Characterization and Economics Analysis of Grain Crops and Livestock Production in west Wollega Zone of Ethiopia

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Abstract: The aim of the study was to characterize and analyze economics of farming systems in line with important variables such as crops and livestock, to identify and prioritize constraints and opportunities in the production and factors that affect total livestock unit in West Wollega Zone, Oromia Region, Ethiopia. The study was based on cross-sectional data collected in 2019 production season. Multiple sampling techniques was employed to collect data and get the target sample. Result of descriptive statistics revealed that, the area is known by three major agro ecologies high land 8.5%, mid land 78.4% and lowland 19.1%. Priority was given and documented among cereal crops, oil crops and coffee is also the most well-known cash crops in the zone. Results of the multiple linear regression model revealed that family size, experience in livestock production, non-farm income positively, nutrition, disease, age and overgrazing were significant and affected total livestock unit. However, nutrition and overgrazing negatively and significantly affect total livestock unit. The implication is that, there will be considerable gain in production level in the sector of agriculture because of idle resource that will bring high economic growth in the study area in specific and Ethiopia at large. Therefore, government authorities and other concerned bodies should take into consideration the above mentioned factors to improve the livestock and crops productivity which initiate agricultural economy in the study area.

Key words: Agro Ecologies · Crop · Determinant analysis · Livestock · Multiple Linear Regression Model

INTRODUCTION

Background: Ethiopia has great potential for increased livestock production, both for local use and for export. However, expansion was constrained by inadequate nutrition, disease, a lack of support services such as extension services, insufficient data with which to plan improved services and inadequate information on how to improve animal breeding, marketing and processing. The high concentration of animals in the highlands, together with the fact that cattle are often kept for status, reduces the economic potential of Ethiopian livestock.

In Ethiopia, West wollega is also known by number of livestock, cattle, sheep, goat, donkey, horse, mule and poultry were prioritized as dominant livestock while maize, sorghum, Niger, sesame, groundnut, haricot bean, faba bean were the potential crops in the study area.

It indicated that the area has been known by variety of livestock that increase the income of the households in the zone in particular and increase Ethiopian economy at large. The most prioritized crops have high opportunity for the country because of they are exported commodity which brings foreign currency from international trade that promote economic growth of Ethiopia in the long run [1].

It was clarified that the past farming system studies lack systematic priority setting procedures across traditional farm ecologies in which a single agroecology is characterized by its priority crops, livestock and natural resources (in line with food production and income generation) along with their priority constraints and opportunities in west wollega zone, Ethiopia. Consequently, inadequate information is currently available in the areas of priority crops, livestock and

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natural resources across traditional agroecological zones (high, mid- and lowland) to support strategic research and development interventions on the one hand and support the strategic involvement of local or international investors in commercialization of farming, which is hoped to be the top instrument for approaching food security.

The characteristics determined for the crops and livestock in the study area will assist the government decision maker, researcher, trader and other actors along the amount and availability to determine potentiality, enterprise selection, type and variety of crops and livestock. Therefore, understanding of observed farming system is essential in order to provide framework for production forecasting, agricultural planning as well as a convincing basis for economic growth. But there is no documented information for the area concerning crop-livestock characteristics and their economics in the study area. So, to fill the existing gap this study was designed having an objective to characterize and analyze economics of farming systems in line with important variables such as crops and livestock, to identify and prioritize constraints in the production and utilization of the above variables, to analyze the factors that affect livestock production and to identify and prioritize the potential opportunities that could be driven from each variable in the future in the study area

Table 1: Name of districts in west wollega zone

Name of District	Name of District
Gimbhie	Bodji chokorsa
Lalo asabi	Bodji dirmaji
Guliso	Nedjo
Ayira	Jarso
Yubdo	Babo gambel
Genji	Leta sibu
Homa	Kiltu kara
Sayo nole	Manasibu
Nole koba	Kondala
Haru	Begi

Source: WWAZO, 2019

MATERIAL AND METHODS

Description of the Study Area: West Wollega zone is one of the zones in National regional state of Oromia and bounded by kellem wollega in the west, Ilu Ababor Zone in south, East wollega zone in the East, Beneshangul regional state in the north. This zone covers about 3.75% from area coverage of Oromia or in a nutshell description the zone covers 12,745.01 km^2 in other words 1,274,501 ha. West wollega zone contains 20 districts and three administrative towns. Totally 23 districts were found in the study area (Table 1), 488 gandas (kebeles) in rural woredas 65 gandas were from urban woredas. Totally around 553 gandas (kebeles) were found in west wollega zone.
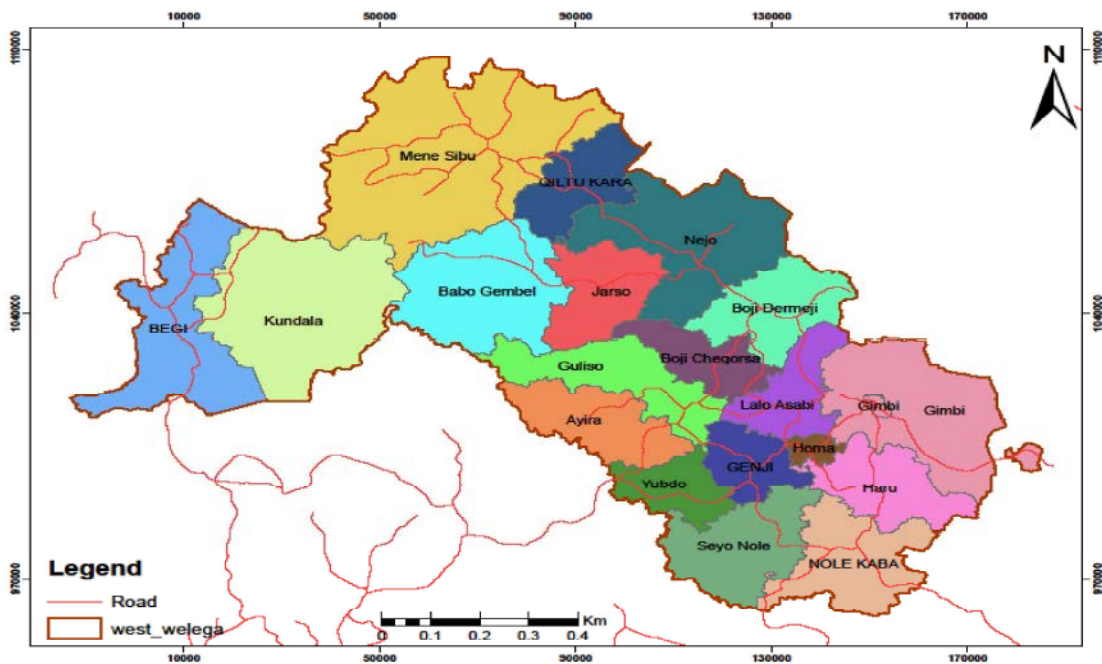

Fig. 1: Map of the study area

Administratively it is divided into 20 districts with three town woredas and 1 city administration (Gimbi city Administration). According to [2] the area were also known by developmental zone, 1464 development zone, 7457 garee misooma with 36,511 shanees in zone. Population of the study area is around 1.7mill in which 1,524,865 were rural dwellers and 216,302 were urban dwellers. From all dwellers of rural 193,900 were active in labor work and around 16,187 peoples were not active on their work because of natural and manmade problems.

Method of Data Collection: The study were used both primary and secondary data. The primary data was collected from the sample farmers while the secondary ones was gathered from the bureaus of agriculture, seed enterprises, cooperative and other input supply organizations nearby the study sites. The remaining part of this study is structured as follows. After briefly introducing the important existing economic theories for the justification of a crops and livestock availability and prioritization of resource. Section two describes the main purposes and the details on its operations. Section three describes the details on the constraint and opportunity of crops and livestock production. In section four, based on data collected from household and targeted office, putting and characterize in west wollega, which is the main part of the study, was presented.

Sampling Techniques: A sampling procedure was applied to draw the required number of sample units for the study. Multi-stage sampling procedures were used to select sample from population for the study. In the frist stage, stratified sampling techniques was applied based on major agro ecologies high land, lowland and midland. Accordingly two districts from each stratum were selected randomly which equals six districts from west wollega zone. From randomly selected districts two kebeles were selected from each districts randomly which equals 12 kebeles. Finally sample households were selected from sample kebeles randomly. List of farmers were identified in each kebeles using Probability Proportional to Size (PPS) sampling technique. A total of 400 households were sampled for the interview from the selected PAs using proportional to size. The sample size was determined based on the following formula given by Yamane [3]

$$n = \frac{N}{1 + N(e^2)} = 400$$

where, n is sample size, N is number of Household and 'e' is the desired level of precision. By taking 'e' as 5% and the total household of 300,000 the sample size become 400.

Method of Data Analysis: The data collected were analyzed using descriptive and econometric statistics tools. Descriptive statistics refers to the use of software statistics such as cross tabulation, percentages and mean comparisons. Multiple linear regression model was used to analyze the determinants of total livestock unit in the study area.

Model Specification: It is necessary to understand the major factors affecting livestock production to evaluate the impacts of determinants (explanatory variables) on total livestock unit on households (dependent variable). Rationale for choosing a Cobb-Douglas production function is due to the fact that it is relatively simple and convenient to specify and interpret. Different studies were conducted using Cobb-Douglas production function. Cobb Douglas production function used to measure growth, impacts of variables and the likes on dependent variables [4]. For this study, the function intended to be used is specified below:

$$Y = AX_1^{\alpha 1} \, AX_2^{\alpha 2}, ..., \, X_n^{\alpha n} \, e \, \beta_1 \, D_1 + \beta_2 \, D_2,$$
$$+..., \beta_n \, D_n + U_i$$

The equation above can be transformed into logarithmic function form as follows:

$$\ln Y = \ln A + \alpha_1 \ln X_1 + \alpha_2 \ln X_2 +, ..., \alpha_n \ln X_n +$$
$$\beta_1 \, D_1 + \beta_2 \, D_2, +..., \beta_n \, D_n + U_i$$

where:

Y: Total livestock owning by household (in TLU)

A: The intercept that reveals combined impact of livestock production

$X_1, X_2, ..., X_n$: Are continuous explanatory variables

$D_1, D_2, ..., D_n$: Are dummy variables

$\alpha_1, \alpha_2, ..., \alpha_n$: Are coefficients/parameters of explanatory variables

$\beta_1, \beta_2, ..., \beta_n$: Are coefficients/parameters of dummy variables

Parameters: $\alpha_1, \alpha_2, ..., \alpha_n$ and $\beta_1, \beta_2, ..., \beta_n$ was estimated by OLS (Ordinary Least Squares) methodology via statistical software (STATA).

Variables Definition and Hypothesis: Different variables were expected to affect the productivity of coffee in the study area. The variables hypothesized to affect is tested whether they were statistically significant or not using appropriate statistical tests. Accordingly, the major variables expected to have influence on the productivity of coffee are explained below:

The Dependent Variable
Livestock Production (LVPRDT): It is a continuous variable and represents the amount of livestock owned by sample producers measured in total livestock unit.

Independent Variables
Family Size (FASI): It is a continuous variable and represents number of family members in the household. Primarily, large family size contributes to better farm management activity which in turns leads to higher farm in livestock. Hence, it was hypothesized to have positively influences on livestock production. Education level of the house hold head (EDL): It is a continuous variable and refers to schooling year for formal education of a respondent during a survey period. Education broadens farmers' intelligence and enables them to perform the farming activities intelligently, accurately and efficiently. Education is also recognized as an important factor affecting productivity through application of experience and investing knowledge in agricultural activity. Educated households tend to have higher productivity, improved use of information and emerging opportunities and are better able to decode new production techniques than the non-educated households. It is therefore, hypothesized to influence livestock production positively. Related deduction [5] also supports this concept.

Extension Contact (EXSER): A dummy variable representing access to extension service as a source of information on technology. Those farmers who have contact with extension workers are more likely to know the advantage of livestock production. Therefore, contact with extension agent is assumed to have direct relation with the production of livestock. Empirical results revealed that extension contact has an influence on farm households' adoption of techniques to improve production [6]

Availability of Credit (CRDT): Farmers can decide to use their own capital for other important production activities or household requirements. Getting credit is one way of improving farmers' ability to make use of opportunities and improve their production [7]. Thus, getting credit would enhance the financial capacity of the farmer to purchase the necessary breeds. Therefore, it was hypothesized that access to credit would have positive influence on production of livestock. Hence, the variable is a dummy variable taking the value 1 if the respondent got credit during the past production season and 0 otherwise.

Total Land (TOTL): It refers to size of total land owned by sample household. It is a continuous variable and measured in hectare. If the producer allocates more land it may have shares for pasture land, he/she could be benefited from economies of scale of production. Thus, farm size for coffee is expected to have positive effect on productivity.

Income from Non-Farm Activities (NOFIN): It is a continuous variable which measures income obtained from non-farming activities by the household head. Since both livestock production and non-farm activities conducted mainly for household cash requirements and hence, nonfarm income is expected to compete with livestock production. Therefore, it is assumed to have inverse relation with total livestock unit.

Experience in Livestock Production (EXCOP): Farmers with longer farming experience are expected to be more knowledgeable and skillful. Therefore, this variable is hypothesized to positively influence livestock productivity. Similar issue was studied by [8] on lychee productivity in Vietnam.

Livestock Disease (LVDS): A dummy variable representing disease as a factor of livestock production. Those farmers who perceive his livestock is affected by disease is represent "1' and "0' otherwise.

Nutrition (NTRN): A dummy variable representing nutrition. Farmers with access to improved nutrition and afford is represent "1" and "0" otherwise

Conceptual Frame Work of the Study: The conceptual framework is also operationalized, which represents how various factors (explanatory variable) inter-relate to influence total livestock unit owned (dependent) by sample household by utilizing transformed cob-Douglas production function and multiple linear regression model (MLRM) and hence the welfare of Livestock producers in

the study area. Rationale for choosing a Cobb-Douglas production function is due to the fact that it is relatively simple and convenient to specify and interpret. Different studies were conducted using Cobb-Douglas production function. Cobb Douglas production function used to measure growth, impacts' of variables and the likes on dependent variables [4]. A farm with high total livestock unit is therefore expected to realize higher livestock ownership compared to one that is less total livestock unit in production. But on the other hand, such a firm is hypothesized to incur less for food production costs leading to higher returns from the enterprise. This therefore has positive spillover effects on the welfare of the livestock producing households (HH). Improved welfare of the households then provides a feedback effect in form of increased access to production inputs and relevant lessons to policy makers.

RESULTS AND DISCUSSION

So far, appropriate methods were specified and input variables and variables that are hypothesized to determine farming analysis with their agro ecologies in the study area were described. This chapter is devoted to presentation and discussions of the results obtained from analysis.

Demographic Characteristics of Sample Households: Understanding the basic characteristics of the decision-making unit is very essential in order to design an appropriate research and development initiative. From the surveyed sample small holder households, variables which are believed to influence the decision making process are analyzed. Obtained results are presented as follows.

Out of the 400 coffee producing sample households, 87% are male and 13% are female headed. There is significant difference between male and female households at 1% significance level. The educational status of the sample producers depicted that 62.3% of them are literate whereas 37.7% are illiterate. Table 3

reflects the age of sample households exhibited variation ranging from 18 to 77 years with the mean of 36.33years. There is also significant difference among the age of the households at 1 percent significance level. In the study area, the average family size of the sample household was 5.33 persons and the difference is significant at 1% significance level (Table 2).

Agro Ecologies and Important Variables in Western Wollega: Agro ecology is fragmented in nature. Indeed, the zone is known by three agro ecologies high land, midland and low land, from these ecologies midland is ranked first by covering 78.4%, low land ranked second by covering 19.1% and highland is about 8.5% (Figure 2). The elevation of the areas was found between 1300-2600 above sea levels. Different agro ecologies in the zone are good opportunity for crop production, livestock husbandry and natural resource because it creates conducive environment for the diversity of the above variables.

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Economics of Crops and Livestock Production in the Study Area: Economics consider about production, productivity and utilization of resources. Given above economic statement it is good and well to illustrate the production and yield of grain and cash crops in the study area.

Livestock Production: Livestock is an important component of the farming system practiced by the farmers and it is an important asset for rural households in West Wollega Zone in Oromia regional state and serves multiple purposes. Cattle provide draught power for crop cultivation, manure for household fuel, organic fertilizer, meat, milk and other products like hides and skin. Donkey, horse and mule are used for transportation. Farmers in the study area practice rearing of Sheep and goat for income

Table 2: Demographic characteristics of the sample households

Dummy variables	Items	Number (124)	Percent (%)	Std. Err.	$X2$-test
Sex	Female	52	13		
	Male	348	87	.006	11.23***
Education status	Literate	250	62.5		
	Illiterate	150	37.5	.098	0.180
Continuous variables	Mean	Std. Err.	Min.	Max.	t-test
Age	36.33	0.76	18	77	29.870***
Family size	5.33	0.08	2	8	18.342***

Note: *** statistically significant at 1% significant level.

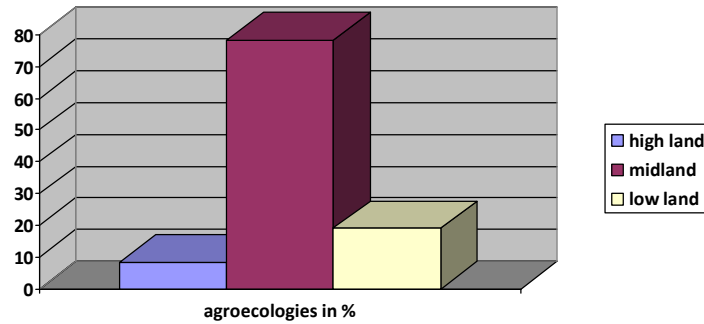Source: Own computation results, 2019

Fig. 2: Major Agro ecologies in west wollega Zone
        Source: own computation (2019)

Table 3: Distribution of oxen ownership among sample households

Names of Livestock	Total number of livestock	
	Number in total livestock unit	Percent
Cattle	2499324	45.1
Sheep	34493.4	17.2
Donkey	172896.8	21
Goat	22271.64	5.65
Horse	8801	5.87
Mule	12853.5	5.46
Chickens	31429.13	16.3

Source: Own survey (2019)

Table 4: Distribution of Livestock holding among sample households

Total livestock Unit range	Total sample households	
	Frequency	Percent
0.00-2.00	191	47.35
2.01-4.00	100	25.00
4.01-6.00	51	13.20
6.01-8.00	46	11.613
≥ 8.01	12	4.226

Source: Own survey (2019)

generation and family consumption. Table 3 indicates the major livestock's in the study area accordingly cattle, donkey, sheep and chickens were the dominant in TLU, 45.1%, 21%, 17.2% and 16.3% respectively. This might be as West wollega is fertile environment for livestock production. Therefore in a nutshell argument livestock can enhance the economy of the study area.

Actually in the study area, small ruminants are used to meet immediate cash need of the households and also for meat production both for cash and home consumption especially during holidays. Poultry is kept for egg and meat production both for cash and home consumption. In most cases farmers kept oxen as a source of draught power, cows are important sources of milk and milk products for consumption and satisfy immediate cash through the sale of butter. To make the unit of measurement uniform conversion factor developed by Strock *et al.* [9] as cited in Arega Alene and Rashid [10] was used to convert the herd size to in TLU.

Below shows that 47.35% of the total sample households have had less than or equal to two TLU. Only 25% of the total sample households have had greater than or equal to two TLU of which 13.2% ranges between two and six TLU. This means, on average, only 15.8% of the households have had greater than six TLU. This indicates though study area is conducive for livestock production, majority of sample household are failed under less than two TLU. Therefore it needs depth investigation on factors that determine livestock production in the study area.

Crop Production: The farming system of the zone is mixed crop-livestock where crop plays the major role in the households' income. However from all hectares of land found in the zone, land for crops were 1, 650,243ha but only 273003ha were cultivated during 2018/19 production season. This might be due to lack of resource such as input (labor, capital and management) and it implies as there is arable land that will create surplus production in the long run in the study area.

The major crops grown in the area include cereals (maize, sorghum and fingermillet), oilseeds (nueg, sesame and groundnut) and pulses (haricot bean, Faba bean and peas). The study area is characterized by cereal, pulses and oilseed-based cropping system in which maize dominates. Sorghum is also an important crop next to maize. Sesame is the very well-known oilseed crops next to nueg in the study area. Regarding the proportion of the area allocated for crops, most respondents had allocated more than half of their total land for the production of sesame and maize in 2018/19 production season.
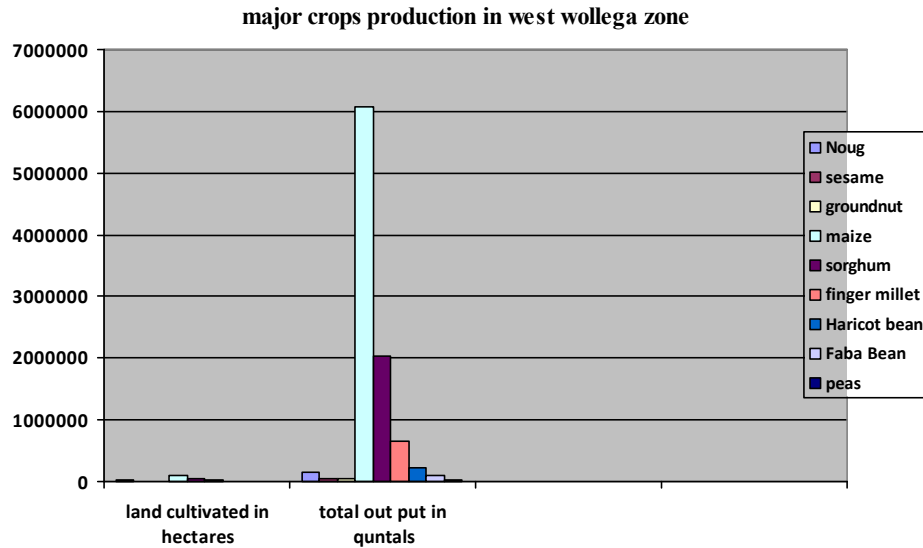
major crops production in west wollega zone

Fig. 3: Major crops production in west wollega zone
       Source: Own computation (2019)

Table 5: Distribution of major crop production in the study area

Types of Crops	Total production	
	Total hectares of land	Total production in Qun
Maize	1, 099, 72	6,068,961
Sorghum	55,271	2,029,203
Finger millet	32,097	642,457
Nueg	16960	146,395.7
Sesame	7601	57037
Groundnut	1750	37635
Haricot bean	12080	229,208
Faba Bean	6195.5	101,357
Peas	1112.97	16,242

Source: Own survey (2019)

Though there are various type of cereal crop are found in west wollega zone, accordingly the most dominant crops are prioritized documented here: Maize receives high external inputs mainly fertilizers, insecticides and herbicides. As data explain that, maize was cultivated on 1,099,72 ha and total production results were 6,068,961 quintals. Sorghum grain is the staple foods for a large part of the population and is drought resistant and is grown well at low elevations where rainfall. Accordingly in west wollega, Land cultivated for Sorgum was 55271 ha and total outputs harvested were 2,029,203 quintals. This implies that second to maize, sorghum plays great role in stabilizing food security by providing more output second to maize in the region.

In west wollega sesame, niger and groundnut are the most prioritized oil crops. As a result the cultivated land for niger production was 16960ha and total output was

146395.7quntals. Sesame production ranked second, cultivated land for this crop was 7601ha and total output harvested was 57037quntals. Groundnut was also the most important oil crop ranked third, accordingly 1750ha was cultivated and harvested total output was 37635quntals in 2018/19 production season [11].

Coffee: Coffee grows best at altitudes between l000 and 2000 meters and it grows wild in many parts of Ethiopia, although most Ethiopian coffee is produced in the southern and western regions of Kefa, Sidamo, Ilubabor, Gamo Gofa, Welega and Harerge. Coffee area is estimated at about half million hectares and about 98 percent of all coffee is produced by peasants on smallholdings of less than a hectare and the remaining two percent is produced by commercial (state and private) farms.

From four zones of wollegas (west, east, qellem and horoguduru zone), west and qellem wollega zones were the leading area in coffee production. As west wollega is the case study area, total land for coffee production was 433381.38ha. From this total landholding, only 255804ha were cultivated and total output was 123897tone and yield was 4.72 [12].

Collected data confirm that there are a lot of arable land which has been idle resource and high opportunity for more production in future. The productivity and yield of this crop is yet under question because of it's far apart from frontier of national productivity (Table 2). Indeed, there are 20 districts in west wollega zone. From all districts in the zone Ganji, Homa, Gulliso, yubdo,

Table 6: Total production with their corresponding districts

No	Districts	Total land holding (hectare)	Cultivated land (hectare)	Total output (quntals)	Productivity (quntals)
1	Gimbhie	23736	16531	74389.5	4.5
2	Lalo asabi	26607.9	21320.5	85281.94	4
3	Guliso	35198.5	24485.5	154993.2	6.33
4	Ayira	15648	11825	48009.5	4.06
5	Yubdo	16276	10796	604576	5.6
6	Genji	20580.25	11987.5	83912.5	7
7	Homa	9065	6894	44121.6	6.4
8	Sayo nole	30647.5	19550.4	81134.33	4.15
9	Nole koba	26561	12272	69950.4	5.7
10	Haru	32930.03	25386	141603.1	5.58
11	Bodji chokorsa	21598	13676.1	73714.3	5.39
12	Bodji dirmaji	21454	10915	53483.5	4.9
13	Nedjo	19001	5765	328605.5	5.7
14	Jarso	12065	2938	10224.24	3.48
15	Babo gambel	13516	4080	13627.2	3.34
16	Leta sibu	10042	5808	21083.04	3.63
17	Kiltu kara	25981.45	12608	29376.64	2.33
18	Manasibu	28408.5	15218.5	67265.77	4.42
19	Kondala	21117	7800	29640	3.8
20	Begi	22948	15947	63788	4

Source: Own computation from the data w/w/z/tea and coffee office/2019

Table 7: Top opportunities for cereal crops production in the study area

Opportunities	Frequency	Percentage
Optimum temperature	132	33
Availability of private crop protection services	112	28
Market demand	64	16
Lower labor cost	52	13
Arable land or unused land	40	10

Source: Own computation (2019)

Haru, Nejo and Nole kaba were the most potential districts in coffee production because their productivity was high when compare with other districts[13]

Crop Production Opportunities and Challenges: A number of challenges, opportunities and entry points for technological, institutional and organizational innovation for further upgrading the production in the study area were identified by the different experts. In this thesis, the major constraints and opportunities at different levels of crops and livestock production are identified and briefly discussed.

Opportunities

Production Opportunities: Availability of optimum temperature rank first level by the majority of sample households. Beside suitable temperature for the production of crops and livestock in the study area, the survey result shows that 33.2% the majority of the samples explained the suitability of temperature as the most important opportunities and intend to expand crop production and supply (Table 7)

Economic Opportunities: The zones private crop protection service, market demand, lower labor cost and arable land ranked by about 28%, 15%, 13% and 10.8% of the sample households respectively and hence are important opportunities in generating better income, its better productivity in the study area, its use as cash income source, increasing price and its continuous increasing demand in the market were some of the opportunities of crop production.

Constraints: The major constraint for crop production in study are land acidity (infertility), termite incidence, disease and tradeoff (between cash crops, cereals and mining activity). Termite, pests and diseases are the major challenges for cash crops in west wollega zone [1, 13] (Table 8). Among the total sample of respondents, 27%, 21%, 20.8%, 18.2% and 13% replied capital shortage, termite incidence, diseases and seed shortage respectively as their production problem (Table 8). This is caused mainly due to insufficient seed multiplying and distributing agency, production trade-off and seed shortage of supply, high input price, inappropriate delivery mechanisms and unavailability when required.

Table 8: Top constraints or challenges against crop production in west wollega zone

Challenges/constraint against cereal crops	Frequency	Percentage
Capital shortage	108	27
Termite incidence	84	21
Disease	80	20
Trade off	76	19
Seed shortage	52	13

Source: Own computation (2019)

Table 9: OLS results of factors that affect Livestock production in the study area

TLU	Coef	Std. Err.	t	P>t
AGE	.0405271	.0088621	4.57	0.000***
SEX	.428383	.4351025	0.98	0.325
EDULVL	.1214235	.0592809	2.05	0.041**
FAMSIZ	1.418397	.3793252	3.74	0.000***
EXPR IN LV	1.473659	.3674742	-4.01	0.000***
LV DISEASE	-1.062879	.2066294	5.14	0.000***
OVERGRAZING	-.6140848	.2054138	2.99	0.003***
NUTRITION	.6913298	.2038268	-3.39	0.001***
NONFRMINC	.9024926	.2094965	4.31	0.000***
ACCESS CREDIT	.1993016	.2328679	0.86	0.393
EXTNCNTCT	.2525639	.2917945	0.87	0.387
TCLAND	.1338009	.1547661	0.86	0.388
cons	-1.972001	.7790511	-2.53	0.012**

TLU: Total Livestock Unit OLS: Ordinary least square

Note: ** and *** refers to 5% and 1% significance level, respectively.

Source: Own computation (2019)

Econometric Analysis Result

Determinants of Livestock Production in the Study Area:
After characterizing the economics of crops and livestock production among farmers and measuring the status of production, finding out factors causing livestock production differentials among farmers was the next most important objective of this study. To see this, the number of livestock owned by household derived from total livestock unit (TLU) were regressed on socio-economic and institutional variables that explain the variations in production of livestock across farm households using multiple linear regression model(MLRM) estimated by ordinary least square (OLS) were used. The estimates of the multiple linear regression model showed that among 12 variables used in the analysis, age, education level of household, family size, off/non-farm income and experience in livestock production, livestock disease, nutrition and overgrazing were found to be statistically significant in affecting the level of TLU of farmers. However, the sign for overgrazing and disease were negative as it was anticipated.

Education: The coefficient of education is positive and significant at 1 percent. This confirm that the importance of education in increasing the efficiency of livestock production. It is a variable that is expected to increase managerial ability and led to good decisions in farming. Because of their better skills, access to information and good production planning; more educated farmers are better to manage their livestock resources and agricultural activities and minimize cost of production than less educated one. Besides this, educated farmers have relatively better capacity for optimal allocation of inputs. In line with this study, research done by Gezahagn Kudama [14]

Family Size: The coefficient of family size for TLU is positive and statistically significant at 1 percent significance level. The result is similar to the previous expectation that Farmers those having large family size are more efficient than farmers having small family size, because; family labor is the main input in livestock production as the farmer has large family size he would manage his livestock on time and May able to use appropriate forage combinations.

Livestock Production Experience: The coefficient of experience is positive and significant at 1 percent. This indicated that increased farming experience may lead to better assessment of importance and complexities of good farming decision, including efficient use of inputs for livestock.

Off/non-Farm Income: The positive and significant coefficient of the off/non-farm income suggests that the income obtained from such non-farm activities could be used for the purchase of forage and augments financing of household expenditures which would entirely dependent on agriculture. This could be due to the fact that most of the non-farm activities (butchery, grinding mills, handicraft and selling of local drinks) performed by the sample households do not compete with time allocated for livestock activities and the availability of off/non-farm income shifts the cash constraint outwards and enables farmers to make timely purchases of those inputs which they cannot provide from on farm income. The result is consistent with Hika [15]

Livestock disease and over grazing were negative and significant at 1%. This indicates that both variables were important in decision of livestock production in the study area because they distort the progress in production of total livestock unit. It might be due to constraint in communal pasture land and incidence of termite that create soil acidity in the study area.

CONCLUSION

Characterizing and advertising the availability of resource in a given area is the most important concept in arena of any research, job creation and policy making in a given countries economy. This necessitates seeking for a means to increase agricultural productivity of smallholder farmers, the dominant producers, which could either be met through characterizing and giving information about the resources available for the experts, researcher, NGOs and government official.

Multiple sampling technique was employed to get the target sample. Data analysis was carried out using descriptive and econometric statistics. The estimates of the multiple linear regression model showed that among 12 variables used in the analysis, age, education level of household, family size, off/non-farm income and experience in livestock production, livestock disease, nutrition and overgrazing were found to be statistically significant in affecting the level of TLU of farmers. However, the sign for overgrazing and disease were negative as it was anticipated. These significant variables can act as catalyst for decision maker to improve current situation of agriculture sector. Result of the descriptive analysis indicated as west wollega is known by three major ecologies high land 8.5%, mid land 78.4% and lowland 19.1%. Priority was given and documented among cereal crops maize, sorghum and pea were dominated, from pulse crops haricot bean, Faba bean and pea were dominated, from oil crops noug, sesame and groundnut were dominated and coffee is also the most well-known crop in west wollega zone.

An important conclusion stemming from the analysis of farming system is that, there exists a considerable room to enhance the level of crops production, livestock. The implication is that, there will be considerable gain in production level in the sector of agriculture because of idle resource that will bring high economic growth in the study area in specific and Ethiopia at large. Moreover, the study contributes to improve farm revenue, welfare and generally helps agricultural as well as economic development.

Ethical Statement

Ethical Approval: Final approval and acceptance of the article is contingent up on the submission of its final copy to the council of Graduate studies through the candidates department or school graduate committee.

Declaration Statement: I declare and affirm that this article is my own work. I have followed all ethical and technical principles of scholarship in the preparation, data collection, data analysis and compilation of this manuscript. Any scholarly matter that is included in the manuscript has been given recognition through citation.

I solemnly declare that this article is neither submitted to any other journal for publication nor to award of any academic certificate.

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Recommendation: The policy implications of this study are characterize and analysis of farming system in major agro ecologies of west wollega indicate both the distribution of resource and existence of crops, livestock and natural resource with their amount and in line with their agro ecologies. Thus, the results of the study give information to policy makers on which part of agricultural activities are yet idle and which farming system is dominant in such a way that the current status of agricultural economy in the study area.

The study results revealed that there is an unutilized resource that needs high consideration from stakeholder family, private and government especially on fruit, natural resource and irrigation activities. This indicated that in the long run improving the existing level of crops, livestock alone may not lead to significant increment in the level of agricultural production. So in the long run it needs attention to introduce other best alternative farming practices and improved technologies in order to change the lives of farmers. Thus, the following policy recommendations are forwarded based on the result of the study.

As the econometric result of this research witnesses, Age of household, Educational level, family size, experience in livestock production and nutrition and non-farm activity of household were very important factor that

contributed positively to the improvement of total livestock unit in the study area. So the government, development agent and all responsible bodies should give more attention to provide educational service for all to attain educated farmers and create fertile condition for better nutrition in order to increase livestock production the country in the long run.

The result of the finding also indicated that, overgrazing and livestock disease affect total livestock unit of farmers negatively in study area. Despite the justification given by this study, it needs further study why it appears to affect efficiency negatively. Therefore all responsible body should give high consideration to improve livestock production in the study area.

Finally the most challenging hegemony against for cereal and pulse production is the shifting of farmers from cereal and pulse to cash crops sesame, noug, coffee and ground nut by considering amount of income they earned from them. The tradeoff between chat and coffee production is also newly emerged idea in the area. Therefore researcher and government official should interfere by considering this data and forecasting future economy by giving priority which crop has high advantage for food security as well as economic growth in the long run.

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Appendix 1: Conversion factors used to estimate tropical livestock unit equivalents

Animal category	TLU
Calf	0.25
Weaned Calf	0.34
Donkey (Young)	0.35
Donkey (adult)	0.70
Camel	1.25
Heifer	0.75
Sheep and Goat (adult)	0.13
Caw and Ox	1.00
Sheep and Goat young	0.06
Mule	1.10
Chicken	0.013

Source: Storck *et al.* (1991)

Appendix 2: Multicollinearity test for inefficiency variable

Variables	VIF	1/VIF
livestock production experience	3.19	0.313127
Family size	2.60	0.384895
Non/off-farm income	2.09	0.479461
Education level	1.71	0.583353
Extension contact	1.16	0.860917
Overgrazing	1.14	0.878383
Credit access	1.12	0.895842
Total cultivated land	1.09	0.914705
Age of household head	1.09	0.920783
Nutrition	1.07	0.935616
Disease	1.04	
Mean VIF	1.53	