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Comparative Cost Benefit Analysis of Dairy and Cereal Crops Production with Special References to Tef and Wheat Crops: A Case Study of Adea and Lume Districts of East Shoa Zone, Ethiopia

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Abstract: The study was conducted to analyze comparative cost benefit analysis of dairy and cereal crop production in Adea and Lume districts of East Shoa Zone, Oromia, Ethiopia. The objectives of the study were to assess the comparative economic advantage of the crop and livestock production and design optimal path for repositioning the smallholder farmers to take advantage of existing technological options and opportunities and finally suggest interventions for policy makers to understand the quick way out of poverty and the sustaining of food secure society at community level through wise utilization of local resources. Primary data were collected from 43 farmers who used to practice both dairy and crop farming households selected randomly through multi-stage sampling procedure. Descriptive statistics, gross margin analysis and cost-benefit analysis were used to assess comparative cost benefit analysis of dairy and cereal crop production in the study areas. Thus, gross margin per hectare production of tef and wheat crops was calculated to be Birr. 15,704.10 and 13,586.05, respectively and that of dairy cross breed milk sold per head per year was found to be birr 10,454.35. The Benefit Cost Ratio (BCR) of tef and wheat crops was 2.29 and 2.13 birr per hectare respectively. The mean milk yield of the cross bred dairy cows in the area was 9.70 liter per day/animal. The dairy cross bred milking cow benefit cost ratio was computed to be 1.83. This ratio depicted that dairy cross bred production was economically more profitable than crop production at farm household level in the study area if assumed to keep 2 or 3 milking cows per household, where the income generated could be estimated to be double or triple.

Key words: Smallholder farmer · Dairy production · Crop production · Grosses margins · Variable cost · Benefit-cost ratio · Ethiopia

INTRODUCTION

Dairy development in Ethiopia has played a major role in increasing milk production, thereby improving income level of smallholder farmers, creating employment opportunities and improving the nutritional standards of the people. Moreover, the low and unreliable incomes from cereal crops production in Ethiopian highlands suggest the need of complementing and intensification of other farming activities. This is in spite of indications that there is a potential for dairy development and dairy can reduce the level of poverty in the smallholder farming system. Likely enough, smallholder dairy production is becoming increasingly important and its contribution is magnificent in livelihood improvement of the smallholder farmers in Ethiopia. The Ethiopian highlands are characterized by mixed crop-livestock farming where both systems are complementary to each other. The complementarities' in general is mainly for draught power and crop residues giving emphasis for increased in food production with a progressive expansion in size and frequency of cropping land indiscriminately; even in livestock potential niche farming areas. This phenomena in the highlands of the country has hampered livestock production and productivity not to go to the level expected to contribute/satisfy the country's national

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income in general and the farming community in particular; rather the hike of livestock products prices in the country, now and again is becoming unaffordable to many of the urban dwellers in the day to day ration. This emanates basically from the already established mind set of the community on resource allocation, which is majorly skewed to crop production, perceiving livestock keeping being looked only as a side line activity to produce oxen and whatever amount of livestock products are produced are either utilized for household consumption or as a source of cash income to buy household necessities or to save for festival occasions. This scenario is not different for East Shoa Zone of Adea and Lume districts, where crop technology promotion is practiced extensively for decades with the aim of the government to produce food and sustain food security at household level. The major crops produced in the two Woredas are tef and wheat in a descending order of area coverage and priority. Horticultural crops are also practiced at limited scale in areas where access to water is available. In a survey made in Godino Peasant Association of Adea district, farmers earned on average Birr 10,309.17 per annum from farming, off farm and non-farming activities from both rain fed and small scale irrigation [1]. In the same locality, there are farmers engaged in keeping high grade dairy cattle and earned a profit of birr 2 or 3 times from sale of milk produced which is an additional income source making big difference than individuals involved in sole crop farming (personal communication). This disparity has persuaded individual farmers request DebreZeit Agricultural Research Center repeatedly for additional dairy cattle intervention to intensify the venture and capitalize on dairy cattle technology as a comparative advantage to crop production; to rapidly alleviate poverty and ensure food secure society at community level. At the same time the demand of milk and dairy products both at local and national level will recuperate from the current situation. Thus this research was initiated to study and investigate the comparative advantage of agricultural production for the 2 districts of East Showa Zone with the following Objectives.

- To assess the comparative economic advantage of crops and livestock production.
- To design optimal path for repositioning the small holder to take advantage of existing technological options and opportunities
- To enable policy makers understand the quick way out of poverty and the sustaining of food secure society at community level through wise utilization of local resources.

MATERIAL AND METHODS

Description of the Study Areas: The study was undertaken in central highland of Ethiopia in two major dairy and crop producing districts of Adea and Lume of the Oromia Regional State of Ethiopia.

Sampling Procedure and Sample Size: Sample size and the sample selection process should assure the representativeness of the population. Sample size determination has its own scientific approach. In this study, to determine sample size, different factors such as research cost, time, human resource, accessibility and availability of transport facilities were taken into consideration. The study used a multi stage procedure employing both purposive and random sampling. The first stage was purposive selection of two districts in East shoa zone of Oromia Regional State where dairy and crop productions are majorly practiced. In the second stage, potential kebeles (the smallest administrative unit) were purposely selected based on the large number of farmers who kept improved dairy to produce milk mainly for market as well as those who practiced crop production for both home consumption and market.

In the third stage, from a list of dairy farmers who owned improved dairy cows and practice crop production, simple random sampling method was used to select dairy farmers who had their cows in milk for the previous 12 months and produce crop in that year. The information gathered pertains to production season of 2013/2014. A Total of 43 smallholder farmers were involved in the study.

Data Collection: The survey collected cross sectional data and made use of both primary and secondary data. Primary data were collected through personal interview applying face–to–face interview method through a structured questionnaire. The questionnaire was pre-tested to remove ambiguities. The structured questionnaires were administered to 43 smallholder farmers producing mixed crop-livestock production. The information collected included quantities of variable inputs used and cost per each variable inputs, dairy cattle production levels, herd size and socio-economic characteristics of respondent farmers. The collected information was first tabulated, coded and entered into computer for analysis.

All the local measurements were converted into standard unit and final analysis was done using computer software packages: Statistical Package for Social Science

(SPSS). Physical data related to tef, wheat and dairy production practices, costs and yield, use of physical input, sale quantity of produce and selling prices has been collected in 2013-2014 production year. Secondary data were collected from previous documents, previous research findings on dairy production in Ethiopia and elsewhere in the world.

Methods of Data Analysis

Descriptive Statistics: The study used descriptive statistics such as frequencies and means to analyze the socio-economic characteristics of dairy and crop producing farmers. Cost benefit and gross margin analysis were used to assess economic analysis of smallholder farmers in dairy and crop production.

Cost-benefit Analysis (CBA): Evaluation of economic returns plays crucial role in influencing farmers' choice to adopt improved agricultural technology and consequently influences farmers' resource allocation decisions. The understanding of costs and benefits is also an important pre-requisite for policy formulations aimed at improving productivity levels. Different scholars used cost benefit analysis to measure smallholder farm profitability. Mburu *et al.* [2] used cost-benefit analysis to compare the profitability of smallholder dairy production in different agro-ecological zones in Kenya highlands. The results showed that farmers in the upper midlands were making much more profit from milk than those in the lower.

Gross Margin Analysis: Johnson [3] defines gross margin as the difference between the value of an enterprise's gross output and variable cost of production. Gross margins are used to evaluate economic viability of an enterprise. They are used in agriculture for farm planning and comparing different farms with similar characteristics or different enterprises on the same farm [4]. The gross margin analysis was used to assess the profitability and viability of smallholder dairy production in Gambia [5]. The results showed that smallholder dairy farming in Gambia was viable.

In this study in order to determine the profitability of the different crop farming activities of tef and wheat, as well the sideline dairy enterprises, gross margin and cost benefit analysis were used to estimate the average variable annual costs and returns of the enterprises and cost benefit ratio. The variable costs are summed to derive the total variable cost of production on a per hectare base for each type of crop cultivated and total variable costs per head of dairy cow milked. Variable costs refer to those costs which vary directly according to the level of production both for crops and dairy cow. These costs include seed, labor, fertilizers, pesticides, feeds (concentrates), veterinary service and AI service which were calculated based on financial prices. Hence, gross margins were calculated in this study for smallholder farmers both practicing improved dairy production and selected crops cultivation. The following formula was used to calculate gross margin.

$$GM = GR - VC \quad (1)$$

where, GM is gross margin per cow or per ha in case of crops and GR is gross revenue calculated as the product of price per unit and output. For this study the amount of milk produced per year per cow in liter and yield produced/ha for crops, VC is variable costs associated with milk production and marketing per cow per year in Birr or variable costs associated with crop production and marketing per ha per year in Birr. Gross income for dairy included the value of milk sold, the value of milk consumed by the household and milk given to the calf. Dairy enterprise variable costs included feed (concentrates), veterinary and labor costs that were calculated based on market prices.

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Households

Sex and Marital Status of Farm Hold Head: The total sample size of farm respondents handled during the survey was 43 sample smallholder farmers and the survey results shows that 100% of the respondent farmers practiced mixed farming system, integration of dairy and crop production. About 25.5% of the sampled farmers were drawn from Urban areas and 74.5% of the respondent farmers were drawn from peri urban areas of the study districts. This implies that majority of the smallholder farmers were dwelling in peri-urban areas of the study areas to practice both dairy and crop production activities for their livelihoods. Out of the total sample respondents, 94.4% were male-headed households and 5.6% were female-headed households. This also indicated that majority of dairy producing farmers were male farmers showing that intervention is required to increase the involvement of female farmers in dairy and crop production. Concerning, marital status 97.7% of the respondent farmers were married and 2.3% were widowed.

Age of Household Head: The overall mean age of the household head of the sample respondents was 44.3 years. The mean age of household heads was 44.6 and 43.8 years old in Adea and Lume district respectively. This implies that middle-aged farmers were involved in dairy production and crop production in study areas. This could be because of the fact that old age and its associated physical and economic constraints would limit the household head to manage the dairy cattle and cultivate crops.

Household Size: Results from the study showed that household sizes varied from an average of about 7 and 7.5 people for households living in Adea and Lume districts respectively. The minimum and maximum household size of household keeping small scale dairy cattle and produce crop in Adea was 4 and 10 people respectively. On the other hand, the minimum and maximum household size for households living in Lume district was 4 and 15 people respectively. From this it could observed that the household size in the study area is higher than the average national household size which is 5 people; probably due to the fact that the study districts contains both per-urban and urban villages which have more people per household. Moreover, household size influences labor availability for crop production and dairy farming activities, because both activities are labor demanding. Household members are the main source of labor for different activities in the study area and other different areas in the region of Oromia where the study was conducted.

Education of Household Head: In regard to the educational statutes of household head, the survey results showed that 7.1% and 11.6% of the respondent farmers were found to be illiterate and able to read and write respectively. Moreover, 32.6%, 20.9% and 23.3% of the respondent farmers were drop out in1-6 grade, 7-8 grade, 9-12 grade range and 4.6% being diploma holders respectively. These results showed that majority of the respondents have acquired basic education (primary education) which can enable them to get knowledge, skills and attitude on how to solve some problems associated with managements of dairy cattle and crop production. It could be observed that level of education has a positive relationship with smallholder dairy cattle keeping and crop production. The high proportion of household heads with secondary school education among smallholder dairy cattle farming and crop production shows that some educated farmers in the study area are engaged in dairy cattle keeping and crop production activities.

Major Sources of Income: The respondent farmer's ranked crop farming (74.4 %) first to be followed by dairy farming (25%) as major sources of income. This means that dairying in the study area operates under a mixed crop- livestock system and dairy production services as secondary source of income. Moreover, it could be noted that dairying makes enormous contribution to income in the study areas since it makes regular flows of cash, milk for household consumption. Carts rent, fattening and other business activities were serviced as tertiary source of income for about 25.6% of the respondent farmers.

Land Ownership of Farm Households: The survey results showed that the average farm land put under crop cultivation and dairy farming by respondent farmers was found to be 1.3 ha in Adea district, out of which 0.8 ha of land accounted for the rented in farm land. As a result the cultivated farm land size discrepancy in Adea exhibited a standard deviation of 4.18. Average cost of land rent was 10,605.20 birr per ha in Adea district of Ethiopia. According to the survey results about 1.8 ha of farm land was put under crop cultivation and dairy farming out of which 0.7 ha of land was rented in. Furthermore, the average cost of land rent was 8,133.20 birr per hectare during 2013/2014 cropping season in Lume district of Ethiopia.

Crop Production Activities: The survey results showed that about 48.8% of the respondent farmers dominantly practiced cereal crops production and 27.9% involved in pulse crop production. The remaining 23.3% of the respondent farmers were engaged in cereal, tuber crops and vegetable crops production. The main purpose of growing crops was both for cash earnings and household consumption, which was justified by about 95.3% of the respondent farmers. The main crops grown for cash earning and food consumption in the study districts were tef abd wheat.

Cost Benefit Analysis of Crop Production: The Cost benefit analysis involved an analysis of the variable costs incurred in crop production of smallholder farmers and the benefits derived from the crop production.

Cost Benefit Analysis of Tef Crop Production: The survey results indicated that on average tef plots are tilled

4 times before sowing. About 25 person-days participated in land preparation. The mean total cost of tillage was 1,092.5 birr per ha. The mean number labor required for sowing tef was found to be 5 person-days with total labor cost of 174.5birr per hectare. The total labor cost incurred for sowing was 174.5 birr per ha. The sample farmers used on average 15.92 kg of seeds per hectare. The fertilizers applied for tef were both DAP and Urea. The average DAP and Urea required for a hectare of tef field was 136 kg and 115.8 kg respectively. The purchase cost was 2021.6 birr per quintal for DAP and 1092.80 birr per quintal for Urea. On average 136 kg of DAP fertilizer was applied per hectare for tef crop production and the mean cost of DAP fertilizer 2021.60 birr per quintal. About 115.8 kg of Urea fertilizer was applied per hectare with the total cost of 1092.80 birr per quintal. Moreover, the mean cost of improved tef seed was 2105.8 birr per quintal.

Tef Crop weeding Cost: Tef weeding is usually labor intensive. About 21 to 37 person days of labor is needed to weed a hectare of Tef field. The labor cost for weeding of tef was 1660. 40 birr per ha. However, in the study areas, farmers use herbicides, particularly 2-4-D to control broad leafed weeds in tef farm. About 2 persons per day per hectare of labor are required for application of herbicide. The recommended herbicide application rate was about 1 liter per hectare. However, in the study area, farmers use to apply about 0.77 liter of herbicide per hectare. The mean cost incurred for herbicide was 64.50 birr per ha.

Tef Harvesting and Threshing Costs: The survey results revealed that about 25 person days of labor per hectare was required to harvest tef crop and the threshing cost required 286 birr for oxen rent and 221 birr for labor for a hectare of tef field.

Average Yield and Revenue of Tef: It is known that farmers grow tef both for its grain and straw. The results of this study showed that the average grain yield is about 14.56 kg/ha. The mean household consumption of improved tef and local tef was found to be 2.69 and 1.02qt per annum respectively. The mean market price of tef grain for the season was 1600 birr per quintal, while the revenue obtained from tef straw sale was 4544 birr per ha.

Cost Benefit Analysis of Wheat Crop Production: The survey results indicated that on average wheat farm land were tilled 4 times before sowing. About 23 person-days participated in wheat farm land preparation. The mean unit cost of labor during tillage was found to be 60.8 birr per day and 48.6 birr incurred per pair of oxen per day. The mean number of labor participated on sowing was found to be 8.78 person-days/ha and the unit of labor for harvesting was about 56.8 birr/day.

Wheat Seed and Fertilizer Costs: The survey results showed that about 186.80 kg of improved wheat seed was sown per hectare and 1544 birr cost incurred per quintal for wheat seed. About 113 kg of DAP fertilizer was applied per ha and 1637.20 birr cost incurred per quintal for DAP fertilizer. About 96.60 kg of Urea fertilizer was applied per ha and 956.80 birr /qt cost incurred for Urea fertilizer.

Weeding Costs of Wheat Crop: According to the survey results wheat crop is weeded 2 times in the study areas; one time of hand weeding and one time of herbicide spray. The total quantity of herbicide applied was about 0.90 liter per ha and the cost of herbicide is 80 birr/liter. The mean total labor cost of hand weeding was 50 birr/day. The mean number of labor force needed for weeding of wheat crop found to be 32 person-day per hectare.

Wheat Crop Harvesting and Threshing Costs: The survey result indicated that the number of labor participated on harvesting of wheat crop was found to be 20 person day per ha and unit cost of labor for harvesting was 70.5 birr/day. The cost of oxen for threshing of wheat was 242.4 birr/ ha. The mean number of labor required for threshing of wheat was 9.35 person-days with the unit cost of for threshing wheat 77 birr per ha.

Average Yield and Revenue of Wheat: According to the survey results about 2125 kg of wheat yield obtained per ha from improved bread wheat. The marketing price of wheat during the survey period was 1050 birr per quintal, in line with this 22310.4 income was generated from sale of wheat grain and 3254.80 birr was generated from the sale of straw of wheat crop per ha.

As indicated gross production value (Birr ha^{-1}) has been calculated by multiplying the grain and straw yields with their respective selling price for crop production. Total revenue in tef crop production using improved seeds was 27,840 birr ha^{-1} and that of wheat production was 25565.2 birr ha^{-1}.

To measure economic efficiency, gross margin was used to assess profitability in crop production in this study. Gross margin in Tef production with improved

seeds is 15,704.10 birr ha^{-1} and that of wheat farming using improved seeds was 13,586.05 birr ha. Accordingly, tef farming using improved seeds provides the higher contribution to the wellbeing of the producer than wheat crop enterprises. Benefit Cost Ratios of different crops was calculated to find the more profitable crop type in terms of total revenue. Accordingly, the Benefit Cost Ratios (BCRs) of Tef and wheat was recorded to be 2.29, 2.13 respectively as shown in table 6. The higher BCR value was observed for tef crop indicting the most profitable crop grown in the districts.

Dairy Production

Cross Breed Dairy Cow Ownership: According to the survey results the mean number of cross breed milking cow owned was found to be 1.88 cows. Similarly, the mean number of cross heifer owned was 1.04 and that of bull cross and calve was found to be 2.2 and 1, respectively. The mean number of cross oxen owned was found to be 2.2 oxen and that of local dairy cow was 1.6 cows in the study areas.

Purpose of Crossbreed Dairy Cattle Production: About 94.4% of the respondent farmers produce cross milking cows and cross breed heifer for market. Moreover, 93% of the respondent farmers produce cross bull for food and market. About 32.6% respondent farmers are rearing local milking cow for food production and majority of the respondents (67.5%) rear local milking cows for market purpose. On top of this, 65.1% of the respondent farmers produce oxen for food production and market and the remaining, 34.9% of farmers produce dairy cattle for food production. It was also observed that 53.5% of the farmers produce local bull for food production and market. In the same way, 46.5% of them produce local bull for food production in the study areas.

Source and Access to Cross breed Dairy Cows: According to the survey results, out of dairy cows in the areas 74.4, 23.3 and 2.3% were found to be cross breed milking cows, heifer and exotic dairy cows in respectively. Most of respondent farmers (41.9%) accessed dairy milking cows through personal approach purchase and 11.6% of the farmers received from Debrezeit Agricultural Research Center through extension service. rendered by the center. About 25.6, 7, 11.6 and 2.3% of farmers accessed milking cows through district office of Agriculture, NGOs, neighboring farmers and cooperative unions respectively. In generally, 93% of farmers access dairy cross cows through their own purchase and the remaining 7% access by means of credit implying that there is very limited credit access for dairy production in the study areas.

Table 1: Socio-economic characteristics of sampled households

Characteristic	Adea disrict	Lume district	All(n=43)
Mean age of household head (Years	44.6(8.9)	43.8(10.8)	44.3(9.75)
Mean household size	7(1.7)	7.5(2.9)	7.2(2.34)
Mean farm size* (No. of milk cows)	1.76(1.05)	2(1.16)	1.88(0.8348)

Source: survey data, 2013/2014

Note: Figures in parenthesis are standard errors

*Farm size was measured by head count of milk cows

Table 2: Estimates of average farm-level variable costs of Tef production in the study areas.

Activities	Amount of input required/ha	Price (Birr/unit	Total cost per hectare	% share
Land preparation (man-days	25	57.5	1437.5	11.8
Seeding rate (kg)	21.92	21.058	461.60	3.8
sowing(person-days)	11	45.8	503.8	4.2
Fertilizer (DAP in qts	1.46	2021.6	2951.5	24.3
Fertilizer (Urea in qts)	1	115.8	115.8	0.95
Weeding (person-days)	45.5	60.5	2752.8	22.7
Herbicide (lts	1	74.7	74.70	0.75
Harvesting (person-days	30	85.4	2562	21
Gathering and piling (person-days)	11	45.6	546.6	4.5
Threshing (person-days	12	60.8	729.60	6
Total			12135.9	100

Source: Survey data (2013/2014).

Table 3: Farm-level profitability of Tef sold during harvest season.

Average yield (qt/ha	Harvest Season price (Birr/qt	Revenue from the grains (Harvest) (Birr/ha	Straw value (Birr/ha	Total revenue	Total variable cost (Birr/ha)	Gross margin Birr/ha
14.56	1600	23296	4544	27840	12,135.9	15704.10

Source: Survey data (2013/2014).

Table 4: Estimates of average farm-level costs of wheat production in the study areas.

Activities	Amount of input required/ha	Price (Birr/unit	Total cost per hectare	% share
Land preparation (man-days	23	60.5	1391.5	11.6
Seeding rate (kg)	186.8	15.44	2884.2	24
sowing(person-days)	8.78	56.8	496.9	4.15
Fertilizer (DAP in qts	1.13	1637.20	1850	15.44
Fertilizer (Urea in qts)	1	956.80	956.80	7.98
Weeding (person-days)	32	50	1600	13.4
Herbicide (lts	1	80	80	0.66
Harvesting (person-days	20	70.5	1410	11.77
Gathering and piling (person-days)	9	38.6	347.40	2.9
Threshing (person-days	9.35	77	719.95	6.1
Pair of oxen power per day	4	60.6	242.4	2
Total cost variable cost (Birr)			11979.15	100

Source: Survey data (2013/2014).

Table 5: Farm-level profitability of wheat crop during harvest season.

Average yield (qt/ha	Harvest Season price (Birr/qt	Revenue from the grains (Harvest) (Birr/ha	Straw value (Birr/ha	Total revenue	Total variable cost (Birr/ha)	Gross margin Birr/ha
21.25	1050	22310.4	3,254.80	25565.2	11979.15	13,586.05

Source: Survey data (2013/2014).

Table 6: Benefit cost ratios for different crops

Crop name	Total revenue	Total Variable cost	Gross margin	Benefit- cost ratios on Variable cost
Tef	27840	12135.9	15,704.10	2.29
Wheat	25565.2	11979.15	13,586.05	2.13

Source: survey data, 2013/2014.

Table 7: Smallholder cross breed dairy production cost estimation

Cost items	Mean costs of items (Eth Birr)
Labor per year per animal	2529
Cost for AI and bull services per year per animal	538.40
Cost concentrate feed per year per animal	6871.4
Cost for medicament per year per animal	254.40
veterinary service per year per animal	1128.45
Transport (for feed and marketing costs) per animal	709.30
Drinking water per year per animal	349.9
Miscellaneous costs(cost of salt, death loss of animal and ropes, etc) per animal	194.40
Total variable costs per animal	12575.25

Source: Survey data,2013/2014.

Table 8: Milk production per dairy cow per year

Number of milking cross dairy cow used for the study	Average lactation period (days)	Average milk production per day (liter)	Total milk production (liter per year	Mean prices of milk per liter
1	262.2	9.7	2,543.3	9.055

Table 9: Annual total revenue to dairy production

Income sources for cross dairy household per year		
Milk sold and consumed in Birr	Average cow-dung sold and used in house per year	Gross income per cross breed dairy cow /year
23,029.60	14.70	23044.30

Table 10: Analysis of gross margin, cost-benefit per cross milking cow.

Gross revenue	Total variable cost	Gross margin Birr/animal head	Benefit- cost ratios on variable cost
23,029.60	12575.25	10,454.35	1.83

Table 11: Benefit- cost ratio per cross milking cow

Name of enterprise	Gross margin Birr/animal head	Total variable cost	Benefit- cost ratios on variable cost
Cross breed Dairy cow	10,454.35	12575.25	1.83

Extent of Adoption of Improved Dairy Technologies: According to the survey results about 51.2% of the respondent farmers' adoption status was found to be low and 44.2% of farmers' adoption status of improved dairy technology was found to be medium at the same time 4.7% was highly adopted**.** Moreove**r,** 90.7% of the respondent farmers adopt only few improved cross breed dairy technology, whilst 9.3% adopt many improved cross breed dairy technologies.

Major Constraints in Adoption of Improved Dairy Technologies: About 44.3% of the respondent farmers elucidated that the major problems associated with adoption of improved cross breed dairy cow technology were found to be unavailability of cross breeds, expensive price of cross breeds cows, low price of milk compared to high cost of concentrate feed and lack of technical training. Furthermore, about 41.8% of the respondents stated unavailability and non-effectiveness of AI service, high transport cost of feeds, very limited veterinary services and high cost of labor were found to be the major problems associated with adoption of improved dairy cross breed technology. The remaining 13.9% farmers point out that milk market problem during fasting period, limited knowledge on record keeping, very limited quality feed supply and expensive feed costs were the major problems associated with adoption of improved dairy technology in the study areas.

Cost Benefit Analysis of Smallholder Dairy Production: This study analyzes variable costs incurred in dairy production of smallholder and the benefits derived from the enterprise.

Dairy Production Costs: Table 11 shows the estimated production costs based on the dairy enterprise. Fixed costs were ignored in the study because it is difficult to obtain the data as there was no record keeping in smallholder farmer's milk production and it will not affect optimal combination of variable inputs in smallholder dairy production [2, 6]. Results showed that concentrates feeds were the major cost in improved dairy enterprises and had higher contribution to total variable costs in improved dairy enterprises exhibited to be 6871.40 (55%) birr per year per animal. This underscores the importance of concentrates in improved smallholder dairy farming. Similar findings were reported by Ergano and Nurfeta [7] feed expenses accounted for 80% of the total expenses in smallholder dairy in Southern Ethiopia.

Furthermore, the mean cost of hired labor for milking and feeding of cross breed dairy cows was found to be 2529 birr/ year. About 538.40 birr cost incurred for bull services and artificial insemination per dairy cow per year. For veterinary service 1128.45 birr was incurred per animal per year. On top of this, About 254.40 cost was incurred for purchasing of medicine per year. The average transport cost of milk was 709.30 birr/ year. The cost for drinking water was 349.9 birr/ year per animal.

Milk Yield and Lactation Length of Cross Dairy Cow: The survey results indicated that the average lactation length of cross milking cows was found to be 8.74 months. The mean milk yield of cross dairy cow was 9.70 liter per day/animal. The mean selling price of milk of was found to be 9.055 birr per liter. About 81.3% of them produce animal dung for the purpose of home fuel and marketing purpose and the remaining 18.7% of them produce animal dung for home fuel use only. About 32.3 kg of dairy cow dung was produced per year per animal and its selling price was 45.6 birr per quintal. Accordingly, 14.70 birr was obtained from the sale of cow dung per dairy cow per year.

The given Table 11 discusses the result of profitability analysis of dairy farm. The profitability was assessed using gross margin and benefit-cost ratio analysis. Accordingly, 23,029.60 birr gross income, 10,454.35 birr gross margin and value for benefit-cost ratio were computed to be 1.83 birr per dairy cow on basis of variable costs of dairy production..

CONCLUSION AND RECOMMENDATIONS

If we look into the 25 years policy and strategy of the Ethiopian government, the agricultural development focus was more skewed to crop agriculture with the aim of creating food secure society in the country. But, this ambition did not bring about radical livelihood change and self sustaining farming community, rather the expected food security was moving in a very unsatisfactory slow pace even in a crop potential areas, where seen practically not to the extent of shouldering the intermittent drought effect that currently heated the country. The challenges faced were majorly alleviated with the usual support of the government and donor countries. Hence, in a situation like our country where climate is not reliable, it is wise to capitalize on diversified agriculture with the aim of broadening the horizon of income source of the community is areas that are opportunistic at most to capitalize. In the years passed, among the interventions made in the study areas, were cross breed dairy milking animals with a strategy of diversification and creation of additional income source to up lift the resilience of the community and at the same time avert risks in situations of adverse climatic change that are likely to happen. This risk averting strategy made on assisting producers engaged in cross breed dairy will minimize the shock usually expected to prevail on crop failure. Even though, the study was limited in area coverage, where only was concentrated in peri-urban cross breed dairy producing potential areas, the scenario in the rural cross bred dairy producing communities was also expected to be similar if constraints like market access, input and service deliveries are not to the reach of the producers. This was emphasized and boldly stressed from the cost benefit analysis of dairy and crop production case study made at Adea and Lume districts of East Shoa Zone of the Oromia Regional State. To this effect, the study was analytical to look into the crop and dairy sectors and has tried to bring on board the advantage and profitability of the latter sector. The analysis was computed by the accounting model used to estimate the average variable annual cost of returns of each farm enterprise (activity undertaken in crop and dairy farming). These costs are summed up to derive at the total variable costs of production on per hectare base for each type of crops cultivated and total variable costs per head of dairy cow milked. Then gross margins which are a measure of economic efficiency per cross breed cow or per hectare in case of crops were calculated by subtracting total revenue from total variable cost. Consequently gross margins of the cultivated crops tef and wheat, was quantified to be 15704.10 and 13.586.05 birr per hectare respectively where the gross margin per cow per year was birr 10,454.35. Hence the BCR of tef and wheat was 2.29, 2.13 in that order, whereas the BCR for cross breed dairy production was 1.83.

From this finding it was concluded that considerable amount of income was generated from one dairy cow milk and dairy dung sold per year compared to the yield of the crops cultivated in the areas. On the other hand if assumed of keeping 2 or 3 cross breed milking cows per household, the income generated could be estimated to be double or triple and will enhance the quick way out of poverty and the sustaining of food secure society at community level with the capacity to tolerate the risk of calamities that are likely to come.. But, if we think of crop production, currently crop cultivation has reached an apex both in size of land cultivated and technology intervention and has reached an average yield performance that is usually attained by the farming community unless and otherwise new technologies are intervened that do better than those in the farming system. Rather natural calamities recurrently expected to come could threaten the success of the crops cultivated, like what has happened in the years passed.

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