	EDUCATION	0.105	0.034	0.323	3.049	0.004
	COOP	1.333	0.349	0.39	3.818	000
	LABOR	0.414	0.138	0.302	3.008	0.004
4	(Constant)	2.948	0.756		3.898	000
	EDUCATION	9.15E-02	0.032	0.283	2.847	0.006
	COOP	0.789	0.369	0.231	2.138	0.037
	LABOR	0.789	0.176	0.575	4.477	000
	AGE	-5.68E-02	0.018	-0.414	-3.093	0.003
5	(Constant)	1.13	0.98		1.153	0.254
	EDUCATION	0.145	0.036	0.45	4.007	000
	COOP	0.768	0.349	0.225	2.203	0.032
	LABOR	0.936	0.175	0.683	5.346	000
	AGE	-5.62E-02	0.017	-0.41	-3.24	0.002
	DISTANCE	1.49E-02	0.005	0.319	2.713	0.009

It was also analyzed for multicolinarity (whether there is correlation with in the socioeconomic variables) using minimum tolerance and tolerance statistics. Therefore, the larger values of tolerance (as indicated in Appendix II) show that the model fit the data well.

The following part briefly discusses the socioeconomic factors included in the best model and those which are to the reverse of the researcher's expectation.

The discussion is with the particular reference to the context of the surveyed area based on multiple regression result (Table 4.10 and 4.11 and see also appendix III).

In the study, ***productive household labor size*** was highly significant and positive effect on crossbreed milk yield. This implies that the more productive labor a household had, it could allocate enough labor to manage the cow. On average holding the other things constant, an increase of one productive labor increase the amount of milk yield by 0.94 litters. Crossbreed particularly those fed in zero grazing bases need grasses, concentrates, water etc... to be brought to home. Some households that lack more productive family member were found producing more milk by hiring daily laborer. More than two-third of surveyed households in town did so.

Effect of ***educational level attained in formal school by a household head*** was highly significant and positive effect on crossbred milk yield. This implies that better educated households heads are able to manage crossbred better than their counter parts with low level of education. On average holding the other things constant, an increase of one grade attained in formal school increase the amount of milk yield by 0.15 litters.

As both experts of RDCO and HCDP project mentioned, illiteracy remained the bottleneck for acceptance of innovations (including improved crossbred technology) in the area. Most farmers in rural kebles were unable to; read, write and speak Amharic. Hence, they cannot make notes during training and also can not read important notes provided. Besides, most of the experts in the area can not speak the local language.

Most of the previous studies confirm this finding. For example, Saliba and Bromley (1986) and Etana (1985) as cited in Habtamu (2006) mentioned that education influences farmers' decision to adopt technologies by enhancing

farmers' ability to obtain, understand and utilize the practice and by improving overall managerial ability of farmers. Benin et al (2002) also indicated in its study that for each additional year of formal schooling of decision maker, daily surplus increase by about 0.3 litters.

Age of a household head was highly significant and inverse association with crossbred milk yield. This implies that the younger household heads produce better than their older counter part.

As older people at 70s in Doko and Dorze mentioned, they delegated their oldest son in all household responsibilities (traditionally oldest son are responsible to act in the place of father if father is not in the home). But the son could not fully act as their parents. As to the household heads mentioned, their crossbred cows were producing less since they lack ability (power due to old age) to provide enough inputs and their son who overtook the responsibilities can not fulfill the cows requirements as their parents. Hence, as observed during the time of survey, the less productivity of crossbreed cows in the households with older head was , not because of that the heads were laggard but they lack labor to fulfil the cows requirement.

Farm size: the influence of farm size on crossbreed milk yield was insignificant and inverse. This implies that farmers cultivating large land were less likely to manage crossbred better than their counter parts with smaller land. This is unexpected; however as mentioned earlier more land size per households is on the hands of Dorze farmers who are traditionally not well experienced in dairy production and found producing the lowest in this study. On the contrary, land less town dwellers were found producing the highest. They are immigrant from such places as Bonke (the neighboring woreda) and Sulla which are traditionally well experienced in dairy production and hence able to integrate the knowledge of crossbred up on already developed local cow dairy production experience.

They have stable and better amount of income from salary source which help them to buy lands from near by rural areas.

Some of the previous studies go in parallel with this. For example, as to Glem (1987) as cited in Habtamu (2006) livestock development often benefits the poor in better way than it can benefit the wealthier farmer. As to Glem's study in Morocco and Egypt small farms have four to six times more animal per hectare than larger farms and from this, concluded that smallholders' dairying does not necessarily require land since in many cases lands less labor operates efficient and profitable dairy enterprises.

Waaijenberg (1994) also mentioned that the amount of land does not markedly constrain farmers wishing to adopt improved animals.

Income: It has insignificant inverse association with crossbreed milk yield. This implies that households with larger income were less likely manage their dairy cows than their counter parts with less income. This is reverse of researcher's expectation. Nevertheless, there is many justifications for the finding.

As mafonazolo keble peasant administration chairperson mentioned, it is not resources but motivation and decision to use crossbred as a source of livelihood play a key role in successful crossbred dairy production. As to the chairperson, people with huge income, even if they have capacity to afford inputs, they usually do not use dairy as a source of livelihood. They were not producing for market but hold 2 or 3 crossbred cows and use all the milk produced in home. Two of household heads with huge income (registered in this study), Ato Basa and Ato kebede, mentioned that they have better off-farm employment opportunities (weaving and trading respectively) and the opportunities are more profitable than dairying. Hence they diverted their resources (money, time, labor....) to those opportunities and only little of it allocated to crossbred dairying.

Numerous previous studies are parallel with this finding. For example, Nicholson et al (1999) found that the percentage of adopters of improved livestock technology was fairly and evenly spread across diverse income categories and hence improved livestock technology is not limited to wealthy households. Devendra (2000) also mentioned that poor farmers prefer to invest in dairy animals as a means to improve their assets and income situations. A poor household seems more committed for management if they once adopt the crossbreeds and in Chencha area adoption was not a problem since it needs presence of only a local cow.

After having said that, a critical analysis of plots for household income versus crossbred milk yield indicated that, not only households with huge income but the poorest of poor were also inferior in crossbred dairy production. Crossbred milk yield found to increase with income up to about 2000 ETB and then start to decline (Fig. 4.6).

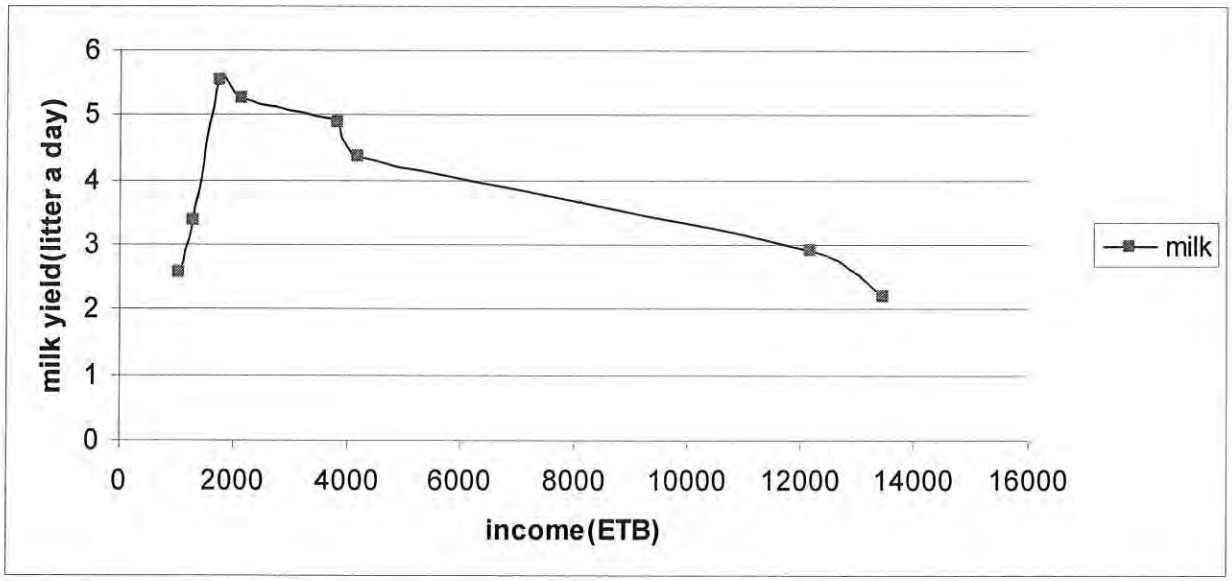


Fig 4.6 Crossbred milk yield distribution across different income group

The poorest of poor were inferior since the challenges with crossbreed were tremendous. These farmers have a cash flow problem when they start to have the crossbred. The farmers had to rear up a cross bred calf, but had no surplus

milk from the local mother from which to get cash to buy the needed inputs. Hence they cannot cover the cost needed until the offspring reach and start to pay off. As Ato Molla from Sulla who was getting 2 litters a day from his first crossbred cow stated the same fact by saying;

> "...Crossbred respond very much for concentrate feed. It needs grazing land. Otherwise we have to buy grass from neighboring. But I do not have enough money to cover these..."

FGD members in Doko also revealed that some households (poorest of the poor) in their surroundings de-adopted the crossbred cows since they could not cope up with the management. Many of other investment opportunities such as local cows, agricultural crop production and small ruminants require smaller initial investment, demand family labor less constantly and were less risky than crossbred dairy cattle. Hence, they shifted to those opportunities.

The influence of distance from Chencha town found to have positive and highly significant association with crossbred milk yield. This is reverse to researcher's expectation. However there are many reasons.

As it can be observed from the mean milk yields of households in the 4 strata(Fig 4.7), the highest crossbred milk yield was found in town and then in Sulla and it was lowest in Dorze.

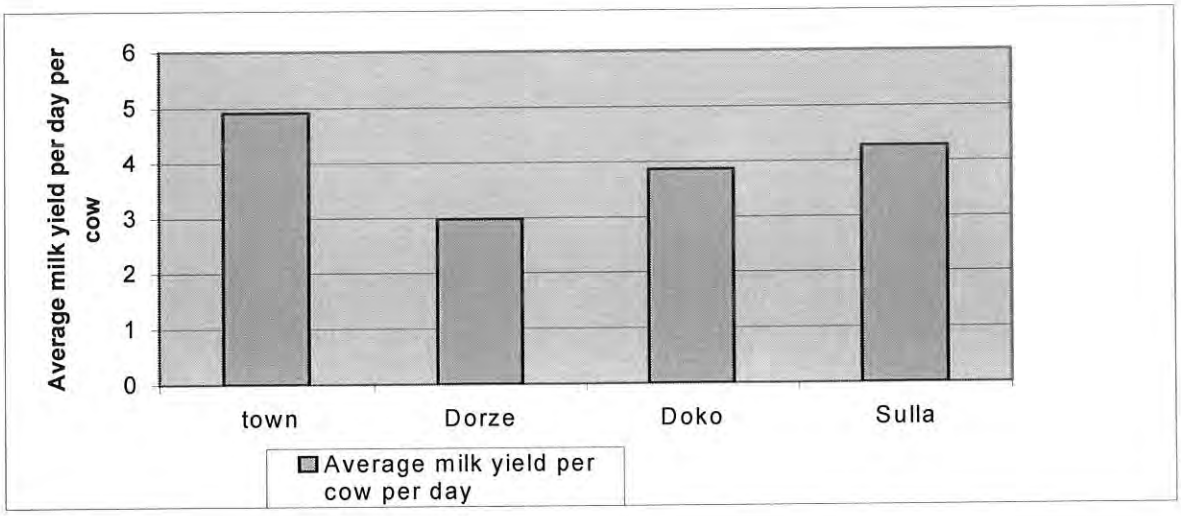


Fig. 4.7 The mean milk yield across the different strata

Sulla is the farthest among the surveyed strata and households at Sulla received training as the other strata received (particularly by HCDP). However, households in Sulla were already experienced in dairy production from local cows and hence were able to integrate the new knowledge of crossbred dairying with already developed skills of local cows and able to produce more.

On the contrary, dairy production is not a tradition of Dorze farmers. As the indicator for this, in Chencha area it is known that Dorze women do not like to drink milk. There is a saying that;

> "... Do not give milk for a Dorze woman but give borde (local drink) instead..."

However, as women at FGD in Dorze argued against to the saying as: up to recent days women do not like to drink milk and even today most of women do not do that. This is not due to they hate milk but they know that they are too poor to drink milk. The women remained with very young member of the family in home and the husband who had already migrated may or may not send money back to home. But in most cases, they do not do so. The women do not have many options to generate income. Hence, they have to make use of few ways such as milk to generate income to cover other priorities in the home.

Besides with the tradition, other factors also hold them back from crossbred innovation. Crossbreeds were introduced to Chencha area before two decades and the bull scheme was established on the land of Dorze at that time. However, the door of Dorze farmers had remained closed for the innovation until up to recent days. One of the the FGD members at Dorze mentioned the reason as follows:

> "... Tollolas have religious interest up on us (Dorze community are strong Orthodox Christianity followers). Since they own crossbreeding scheme, we refused to involve in the breeding program. Besides, the ten-hectare land on which their bull scheme stationed taken from our lands with out the recognition of us for which we are still complaining. But nowadays we start to use the bull scheme..."

As it was said, Dorze households lost their productive working force by migration. Remnants were women, old people and children. Among the surveyed households, 6 were women and 2 of these were of age 74.

Dokos are doing trading activities side by side with agriculture. As observed during time of survey they have good experience in dairy production. But they have limited interest on dairy production since they are occupied by agricultural activities during sowing and planting seasons and by trading activity in the other season.

The availability of marketing access in all strata also contribute to increase in milk yield with the distance. Among the surveyed households in Doko and Sulla, 70% and 57.1% respectively were the member of the cooperatives. They submit their milk to the cooperatives and also got dairy inputs from the cooperatives. Generally, farmers at far have equally accessed as those in town and Dorze almost in every aspect.

Table 4.12 milk yields, cooperative members and distance from service centers

Area	Average distance from urban center	Cooperative members (%)
Urban	30 minutes	80.6
Dorze	60 minutes	30
Doko	100 minutes	70
Sulla	120 minutes	57.1

Other studies also confirm this idea. Hollow and Ehui (2000) indicated that offering the extension service for those at far from service center minimize the impact of distance. Leeuw et al (1999) also mentioned that after infrastructural improvements occur, the advantage of proximity will be reduced and production may well move away from the intensive peri urban systems.

Training: have insignificant inverse association with the amount of dairy milk yield. This is unexpected. There are ample reasons found as observed by the researcher;

- Training occurred only in rural areas by NGOs and the Woreda RDCO office. Hence, even if rural people were trained, they have less capacity to process information and convert it into product than their urban counter parts who are exposed for informal sources of knowledge (such as mass media) even if not formally trained. Besides, training could not release those at Dorze who were not experienced in livestock management.

- Provision of training by NGOs (particularly HCDP) started only few years ago and these times was not enough to show observable change. Besides, the methodology, approach and language used during training were too poor to bring the expected change. The training was based on demonstration sites, which is running by project budget and hence can not at all demonstrate the small holder's farm. It was found that farmers were

eager to participate in training, not due to the benefit(knowledge) brought by training but for other benefits such as perdium.

- Training of NGOs was poverty focused and hence deals with the poor. Then, the training and input provided for these poor people were not enough to release rural people from poverty to attain households in town. However, it is believed that training imparts knowledge and skills to farmers and helps them adopt improved live stock technology.

CHAPTER Five: Conclusion and Recommendations

5.1 Conclusion

Management practice of crossbred dairying was very weak. Some of the reasons contributed for such low management were: low and inefficient service delivery, poor marketing condition which made dairying not viable from economic point of view, lack of business mindedness among farmers, lack of experience in crossbred dairying etc. Hence the return from crossbreds were very less when compared with its potential.

Generally, human capital (labor, age, education, motivation, experience in dairy production) found to play a great role together with guaranteed market for milk in complementing crossbreeds for higher productivity. In multiple regression analysis, both farm size and household income have inverse relation with crossbred milk yield. The plot of household income versus crossbred milk yield shown that it has positive relationship up to about 2000 ETB and then started to decline. Hence, it was found that both households with huge resources (with respect to income and land) and the poorest of poor were inferior in crossbred dairy cow production. As to the common thought in Chencha, land and income not necessarily constrained the crossbred dairy production. This may be good news for the poor who have no diverse alternatives. Livestock hence can be used as main vehicle for poverty alleviation.

The crossbreeding program improved household livelihood by improving the genetic pool of the cattle. The benefit from crossbreeds include early mature cattle, higher milk yields, increased crop production as a result of manure use and increased social capital particularly sharing of information in farmers' unions in such areas as cooperatives. However, farmers at far from town never been exposed for such opportunity. Due to inaccessibility to appropriate bulls, they have been using inferior crossbred bulls whose backgrounds were unknown. A tendency for farmers to opt for any black and white bull on offer seems to

continue unless the problem is tackled. This would have negative impact in sustaining the benefit of crossbred dairy cow.

There were no tradition of reinvesting from revenue and credit. Revenue from the dairy were used to cover other temporary expenditures, while there was much unutilized potential of the crossbreds. With respect to credit, some, as they said were not allowed to take credit by God. For credit institutions on the other hand, agriculture was not priority area of investment. This was visible through the discrimination of agriculture in interest rate and facilitation of delivery.

There were high biomass yielding grasses and fodder trees at the demonstration sites of the RDCO as well NGOs. However, farmer's adoption of this technology has been poor. Much of the work did not come out to community from demonstration stations. This was because it lacked a farming system perspective. It does not consider access to resources and skill that a single household owing enterprises. It also lacks ample interaction between crop and animal going on in smallholder's farm. After all, farmers think that such activities of demonstration site were not implementable by their capacity and level.

For one whose livelihood base is agriculture in Chencha, it was obligatory to have livestock to provide manure. This was because depletion of soil fertility was a major constraint to agriculture, since the use of inorganic fertilizer was low. The district's farmland was more of nutrient poor sandy soil and hence even when the inorganic fertilizer was applied, crop yield does not maintain under continuous cultivation.

However, the nutritive value of cattle manure was found to be poor due to poor nutrition delivered to cattle. Thus, usually it is converted to compost or such as ash added to improve its nutrient value. The traditional method of manure handling is also so poor that it exposes the volatile nutrients, such as nitrogen, to

atmosphere. Besides, manure is also used for fuel. Manure is the only source for land fertility in Chencha but alternative uses are competing for it.

Labor need of crossbred management was found to be higher and the sector was helping in absorption of excess labor. It has an impact on those with out crossbred, including those who were too poor to own cattle. Some of the benefits were selling grass to those who were managing their cows on zero grazing basis and working as daily labor in dairy management for crossbred cow owner.

5.2 Recommendations

Cooperative establishment and strengthening found to be the right strategy in dairy development and its contribution to local development. Cooperative can play a role in dairy input distribution and in providing other services besides being market link for smallholders. Hence, those concerned should work together in strengthening the existing cooperatives and in creation of other cooperatives (or milk groups) at areas where it did not exist.

Training and regular follow up (in crossbred husbandry, integration of animal and crops etc.) should be provided. Training and service delivery may easily achieve its objective if: literate, relatively younger and households with larger labor size and experienced in dairy production targeted as beneficiary. The poorest of poor and households with huge income (unless they decided to use crossbred as one of the livelihood sources) are also not preferable.

All the services were concentrated at the town and competing to each other. On the other hand, farmers at distance places were using the wrong bull because of lack of access for the right bull. The bull scheme in principle should target more remote areas, where accessibility for artificial insemination was very difficult. It was time to stop the subsidized bull service at Tollola and hand it over to privates or groups such as cooperative. The community around Tollola was already

understood the innovation and expected to manage it sustainably. On the contrary, for the community at far subsidy may be needed at least at early stage.

For resource poor person who has not been exposed to improved livestock technology, the best choice is to go for local breed and improve management level. From that one can acquire experience and then can aim at increase slowly the amount of foreign blood level in the subsequent offspring. When there is substantial change from the accustomed experience, the process become difficult to cope up. Hence, it is wise to work with farmers to device a management system that can build on existing skills and experience with gradual improvement.

Demonstration sites and trial stations should consider the access, resources, skills and the likes that a single households owing to. Besides, it should give special attention for integration of animal and crop farm enterprises.

Over all produced amount of manure was small and hence unless chemical fertilizer can adequately compensate the use of dung for other purposes such as for fuel, this competition may negatively affect food production and food security. Besides, it is needed to improve the efficiency of utilizing manure.

There is a couple of organizations working in livestock sectors but their works were not coordinated. They were investing much more resources in accordance to their interest while the priority for the area was untouched. The NGOs coordination office of the government is hence has to play the role of diverting the resources to the areas of priority in the Woreda. It is wise to have a kind of common forum of all organizations working in Chencha.

About 37.3% of the variation in the crossbred milk yield is remained unexplained (residuals). The variation with in different varieties of crossbred (for example with in Jersey and Holsteins), variation in the level of foreign blood and dissolved

components of off-farm employment (such as weaving, petty trading and salary based employment) are expected to cover most proportion of the residuals. Hence, it is recommended that more research has to be carried out in these areas.

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Appendixes

Appendix I. Results of the survey

Quantitative values of selective socio-economic variables and crossbred milk yield

No	Strata /SV*	labor	Educ.	Farm	Frag	Dist	coop	off-farm	Training	Income	Relig	Gende	Age	Milk
1	Town	4.5	12	0	0	30	1	1	0	9100	1	1	47	5.5
2	Town	5	12	0	0	30	1	1	0	19100	1	1	45	8.8
3	Town	2	12	0	0	30	1	1	0	6585	1	1	40	4.5
4	Town	5	12	0	0	30	1	1	0	2720	1	1	67	5.5
5	Town	3	12	0	0	30	1	1	0	3700	0	1	38	4.5
6	Town	4.5	12	0	0	30	1	1	0	4880	0	1	47	7.3
7	Town	4	12	0	0	30	1	1	0	3300	1	1	38	5.3
8	Town	4	12	0	0	30	1	1	0	1620	1	1	46	4.8
9	Town	3	12	0	0	30	1	1	0	9900	1	1	36	4.3
10	Town	4	12	0	0	30	1	1	0	11630	1	1	40	5.8
11	Town	5.5	12	0	0	30	1	1	0	6330	1	1	35	8.5
12	Town	4	12	0	0	30	1	1	0	16275	1	1	35	5.5
13	Town	5.5	12	0	0	30	1	1	0	4115	0	1	65	7.3
14	Town	3.5	12	0	0	30	1	1	0	4950	1	1	43	4.3
15	Town	4.5	12	0	0	30	0	1	0	13450	1	0	70	2
16	Town	2	12	0	0	30	1	1	0	5100	1	1	40	2.3
17	Town	2.5	12	0	0	30	0	1	0	1100	1	1	42	2.4
18	Town	2.5	12	0	0	30	0	1	0	1025	0	1	42	2.8
19	Town	4.5	12	0	0	30	1	1	0	4200	1	1	46	4.8
20	Town	4.5	12	0	0	30	1	1	0	1750	1	1	40	6.5
21	Town	5	12	0	0	30	1	1	1	12750	1	1	55	4.8
22	Town	4.5	12	0	0	30	1	1	0	4200	1	1	46	4.8
23	Town	2.5	12	0	0	30	1	1	0	4950	1	1	43	4.3
24	Town	4.5	12	0	0	30	1	1	0	5950	1	1	43	5.3
25	Town	3.5	6	0	0	30	1	1	0	9510	1	1	45	4.5
26	Town	3.5	12	0	0	30	1	1	0	7510	1	1	55	4
27	Town	4.5	12	0	0	30	0	1	0	7510	1	1	40	5.8
28	Town	4.5	12	0	0	30	1	1	1	8510	1	1	40	7.3
29	Town	4.5	12	0	0	30	0	1	0	15450	1	1	70	2.8
30	Town	4.5	8	0	0	30	0	1	0	13450	1	0	70	2.4
31	Town	3.5	12	0	0	30	1	1	0	9510	1	0	45	4.2
	Summary	**3.97**	**11.68**			**30**	**25**	**31**	**2**	**7423.54**	**27**	**3**	**47**	**4.93**
1	Dorze	2	5	3	3	60	0	1	1	1300	1	1	40	3.5
2	Dorze	5	0	1	3	60	0	0	0	2150	1	0	74	2
3	Dorze	5.5	0	4	4	60	1	1	1	5050	0	1	54	2.5
4	Dorze	3	12	2	5	60	1	1	0	4660	1	1	45	5.8
5	Dorze	2.5	0	1	2	60	0	1	0	1040	1	0	45	2

6	Dorze	5	0	1	3	60	0	0	0	2150	1	0	74	2
7	Dorze	2.5	0	1	2	60	0	1	0	1040	0	0	45	3
8	Dorze	2.5	0	1	4	60	0	1	0	1040	1	0	45	2.7
9	Dorze	2	8	1	4	60	1	1	0	3280	1	1	35	2.5
10	Dorze	3	0	2	3	60	0	1	0	6100	1	0	55	3.8
	Summary	**3.3**	**2.5**	**1.7**	**3.3**	**60**	**3**	**8**	**2**	**2781**	**8**	**4**	**51**	**2.98**
1	Doko	1.5	0	1	2	100	1	0	0	12200	1	1	25	3.2
2	Doko	5.5	3	1	3	100	0	1	0	1350	1	1	76	4.3
3	Doko	2	5	0	3	100	0	1	1	1300	1	1	40	3
4	Doko	3	0	1	3	100	1	0	0	5400	1	1	40	2.9
5	Doko	2	6	0	2	100	1	0	0	1150	1	1	25	4.4
6	Doko	2.5	0	1	3	100	1	0	0	1750	1	0	50	4.6
7	Doko	3	0	2	3	100	1	0	0	930	1	1	35	3.2
8	Doko	2	3	1	1	100	1	0	0	220	1	0	40	4.6
9	Doko	2	12	1	3	100	1	1	0	3850	1	1	42	4.5
10	Doko	3	5	1	3	100	0	0	0	1300	1	1	40	3.9
	Summary	**2.65**	**3.4**	**0.9**	**2.6**	**100**	**7**	**3**	**1**	**2945**	**10**	**8**	**41**	**3.86**
1	Sulla	3	3	1	3	120	1	0	1	1600	0	0	50	4.8
2	Sulla	1.5	0	1	2	120	1	0	0	12200	1	1	25	2.6
3	Sulla	2	5	0	4	120	0	0	0	1300	1	1	40	2.5
4	Sulla	3	5	1	3	120	0	1	1	1300	1	1	40	4
5	Sulla	4	6	2	8	120	1	0	1	4272	1	0	45	5
6	Sulla	3	12	2	5	120	0	0	0	8100	0	0	46	5
7	Sulla	2	12	1	3	120	1	1	0	3850	1	1	42	6
	Summary	**2.64**	**6.14**	**1.14**	**4**	**120**	**4**	**2**	**3**	**4660.3**	**5**	**4**	**41**	**4.271**

❁Socioeconomic variables used in the study are described as follows

Labor; productive household labor size, a number in summary is average.

Education; grade attained by household head in formal school, a number in summary is average.

Farm; size of farm holdings of a household, a number in summary is average.

Frag; number of plots owned by a household, a number in summary is average.

Dist; Average distance it takes in minutes to travel from home to town (service center), one way.

Coop; membership to cooperative, a number in summary indicate members of coop.

off-farm; employment opportunity out of agriculture, summary figure indicate those with off-farm employment opportunities.

Training; formal training related to crossbred, a number in summary indicate those who attained training

Income; gross household income in ETB, a number in summary is average

Religion; religion of a household, a number in summary indicate number of Protestants.

Gender; sex of a household head, a number in summary indicate male household heads.

Age; age of a household head, a number in summary indicate the average.

Milk; milk yield of a crossbred cow in litter per day.

Appendix II. Collinearity statistics

Socioeconomic variables	Beta In	Partial Correlation	Collinearity Statistics		
			Tolerance❁	VIF	Minimum Tolerance ❁❁
LABOR	0.289	0.328	0.925	1.082	0.925
FARM	0.071	0.067	0.645	1.55	0.645
FRAG	0.037	0.035	0.652	1.534	0.652
DIST	0.133	0.125	0.629	1.589	0.629
COOP	0.379	0.424	0.894	1.119	0.894
OFFARM	-0.095	-0.091	0.658	1.519	0.658
TRAINING	0.096	0.112	0.974	1.027	0.974
INCOME	0.044	0.049	0.887	1.127	0.887
RELIGION	-0.085	-0.1	1	1	1
GENDER	0.091	0.096	0.793	1.261	0.793
AGE	-0.14	-0.165	0.998	1.002	0.998

❁ The proportion of variable's variance not accounted by other variable in the model.

❁❁ The minimum tolerance of all socioeconomic variables already in the model if socioeconomic variables not in the equation included.

Appendix IV. Some of the bulls which were being used by Church bull station

Bulls	Blood type and level (%)	How long the bull stayed in service	Birth place
Rambo	75 Holstein 25 zebu	5 year, 9 month, 18 days	compound
Bereket	87.5 Holstein 12.5 zebu	5 year, 2 months, 3 days	Abernosa
Teka	100 Holstein	2 year, 10 month, 27 days	Compound
Aschalew	100 Jersey	6 years, 11 months and 5 days	Wolita Sodo
Addisu	37.5 Holstein 50 Jersey 12.5 zebu	4 years, 9 months and 11 days	Compound
Yishalal	100 Jersey	2 years, 6 months	Wolita Sodo
Melku	75 Jersey 25 zebu	4 years, 3 months and 19 days	compound
Shanko	50 Jersey 50 holistein	More than 5 years	compound
Jegna	100 holistein	More than 3 years	compound
Jaguar	50 Jersey 50 holistein	More than 5 years	compound

Source: Chencha HCDP project office.

Appendix V. Formula to decide total sample size as (Cochran, 1977 in Belayneh, 2005).

$$n_0 = \frac{Z^2pq}{d^2} \rightarrow n = \frac{n_0}{1+\frac{n_0-1}{N}}$$

Where; n0 is the desired sample size when the population is greater than 10000

n is number of sample size when population is less than 10000

Z is 95% confidence limit i.e. 1.96

p is 0.1 (proportion of the population to be included in the sample i.e. 10%)

q is 1-0.1 i.e. (0.9)

N is total number of population

d is margin of error or degree of accuracy desired (0.05)

Appendix VI. Household Survey questionnaire

Part 1. General

1.1 Questioner number: _____

1.2. Date of interview: Day _____ month _____ year _____

1.3 Interviewer _____

1.4 Name of PA _____

1.5 Name of household head _____

1.6 Distance to market center (agent's office) _____

1.7 Distances to nearest extension agent _____

Part 2. Household characteristics:

2.1 Age of the Household head: _____

2.2 Sex of household head 1. Male 2. Female

2.3 Marital status 1. Single 2. Married 3. Widowed

2.4 Religion:

Orthodox	Muslim	Protestant	catholic	Others (specify)

2.5 Ethnicity

Gamo	Amhara	Oromo	Wolita	Others (Specify)

2.6 To which social organization do you belong?

1. Mahber 2. Equib 3. Debo
4. Idir 5. Senbet 6. Others

2.7 What is your Social position in PA or in any social organization?

Ordinary member	Leader	Committee member	Church leader	Others (specify)

2.9 Residence

1. Permanent 2. Shifting

2.10 Size of the family, age, sex and occupation

Name	Age	Sex	Grade attended in formal school	Work

Part 3. Land characteristics, fertilizer and organic manure

3.1 What is the size of land holding of the household in hectare? (State the number in hectares)

3.2 How could you get access to the land you are cultivating currently? (If there is more than one response, more than one choice can be made.)

1. through renting
2. through sharecropping
3. Inherited from the family

4. Allocated by the PA

3.3 Have you hired farm labor in 1998/99 farming season?

1. Yes 2. No

3.4 Do you share labor with others in such as Debo?

1. Yes 2. No

3.5 How many parcel of land do you cultivate?

1. One 2. Two 3. Three 4. More than three

3.6 Do you ever keep your field in fallow?

1. Yes 2. No

3.7 Land used for different usage in 1998/99 harvesting season?

Farm land in hectare	**Areas in hectare**
Consumption crop	
Vegetables and fruits	
Pasture /grass/Grazing	
Others (specify)	

3.8 What is the distance of your cultivation field form your residence?

State in time (minutes) it takes to travel to plots

3.9 How do you perceive the distance of your cultivation land from your residence?

1. near 2. Far 3. Very far

3.10 How do you perceive your current land holding to support your family?

1. in sufficient 2. Sufficient 3. Excess.

3.11 What measures do you apply to enhance the fertility status of your land?

(If there is more than one response, more than one choice can be made.)

1. Application of commercial fertilizer
2. Animal manure/compost
3. Fallowing
4. Intercropping
5. Crop rotation
6. Others specify

3.12 Are you liable to buy fertilizing, whenever you want?

1. Yes 2. No

3.13 If you did not use fertilizer, what is/are reasons?

1. No supply (Shortage of supply)
2. It is expensive
3. Lack of knowledge on application
4. It is not effective in productivity.
5. Others (specify)

3.14 If you use fertilizer, what is the amount of money you spend in 1998/99 years? (In Birr)

Part 4. Livestock, Grass, Forage, pasture

4.1 Which of the following Animal do you have? (In number)

a- cattle -------- d- donkey --------

b- sheep-------- e- horse

c- Goats -------- f- Others (specify)

4.2 Have you any animal in your home kept for some one else?

1. Yes 2. No

4.3 If yes, mention them in:

type of animal	kind of agreement with owner

4.4 Have you crossbred cow?

1. Yes 2. No

4.5 If yes, where did you get it?

1. By crossing own zebu cow with bull
2. By crossing own zebu cow with artificial insemination service
3. by purchase
4. If others (specify)

4.6 Do you know the major input included in crossbreed management?

1. Yes 2. No

If you know, mention them

1. _____ 3._____

2. _____ 4. _____

4.7 What are reason(s) that you are not investing more on your crossbred cow than what you are investing now?

1. Market for milk is not attractive
2. It is not profitable
3. Inputs are expensive
4. It has high-risk
5. Labor shortage
6. Others (specify)

4.8 Have you encountered unanticipated problem because of adopting crossbred cow? 1) Yes 2. No

If yes, mention it _____

4.9 Are you satisfied with your crossbred cow?

1. Yes 2. No

4.10 Do you know foreign blood level of your crossbred cow?

1. Yes 2. No

4.11 If you know, mention it

_____

4.12 How much milk do your dairy cow gives in litter a day?

4.13 What do you think the amount of milk your crossbred cow is giving?

1. Optimum
2. Moderate
3. Less
4. very less

4.14 Were did you get information about crossbred cow management techniques? (Rank them according to their importance if they are more than one, giving one to the most important source?)

1. Traditionally (learned by self)?
2. From neighbors
3. From media
4. From DAs(extension agent)

5. From model farmer
6. Other NGOs
7. Other source, specify

4.15 How many times extension agent visited you in the last 12 months? (In number)

4.16 Have you ever attended training related to livestock management?

1. Yes 2. No

4.17 If you have any contact with DAs, what kind of assistance (service) has/have been given to you? (Rank them for the most to the least if more than one.)

1. Veterinary 2. Medicine 3. Shade
4. Pasture 5. Others (specify)

4.18 If you have more cows, what will you do to them in next five-year time?

1. Reduce their number
2. Retain them
3. Increase their number
4. Other (specify)

4.19 To whom did you sell your milk produce last year?

1. Merchant _____
2. at the local market _____
3. to Cooperative _____
4. Others _____

4.20 What are the milk products that you usually sell? _____

4.21 Are you Member of any cooperative?

1. Yes 2. No

4.22 Why did you join the cooperative? _____

4.23 Were you satisfied with the sales? _____

1. Yes b. No

If not, what are the reasons? _____

4.24 Would you like to borrow money to improve your dairy production?

1. Yes 2. No

4.25 Compared with the best farmers in this area, do you think your cow gives good amount of milk? 1) Yes 2) No

Why do you think your cow gives greater or lesser milk than your neighbors?

_____

4.26 Have you ever planted grasses? 1. Yes 2. No

If yes, how much land of grasses in ha? _____

4.27 If yes, what are the species?

_____

4.28 (If the farmer are using improved seeds) who first convinced you of the advantage of using improved seeds?

1. Extension agent _____ 3.Neighbors _____

2. NGO _____ 4. Others (specify) _____

4.29 Have you reserve any hay or silage for dry season?

1. Yes 2) No

4.30 (If yes), what amount? _____

4.31 major source of feed for dairy cow (type of fodder/Grasses... to be arranged by the farmer in order of importance.)

1. Natural grass (private) 2.Natural grass (communal)

3. Planted grasses 4. Trees and shrubs 5. crop remains. 5. Others (specify)

4.32 Where do you get pasture/grass seeds?

No	Forage/Grass type	Source of seeds	Price per kg
1			
2			

4.33 Are you liable to buy the pasture seeds according to your need and time?

1. Yes 2. No

4.34If you say no, identify the problems?

1. No supply 2. Expensive

3. Seeds are not better than local variety 4. We have no information

5. We can prepare enough hay 6.Others (specify)

4.35 What should be taken as a remedy for shortage of animal feed?

1. Distributing communal grazing land
2. Increasing private grazing land area
3. Introduction of controlled grazing
4. Reduction in livestock number
5. Planting grasses and pasture
6. Others, specify

4.36 What is the trend of live stock population in the area?

1. Decreasing 2. The same 3. Increasing 4. I don't know

4.37 Have you ever bought concentrate feed?

1. Yes 2. No

If yes, how much? (In kg) _____

If yes, how frequent? Time interval in month or weeks. _____

4.45 Categorize each of their following tasks related to crossbreed cow among members of family,

Tasks	Responsible person (mother,father, children)	Tasks	Responsible person (mother, father, children)
Feeding (chopping grass, delivering concentrate)		Taking the cow for medication	
Delivering water		Shade making	
Cutting and delivering grass		Washing cow	
Control over income		Collecting manure to the farm	
Milking and Selling milk		Taking the cow to bull service	
Selling Animal		Planting grass and weeding	

4.46 Among your family member, who took training?

1. Father (head) 2. Mother 3. Son (boys) 4. Daughter (female)

4.47 With introduction of cross breed cow, whose home duty burden increased? (Put from higher to lower in order, if more than one)

1. Father 2. Mother 3. Son 4. Daughters

Part 5. Income and expenditure of household

5.1 What is the major source of income?

1. Sales of crop production
2. Sales of animal
3. Off farm income
4. Income from migration
5. Others (specify)

5.2 What was the total income the family earned from different sources?

No	Income source	Amount of income(in Birr)
1	Sales of teff	
2	Sales of wheat	
3	Sales of Barely	
4	Sales of peas	
5	Sales of apple seedlings	
6	Sales of apple fruit	
7	Sales of plum	
8	Sales of animal and animal products	
9	Sales of Gabi	
10	From self employment(such as wood work, tella,areke)	
11	From wage(on daily labor base)	
12	From salaries	
13	From pity trading	
14	Migration income	
15	Others (specify)	

6.8 Would you say that farmers in your extension area have understood the crossbreed cow management techniques or package?

6.9 Have farmers ever given you any information that caused you to improve your program? No _____ yes _____give an example _____

6.10 have you model farmers _____--

6.11How often do you see and discuss with the model farmers

Once a week _____ more than once a week _____

Once in two weeks _____ once a month _____

Others _____

6.12 What is the attitude of local officials on extension activities, Such as PA?

Part 7. Leading Questionnaire for the RDCO

7.1 What type of crossbreed cows exist in the area?

7.2 Is crossbred cow management a package?

7.3 Who under takes the breeding programme?

7.4 Who designee the breeding programe?

7.5 What incentive given to farmers who adopt the programme?

7.6 How long it accounted since the intervention started?

7.8 What is the role of RDCO?

7.9 How do you evaluate the performance of the programe increasing productivity? (Milk yield, as fertilizer)

7.10 What is its impact on local economic development?

Index IV. Ato Salile Shanko doing his weaving (Photo a) and some of his livestock (Photo b).

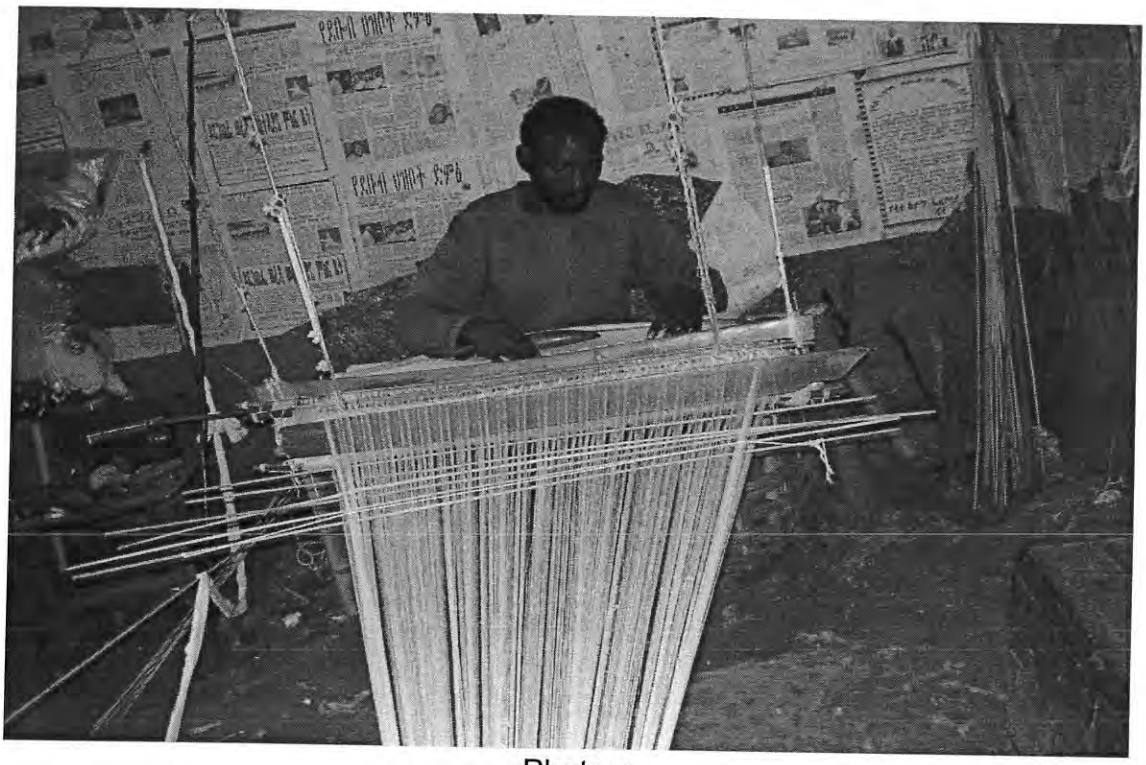

Photo a

Photo b