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Research article

Assessment of challenges of crop production and marketing in Bench-Sheko, Kaffa, Sheka, and West-Omo zones of southwest Ethiopia

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ABSTRACT

This study was conducted to identify the challenges of crop production and marketing in southwest Ethiopia. Primary and secondary sources of data were used. Qualitative and Quantitative data types were collected from 385 respondents through interviews, focus group discussion, key informant interviews, and observations. The collected data were analyzed by using descriptive statistics and econometric models. Crop productivity was analyzed by the Cobb Douglas model and its efficiency and determinants were identified by the stochastic frontier model. The major bottlenecks of crop production were the low attitude of farmers towards improved technology, low supply and usage of improved seed varieties (94.5%), low supply and use of fertilizers (95%), knowledge and skill gap of farmers (80.1%), poor extension service (57.3%), soil acidity (94.8%), diseases and insect pest (77.8%), conflict (84.9%) and the outbreak of human diseases (60%). Marketing challenges were poor infrastructure (87.3%), lack of market linkage (62.5%), and lack of credit services (70.6%). The Cobb Douglas model result revealed that land size, local seed, improved seed, repetition of weeding, and labor force influenced crop productivity. The mean level of crop technical efficiency was 51.3%. Education level, extension service, access to credit, cooperative membership, number of livestock owned, and soil fertility were influenced crop inefficiency negatively and distance to the farm was positively related to technical inefficiency. Improving extension services and skill of farmers through practical based training and building capacity of extension workers and systems to enhance the attitude of farmers towards technology usage and proper management practices, timely provision of farm inputs, improving road and market access, and provision of credit services to producers were some of the recommendations forwarded to alleviate crop production and marketing challenges in the study areas.

1. Introduction

Ethiopia is heavily dependent on agriculture as a predominant source of employment, income, and food security for the vast majority of its population. The agriculture sector plays a central role in the life and livelihood of most Ethiopians, where about 12 million smallholder farming households account for an estimated 95 percent of agricultural production (FAO, 2011). It contributes 34.1% to the GDP, creates employment opportunities for 79% of the population, responsible for 79% of external earnings, and is the major source of raw material and wealth for investment and the market (Diriba, 2020). About 95% of the total area under crop and greater than 90% of its output is generated from small-scale farming. Ethiopia is a center of origin and diversity for several crops. The main food crops are obtained in almost all areas of Ethiopia despite the variation in the amount of collection across the areas due to the level of area devoted to each crop nature, climate change, and a change in preference for the crops grown. They are categorized into cereals, pulses, oilseeds, vegetables, root and tuber crops, fruits, stimulant crops, and sugar cane.

Cereals are the most important in terms of volume, accounting for 54% of the total production, while Maize, Wheat, and Teff combined accounted for 77% of all cereal production (CSA 2015). The results of the year 2018/19 (2011 E.C.), Meher season post-harvest crop production survey indicated that about 71.6% of the total area under the crop and more than 69.5% of crop output is generated from cereals. Pulses are the second food crop after cereals in terms of area coverage and production in which they account for about 11.2% of the overall area under the crop and 7.5% of total production (CSA, 2019). According to the same source,

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in 2018/19 Meher season, out of 12,727,191.21 ha of land covered with major food crops and about 315,602,058.49 Qt of the harvested crop in the country, 1,159,993.92 ha of land or 9.1%, and 28,980,614.95 qls or 9.2% is covered by SNNPRS (Southern, Nations, Nationalities, and Peoples, Region) making it the 3rd largest region in terms of area coverage and production next to Oromia and Amhara Regions.

Agriculture is the most important determinant of SNNPRS of Ethiopia's economy, and it will continue to play the main role in the overall economic development of the region. The livelihood of the majority of the people of the country depends highly on agriculture. The agro-ecology of the region including southwestern parts such as Bench-Sheko, Kaffa, Sheka, and West-Omo zones are suitable for growing major food crops grown in the country. However, agricultural systems in the region are at subsistence level and production and productivity of food crops are low as compared to the crop potential. The most common factors are recurrent drought, degradation of natural resources, lack of appropriate technologies and low levels of input use (fertilizer, pesticide, improved seeds), weak institutional support, inadequate agricultural research and extension, pests, and constraints in market development (Merga and Haji, 2019; Taffesse et al., 2012). However, production potentials and its factors vary across different agro-ecologies in the region. Therefore, this study focused on the assessment of Production potentials and Bottlenecks of crops in the Bench-Sheko, Kafa, Sheka, and West-Omo zones of southwest Ethiopia.

2. Materials and methods

2.1. Description of the study area

This study was conducted in Bench-Sheko, Kaffa, Sheka, and West-Omo zones of SNNPR (Figure 1). Kaffa is one of the administrative zones within the SNNPRS and is bordered at the south by Debub Omo, at the southwest by Bench-Sheko, at the west by Sheka, at the north by the Oromia Region, and at the east by Konta. Gojeb River runs along part of the northern border of this zone. The administrative center of Kaffa is Bonga. The total population of the zone in the year 2017 was estimated to reach 1,102,278. Out of the total population 49.14% and 50.86% are male and female respectively (CSA, 2013).

Former Bench Maji (Bench- Sheko and West-Omo zones) bordered at the south by the Ilemi Triangle, at the west by South Sudan, at the northwest by the Gambela Region, at the north by Sheka, at the northeast by Kaffa, and at the east by Debub Omo. The administrative center of Bench-Sheko is Mizan Aman. Bench Sheko Zone is located at a latitude from 5°.33 to 7°.21 N and longitudes from 34°.88 to 36°.14 E with an elevation ranging from 1200 to 1959 m above sea level. The average annual rainfall ranging from one thousand five hundred millimeters to one thousand eight hundred millimeters (an average of one thousand six hundred ninety-two millimeters) per year and has a fifty-degree centigrade to a twenty-seven-degree centigrade range of temperature annually. The main food crops in this zone include Maize, Taro, and Enset. Cash crops include fruits (Bananas, Pineapples, and Oranges) and spices (e.g. Coriander and Ginger); Honey is also an important local source of income. However, Coffee is the primary cash crop. The total population of the zone in the year 2017 was estimated to reach 847,168. Out of the total population 49.31% and 50.69% are male and female respectively (CSA, 2013).

Sheka is a zone in the Southern, Nations, Nationalities, and Peoples' Region (SNNPR). Sheka is bordered on the south by Bench-Sheko, on the west by the Gambela Region, on the north by the Oromia Region, and on the east by Kaffa. The administrative center of Sheka is Masha. It lies between 7°24"to 7°52" N, 35°13"to 35°35" E, and 900 to 2700 masl. The zone covers about 2175.25 km^2, out of which 47% is covered by forest, and 56, 24, and 20% is a highland, amid altitude and lowland, respectively. It receives high amounts of rainfall, with an average of one thousand eight hundred millimeters to two thousand two hundred millimeters per annum. The total population of the zone in the year 2017 was estimated to reach 269,243. Out of the total population 50.30% and 49.70% are male and female respectively (CSA, 2013).

2.2. Sampling procedure

In this study, a Multi-stage sampling technique was used. In the first stage Bench-Sheko, Kaffa, West-Omo, and Sheka, zonal administrations were selected purposively. In the second stage, three kebeles from each woreda were selected purposively. In the third stage, households participating in crop production were chosen randomly.

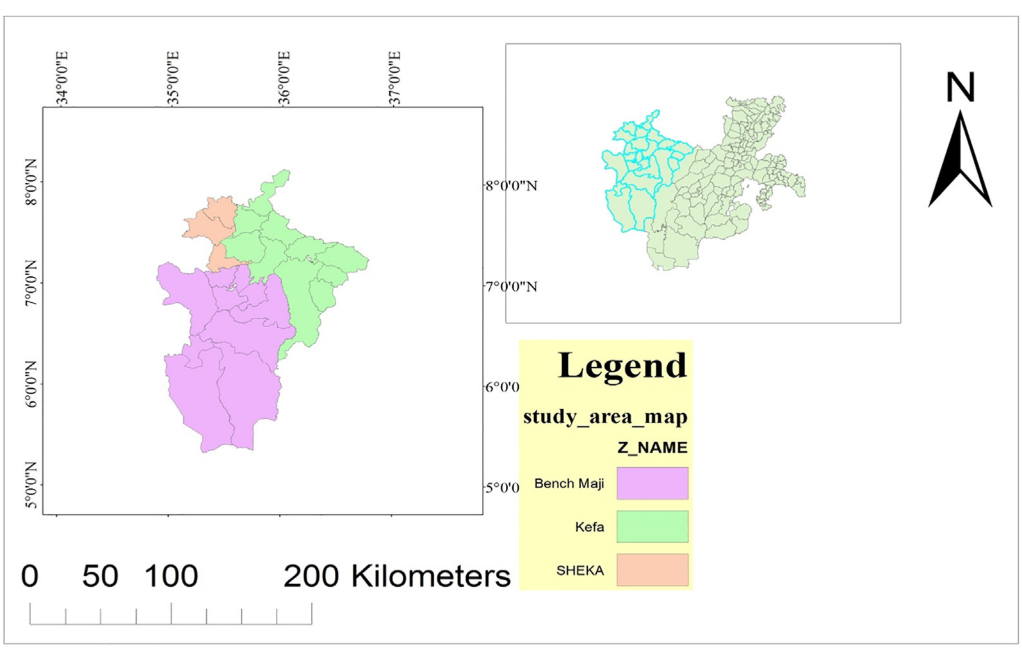

Figure 1. Description of the study area.

2.3. Sources, types, and collection of data

In this study, both primary and secondary data sources were used. Primary data were collected through a sampled producer interview, focus group discussions (FGDs), key informant interviews (KIIs), field observations, and market assessment. Questionnaires were prepared independently for each actor of crop producers. Data were also collected from traders and other actors. Both qualitative and quantitative data types were used in this study.

2.4. Sample size determination

In this study, the sample size was determined by the formula of Morgan (1970)

$$n=\frac{Z^2P(1-P)}{D^2} \tag{1}$$

Z = the table value of 95% confidence interval = 1.96
P = the population proportion (assumed to be 0.5 for it provides the maximum sample size).
D = the degree of accuracy expressed as a proportion (0.05)

$$n = \frac{1.96^2 0.5(1-0.5)}{0.05^2} = 385$$

Accordingly, the required sample size at 95% confidence level with a degree of variability of 5% and level of precision equal to 9% is used to obtain a sample size required which represents a true population (Table 1).

2.5. Data analysis

The collected data were analyzed by using both descriptive and econometric methods. Descriptive statistics such as mean, percentage, frequency, and standard deviations were used. Econometrically, Cobb Douglas and stochastic frontier methods were employed. Multicollinearity, Heteroscedasticity, and Post-estimation of the stochastic frontier model were checked and there is no rule violation exists.

2.5.1. Specification of econometric models

This study employed Cobb Douglass production function to analyze the functional relationship between crop productivity and selected variables. It is a commonly used model in similar studies (Tru, 2009; Aneani et al., 2011; Temesgen and Tufa, 2017; Kudama, 2019). For this study, Cobb Douglass production function is specified as follows:-

$$Y = AX_1^{\alpha_1}.X_2^{\alpha_2}.X_3^{\alpha_3}.X_4^{\alpha_4}.X_5^{\alpha_5}.e^{\beta_1 D_1+\beta_2 D_2+Ui} \tag{2}$$

Where;

Y = Crop productivity (Quintal/Hectare); A = constant Term; X_1, X_2, X_3, X_4 and X_5 are explanatory variables; β_1 and β_2 are coefficients of dummy variables; α_1, α_2, α_3, α_4 and α_5 are coefficients of explanatory variables; D_1, D_2 are Dummy variables; U_i = Error term

The linear transformation of the above equation by taking the natural logarithm of the function can be given as:-

$$\ln Y = \ln A + \alpha_1 X_1 + \alpha_2 \ln X_2 + \ldots + \alpha_5 \ln X_5 + \beta_1^{D_1} + \beta_2^{D_2} + Ui \tag{3}$$

Parameters, $\alpha_1 \ldots \alpha_5$ and β_1 and β_2 are estimated by OLS (Ordinary Least Square) models.

2.5.2. The stochastic frontier production model (SFM)

This model has generally been preferred in agriculture due to several reasons. First, the hypothesis that all differences from the frontier rise from inefficiency, as expected by data envelopment analysis (DEA) is tough to admit, agreeing with the natural variability of crop production due to overwhelming factors such as weather, pests, and diseases. Second, because of the small farm size, family own farm records are kept seldom. Finally, available data on production is likely to be subject to measurement errors.

The frontier production model begins by considering a stochastic production function with a multiplicative disturbance term of the form

$$Y_i = f(X_i, \beta_i) e^{\varepsilon i} \tag{4}$$

Taking the natural logarithm of the specified Cobb–Douglas production function, we can reach the following linear production function which can be easily estimated:

$$\ln Y_i = \beta_o + \sum_{j=1}^{n} \beta_j \ln X_{ji} + \varepsilon_i \tag{5}$$

Where ln = natural logarithm and n = 1, 2,..., 5; β′s are the vector of parameters to be estimated and εi is a stochastic disturbance term consisting of two explanatory components u and v, where u is the symmetric factor, v, accounts for the random difference in production due to issues outside the producer's control, for example, climatic issues, crop pests, and diseases. It is assumed to be independently and identically distributed as N (0, σ2 v). u is a one-sided component, where $u \leq 0$ reflects technical inefficiency relative to the stochastic frontier, f (Xi; β)eε. Thus, u = 0 for a crop yield that depends on the frontier, and u is half-normal.

In this study, one of the objectives is to find out the determinants of productivity variation/inefficiency gaps among crop-producing farmers. Thus, knowing crop producers are technically inefficient by itself can not be important except the causes of the inefficiency are well-known. The inefficiency function is set by the proportion of recognized production to stochastic frontier production that can be indicated as a function of crop farm and producer-specific characteristics that affect producers' technical inefficiency difference is given as:

$$TE_i = \frac{f(X_i, \beta_n) e^{vi-ui}}{f(X_i, \beta_n) e^{vi}} = e^{-u_i} \rightarrow e^{f(z_i, \delta_i)+\omega_i} \tag{6}$$

Following Coelli and Battese [9], the inefficiency function can be expressed as:

$$U_i = \delta_o + \sum_{j=1}^{n} \delta_j z_j + \omega_i \tag{7}$$

Where U_i is the inefficiency scores for the i^{th} farmer; Z_i is the vector of explanatory variable which explains the producer's inefficiency, δ_i =

Table 1. The sample size of the respondent.

No.	Commodity	Zones	No woredas	Sample size
1	Crops	Bench sheko	5	83
2		Kafa	10	167
3		Shaka	3	52
4		West-Omo	5	83
		Total	23	385

Source: Authors computation, 2020.

Vector of the unknown parameter to be expected, and ω_i = Unobservable random variables, which are hypothesized to be identically distributed.

2.5.3. Definitions and measurements of variables used

Eighty explanatory variables were hypothesized to influence crop productivity, and technical inefficiency (Table 2).

3. Results

3.1. Socio-demographic characteristics of respondents

As indicated in Figure 2, from the total respondents in Bench-Sheko, Kaffa, West-Omo, and Sheka zones, 91.7, 97, 99, and 92 % of respondents were males, respectively and the rest of respondents were females. Regarding marital status, 89.7, 91.9, 95.8, and 94 % of respondents were married. The educational levels of the West-Omo zone affect the production and productivity of crops negatively.

This result shows that the respondents in the study area were of productive age. Table 2 indicated that the average age, educational level, family size, labor force, and the mean distance of respondents to market in the study area.

3.2. Crop production and productivity in southwest Ethiopia

The dominant crop in the study area was maize which covered the highest land than other crops in the Kaffa, Bench-Sheko, and Sheka zones of Southwest Ethiopia. The highest Teff producer from the study area was the Kaffa zone followed by faba bean, wheat, field pea, and haricot bean (Table 3). In the Bench-Sheko zone, Finger millet was the second-highest produced crop (see Table 4).

When we compare the output level of maize with regional and national productivity level, the yield level in Kaffa and Bench Sheko zones were smaller than that of regional and national productivity level of Maize but in the Sheka Zone, the productivity level of maize was higher than that of regional and national productivity level of maize (Table 5).

The productivity level of wheat in the Kaffa zone was higher than that of the regional and national productivity level of wheat but it was lower in the Sheka and Bench-Sheko zones of Southwest Ethiopia. The fewest crops in productivity level were sesame and finger millet in the study area.

3.3. Production and productivity level of vegetables, fruits, root and tuber crops

Enset (false banana) was the dominant root crop in Kafa and Sheka zones while Taro production was the highest in the Bench-Sheko Zone (Table 6). In Kaffa and Sheka Zones, potatoes were highly produced. The Onion, cabbage, and beetroot were highly produced in the Kaffa zone.

Concerning fruit production, almost all types of fruits were produced in Kaffa and Bench-Sheko zones. Pine Apple, papaya, orange, lemon, guava, and apple was not produced in the Sheka zone but are produced in Kaffa and Bench-Sheko zones. Mango and banana were produced in Keffa, Sheka, and Bench-Sheko zones (Table 6).

The productivity level of root and tuber crops, vegetables, and fruits were presented in Table 7. The average yield of potato in Bench-Sheko, Kaffa, and Sheka zones was 280–310 qt/ha which is by far lower than the potential of the crops. However, the crop can produce up to 475 qt/ha indicating potato productivity in this zone was 53–70% lower than the potential of the crop in well-managed farms (Table 7). Similarly, more than 50% lower productivity was harvested for enset and mango and, more than 100% less productivity was collected for Onion, cabbage, tomato, pepper, and banana.

3.4. Crop area coverage and production level of West-Omo zone

The total land was sown and the production of crops in the study area was 315,243 ha and 8,721,436 quintals, respectively (Figure 3). The leading crops in production are cereals, pulses, oil crops, fruits, and vegetables. The average output of large grain cereals in the zone was decreased from year to year. The recent yield of large grain cereals was 25 qt/ha (figure, 2). Small cereal grains productivity in the study area was 25 qt/ha. There are oil-producing crops in West-Omo and their production also very small which was 3 qt/ha. The average root crop productivity was 90 qt/ha in the study area. Vegetable productivity in the zone accounts for 25 qt/ha in the production year of 2018/19.

3.5. Level of inputs usage in West-Omo zone

In the study area, the use of improved seed variety was a severe Problem. Table 8 indicated that the average covered from 2015/16 to 2018/19 was 48,135.7 ha of land and the average improved seed variety usage for this land was 1,335.5 qt. From this, it was concluded that the

Table 2. List and description of variables.

Variable	Description	Type	Expected signs
Yield	Production level by the quintal	Continuous	
Age	Age of the respondents	Continuous	+/−
Education level	The education level of the respondents	Continuous	+
Local seed	Amount of local seed used for crop production in quintal	Continuous	−
Improved seed	Amount of improved seed varieties for crop production in quintal	Continuous	+
Fertilizer	Amount of fertilizer used for crop production in quintal		
Family size	Family size of the respondents	Continuous	+/−
Tillage	Tillage performed by producers measured by numbers	Continuous	+
Weeding	Weeding performed by producers measured by numbers	Continuous	+
Labor force	Labor force for crop production	Continuous	+
Sex	Sex of the respondent	Dummy	+
Cooperative membership	Membership status of the respondents in cooperatives	Dummy	+
Income	Income level of the respondents	Continuous	+
Distance	Distance from the nearest market center of the respondents	Continuous	-
Access to credit	A dummy variable (1 = access to credit, 0 = otherwise)	Dummy	+
Number of livestock	Number of livestock owned	Continuous	+
Soil fertility	Soil fertility status (dummy variable 1 = fertile, otherwise = 0)	Dummy	+
Extension service	Access to extension service (=yes, 0 = otherwise)	Dummy	+
Experience	Experience of the respondents in honey production	Continuous	+

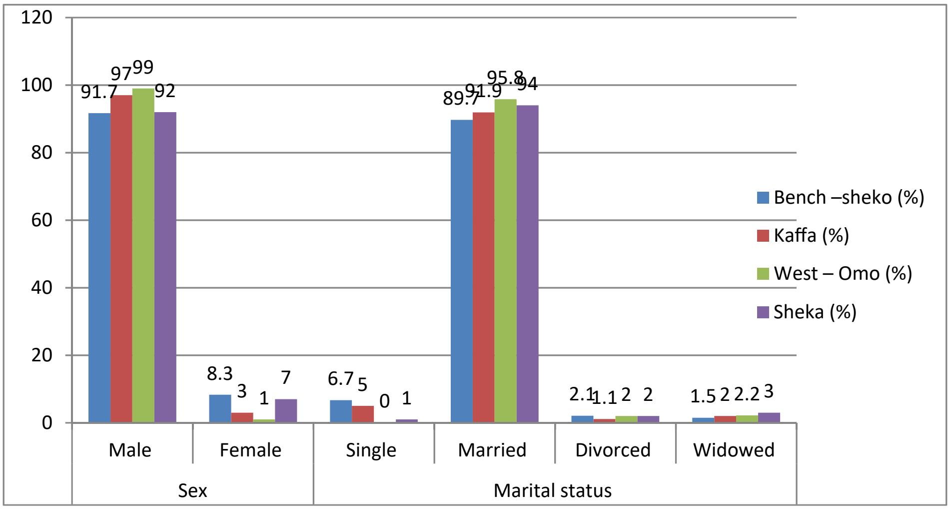

Figure 2. Sex and marital status of respondents.

Table 3. Socio-demographic characteristics.

Variables	Bench-Sheko			Kaffa			West-Omo			Shaka		
	Mean	Min	Max	Mean	Min.	Max	Mean	Min.	Max	Mean	Min.	Max
Age (years)	38.48	28	74	42.4	23	68	41.52	26	60	38.42	27	67
Education level (years)	3.35	0	11	6.4	0	13	2.15	0	10	5.13	0	10
Family size (numbers)	7.5	3	12	6.3	1	15	9.16	3	18	4.24	1	8
Labor force (numbers)	4.32	2	6	3.15	1	6	4.7	2	9	2.12	1	6
Distance to market (km)	6.53	3.25	13.06	11.5	5.75	23	7	3.5	14	4.5	2.25	9

Source: Own survey data, 2020.

improved variety usage behavior of the West-Omo zone was weak and needs intervention. The reason for this is lack of knowledge, poor extension service, accessibility, and supply problems.

The average usage of fertilizer in the study area from 2015/16 to 2018/19 production years was 5,760 qt of Dap and 8,444.5 qt of Urea. The fertilizer application status and the land covered by crops can not be comparable because the land covered by crops needs more fertilizer than the used one. In the study area, especially in the 2015/16 and 2018/19 production years, there was no supply of inputs like fertilizer, improved seed varieties, and the likes which affected the productivity level of crops highly (Table 8).

3.6. Crop production challenges

The major challenges that have been influencing crop production and productivity of the study area were identified as poor extension service, low supply and use of improved varieties and fertilizers, knowledge and skill gap of farmers, soil acidity, disease, insect pests, and other related problems like human disease and security Problem. These problems were discussed hereunder.

The Problem of supply and use of improved seed varieties:- The majority of respondents (96, 92, 91, and 99%) from Bench-Sheko, Kaffa, Sheka, and West-Omo zones respectively, indicated that supply and use

Table 4. Land allocation and Production of crops in Kafa, Bench Sheko, and Sheka zones.

No.	Crops	Kafa zone		Bench Sheko		Sheka	
		Average from 2016/17–2018/19					
		Area cultivated (ha)	Production level in Qt	Area cultivated (ha)	Production level in Qt	Area cultivated (ha)	Production level in Qt
1	Maize	32,794.9	1,101,597.7	24477.2	460356.7	6054.3	294428.7
2	Sorghum	2894.9	69479.3	5612.7	55681	2174	63668.7
3	Wheat	9249.3	317,045.5	846.8	14723.3	470.3	10423.7
4	Barley	5,376.2	95564	869.3	6057.7	603.3	11994.7
5	Teff	13,678.5	225964	1877.5	16839.7	673	5347
6	Finger millet	74.2	964.2	9281.8	155086	271.3	4980.7
7	Rice	427.7	12,207.1	454.8	3018.8	1606	17848
8	Faba bean	13563.6	234,612.5	2160	21258.7	1661	16470
9	Haricot bean	6089.5	86654.1	4686	56106	127.7	1220.3
10	Sesame	7.67	46.75	183.3	1300	6054.3	294428.7
11	Field pea	8,602.7	132463.5	694	1691.7	2174	63668.7

Source: Authors computation from Government Reports, 2020.

Table 5. The productivity of crops in southwest Ethiopia.

No.	Crop	Average from 2016/17–2018/19			Regional productivity (Qt/ha)/2011	National product (Qt/ha)/2011
		Kafa zone	Sheka zone	Bench Sheko		
1	Maize	33.5	48.7	28	39.29	39.92
2	Sorghum	24	29	16.5	26.09	27.36
3	Wheat	34.2	22	23.7	26.58	27.64
4	Barley	17.8	20	17.33	19.42	21.77
5	Teff	16.5	8.33	12.5	14.83	17.56
6	Finger millet	4.33	31.3		15.91	23.17
7	Rice	28.4		32.7		27.12
8	Field pea	15.26	11.3	9.7	16.1	16.64
9	Faba bean	17.37	10	14	20.01	21.17
10	Haricot bean	14.06	10.33	19	15.64	16.8
11	Sesame	4.1		4.33	6.77	6.83

Source: Authors computation from Government Reports, 2020.

Table 6. Production and land allocation of Vegetables, Root, and Tuber crops.

No.	Crop	Average (2016/17–2018/19)					
		Kafa		Sheka		Bench sheko	
		Land (ha)	Production (Qt)	Land (ha)	Production (Qt)	Land (ha)	Production (Qt)
Root and Tuber							
1	Enset	16531.2	2209789.3	8457.7	2161217	1870.7	414255
2	Taro	4579.9	515720.5	62.3	9450	10555	2999850
3	Anchote	411.1	43433.5	61.7	3083.333		
4	Yam	382.1	28278.5	61.7	3083.333	1917.9	470317.4
5	Cassava	150.8	14175			759	223306.4
6	Sweet potato	709	70235.3	104	26000	1032.2	300125.3
7	Potato	4606.6	859236.5	2318.7	668493.3	348.3	103614.2
Vegetable							
1	Onion	2012.4	242069	417	44064	690.4	117204.3
2	Cabbage	2265.8	332537.5	524.7	99966.7	485.5	104637.7
3	Beet root	1206.5	188588.5	360	59038.7	159.1	24949.3
4	Carrot	566.5	89053.5	54	8220	144.8	22643.7
5	Tomato	483.5	93834.5	121	18366.3	242.04	57010.3
6	Swiss chard	39.5	8279			6.8	1413.8
7	Lettuce	0.3	20			7.9	1642.5
8	Pepper (green)	586.3	73941.5			807.1	51686.8
9	Ethiopian cabbage	2721	439964	531.3	63760	1668.7	333741.7
10	Garlic	1901.8	285780	81.3	6481.3	270.9	36510.7
Fruits							
1	Avocado	2668.1	416520	499.3	118200	1026.3	322018.3
2	Mango	1158.5	163142.5	65	14667.7	1361.3	249533.3
3	Banana	1811.25	210374	303.7	61683.3	10003.7	2416254
4	Pineapple	58.315	6011.3			182.7	45604
5	Papaya	172.94	25543			174.7	43676.7
6	Orange	244.19	31894.5			85.2	13635
7	Lemmon	101.375	9277			14.7	2346.7
8	Guava	11.25	1445				
9	Apple	10.125	440			6.44	736.3

Source: Authors computation from Government Reports, 2020.

of improved seed varieties as one of the constraints in crop production (Table 9).

The descriptive result indicated that the average land covered by maize in Bench-Sheko, Kaffa, and Sheka zones were 24,477.2, 32,794.9, and 6,054.3 ha, respectively. The average land covered by improved seeds and fertilizer was 7,576, 10,866.5, and 2,203 ha in Bench-Sheko, Kaffa, and Sheka zones, consecutively. This indicated that the land covered by improved seeds of maize and fertilizer was 30.9% in Bench-Sheko, 33.1% in Kaffa, and 36.4% in Sheko zones. There was no land enclosed by improved sorghum variety in all zones. In wheat production, the land covered by improved variety was 343.7 ha in Bench-Sheko and 2915.1 ha in the Kaffa zones. This revealed that from the total land

Table 7. The productivity of Vegetables, Root, and Tuber crops in Kaffa, Sheka, and Bench-Sheko zones.

S/no	Crops	Average productivity from 2016/17–2019			Regional productivity (Qt/ha)	National Productivity (Qt/ha)
		Bench shako (Qt/ha)	Sheka zone (Qt/ha)	Kafa zone (Qt/ha)		
Root and Tuber crops						
1	Potato	296.667	292	186.4	171.1	141.76
2	Enset	221.333	254.3	123		
3	Taro	283.333	101.3	110	269.21	261.01
4	Yam	244.717	33.33	75	94.77	89.97
5	Anchote		33.33	105		
6	Cassava	293.333		95		
7	sweet potato	289.997	166.7	96.2	218.94	359.97
Vegetables						
8	Onion	172.503	108	122.6	100.8	91.43
9	Beetroot	156.667	170.3	153.8		82.41
10	Cabbage	213.333	191.7		58.08	60.89
11	Tomato	233.333	153.7		10.3	51.21
12	Carrot	156.667	155	155.6		
13	Garlic	133.96	80.3	154.8		39.7
14	Eth. Cabbage	200	80	161.1		
15	Pepper	63.3333		133		
16	Swiss chard	206.667		164.5		
17	Lettuce	206.66		80		
Fruits						
18	Avocado	312.2	216.7	137.7	44.79	42.91
19	Mango	183.3	150	140.1	86.72	69.68
20	Banana	234.5	217	107.3	84.96	75.97
21	pineapple	250		137	22.78	21.47
22	Papaya	250		133.8	187.88	147.2
23	Orange	160		124.9	101.33	82.45
24	Lemmon	160		90.5	64.34	69.68
25	Apple	113.1		81.25		
26	Gravia			64.22		

Source: Authors computation from Government Reports, 2020.

covered by wheat 40.6% in the Bench-Sheko zone and 31.5% in the Kaffa zone were covered by improved wheat seed variety and fertilizer. From the total land covered by barley and teff, 12.9% and 8.9% respectively in Kaffa zone covered by improved barley and teff variety. Meanwhile, the total land covered by barley and teff in the Bench-Sheko zone was by local variety.

In the Sheka zone, except maize variety, all were covered by local seed variety and no fertilizer application due to long-time security problems. From the total land covered by rice and field pea, 100% and 64.8% respectively in Bench-Sheko were covered by improved seed and fertilizer, while 100% of rice and field peas were covered by local seed. Regarding faba bean and haricot bean, from the total

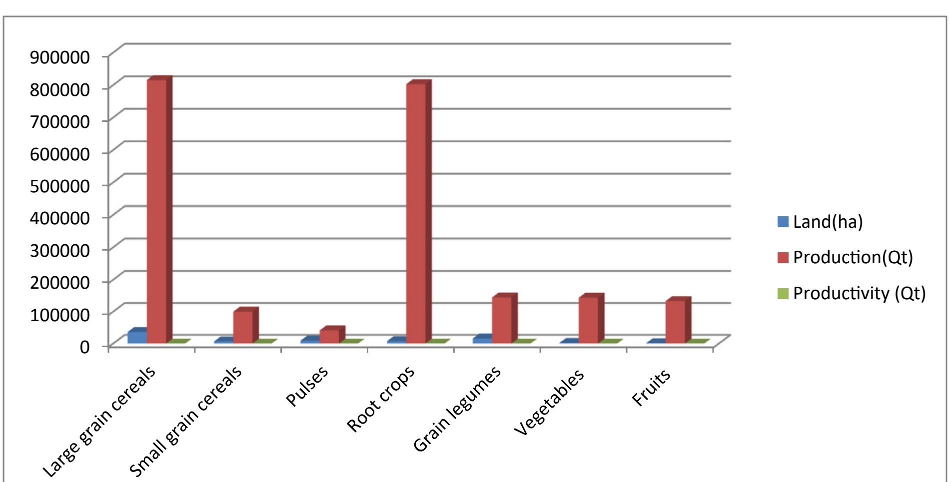

Figure 3. Crops land coverage, production, and productivity.

Table 8. Level of input usage in West- Omo Zone.

No.	Input supply	2015/16	2016/17	2017/18	2018/19	Average (2015–2019)
		Amount (Qt)	Amount (Qt)	Amount (Qt)	Amount (Qt)	
1	Dap	12110	10930	0	0	5760
2	Urea	6500	7778	0	0	8444.5
3	improved seed varieties	2297	3045	0	0	1335.5
6	vegetable seeds	35	658	0	0	173.25

Source: Authors computation from Government Reports, 2020.

land covered by faba bean and haricot bean 10.7% and 4.98% respectively in Bench-Sheko, and 1.3% of Faba Bean and 2.39% of Haricot Bean in Kaffa covered by improved seed variety and fertilizer (Table 9).

Problem with fertilizer supply and use: Regarding the use of fertilizer, about 95, 95, 94, and 97% of respondents from Bench-Sheko, Kaffa, Sheka, and West-Omo zones respectively, indicated that supply and use of fertilizer is one of the major constraints known in crop production (Table 9). The main reason for poor fertilizer application habits was a supply problem and farmers' beliefs. There is a wide gap in the use of fertilizer in the Bench-Sheko Zone. For example, only 32.03% of maize-covered fields were fertilized in 2018/19. The remaining 67.97 % was sown without fertilizer. However, from cereal crops, maize was fertilized relatively from other cereal crops and barley was cultivated without fertilizer. In some woredas, like Gimbo, Bixa, cheta, Gawata of Kaffa zone fertilizer supply was a serious issue. For example, barley and sorghum were produced without fertilizer whiles 36. 18% of lands covered by maize were produced by fertilizers; the rest 63.82% were produced without fertilizers. Although in Sheka Zone maize, wheat, barley, sorghum, teff, finger millet, and rice are the major crops produced in the area. Due to frequent insecurity problems in the area, the farmers had not been able to produce cereal crops with fertilizer. As a result, only 19.93% of the maize-covered lands in the 2015/16 production year were sown with fertilizer while in 2018/19 the land covered by maize was significantly reduced to 4.53%.

Lack of technical knowledge and skill:- The use of traditional technologies is widespread and continues in this sector. Although farmers have a background in agricultural production, they still use traditional crop management practices and are not familiar with modern farming methods. The level of education is low and affects the ability and skill of farmers to adopt new technologies and innovations to increase production and productivity and consequently to supply more products to the market. In this study, about 97, 60, 63,100% of respondents of Bench-Sheko, Kaffa, Sheka, and West-Omo zone respectively, indicated lack of skill and knowledge has a significant effect on crop production (Table 9). Farmers also mentioned interruption of previously (3 years before) available skill development training aggravated the Problem by this time.

Soil Acidity:- Soil acidity was stated as a constraint in the highland areas affecting the productivity of crops. It was reported almost in all zones of the study areas. As indicated in Table 8, the majority of the respondents (99, 97, 91, and 91% of Bench-Sheko, Kafa, Sheka, and West-Omo zone respectively) mentioned that they were informed about the presence of soil acidity in their farm which reduced crop productivity but no actions were taken. According to the focus group discussion and key informant interview made in the Bench-Sheko zone, soil acidity reduced productivity and farmers are replacing their farms with eucalyptus trees. As a result, soil fertility is deteriorating in shay-bench, north-bench, and some parts of south-bench woreda. Farmers, especially those in the Bench-Sheko zone are less likely to use lime to treat acidic soils.

A similar Problem of soil acidity was prevalent in the Kaffa zone. According to the focus group discussion and key informant interview, the problem was serious in Gimbo, Decha, Cheta, Bita, and Chena woredas of the Kaffa zone. Similarly, in the woredas, soil acidity has been highlighted and pointed out but the samples collected by development agents were not taken for a laboratory experiment. Soil acidity is widely observed in all woredas of the Sheka zone and the problem was more serious in Masha and Andiracha woreda. Shortage of lime, lack of on-time determination of the soil acidity in the laboratory, poor attitude of farmers towards lime use, and lack of demonstration on lime use were some of the problems mentioned in all study areas regarding soil acidity.

Extension service Problem:-In the study area, many respondents raised poor extension service as one of the major constraints of crop production (Table 9). During key informant interviews and focus group discussions in all study areas, participants seriously mentioned the development agent's knowledge level and unavailability of enough development agents that were required per kebele. They responded as most development agents lack the knowledge to assist producers with modern production mechanisms. The status of extension workers named as development agents (DAs) in Kaffa 34.95%, Sheka 14.79 %, Bench-Shako 40.75 %, and West-Omo 74.5% was below standard (below Diploma level). The researchers identified during key informant interviews that there was a critical problem in the supply of working inputs for development agents and the sectors were suffering from restricted financial and human resources.

Table 9. Production challenges of study areas.

No.	Constraints	Zones				
		Bench Sheko	Kafa	Sheka	West-Omo	Average
		Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
1	Poor extension service	68 (81.8)	108 (6.8)	23 (43.5)	81 (97.4)	70 (57.3)
2	Low supply and use of improved seed varieties	80 (96.1)	153 (91.9)	47 (91.3)	82 (98.7)	91 (94.5)
3	Low supply and use of fertilizers	79 (94.8)	158 (94.6)	49 (93.5)	81 (97.4)	92 (95)
4	Knowledge and skills gap of farmers	81 (97.4)	101 (60.0)	33 (63.0)	83 (100.0)	74 (80.1)
5	Soil acidity Problem	82 (99.7)	162 (97.2)	47 (91.3)	75 (90.9)	92 (94.8)
6	Crop diseases and insect pests	69 (83.1)	95 (56.8)	45 (86.9)	70 (84.4)	69.8 (77.8)
7	Conflict	72 (87.01)	106 (63.2)	50 (95.7)	78 (93.5)	76.5 (84.9)
8	The outbreak of human disease	57 (68.8)	91 (54.6)	25 (48.1)	60 (72.3)	58.3 (60)

Source: Authors survey result, 2020.

Crop disease and insect pests: From respondents 83, 57, 87, and 84% reported that disease and insect pest occurrence highly affected crop production in Bench-Sheko, Kaffa, Sheka, and West-Omo zones respectively. Some of the diseases mentioned by participants were leaf diseases like leaf rust on cereals like maize, wheat, barley, and leaf blight on maize. Potato late blight and avocado root rot were other serious problems in the study area. Regarding insect pests, african bollworm, american armyworm, and stalk borer were some of the insect pests causing yield reduction in maize and sorghum, and mango white scale were the major pests mentioned during a focus group discussion in the study area. According to the focus group discussions and key informant interviews made in the study area, enset bacterial wilt was the major production constraint in the study area. The Problem was more serious in enset growing woredas like Gimbo, Bita, Chena, and Decha woredas of Kaffa zone; She-Bench and Semen Bench woredas of Bench-Sheko zone; Maji woreda of West-Omo zone; and Masha, Andiracha, and Yeki woredas of Sheka zone.

Conflicts: As indicated in Table 9, a security Problem was one of the factors influencing productivity in some parts of the study area. Respondents of the study area also mentioned one of the reasons which contributed to the decrease in production and productivity of crops for the last two years was security problems observed in Maji, Surma, and Bero woreda of West-Omo zone; Cheta, Decha (Goba), and Gawata woreda (for some months) of Kaffa zone; Yeki woreda of Sheka zone and in some kebeles of Sheko, South-Bench and Guraferda woredas of Bench-Sheko zone affected the productivity of crops by hindering seasonal farming activities in the field, free movement of extension agents, distribution of agricultural technologies to the farmers, diverting the attention and resources of the woredas from activities related to improving agricultural production to security issues.

Human disease outbreak (Malaria):-In the Kaffa zone, especially in cheta woreda producers cited seriously about the outbreak of malaria influenced their productivity. They raised there was no equipment like bed nets distributed or existed for purchase to prevent malaria. Many studies deal with the impact of malaria at the productive stage. The major effect of malaria, therefore, lies in the production time (labor time) lost by the ill and the farm household members who divert productive time on the farm to care for the sick. Reduced farm labor may adversely affect the adoption of labor-intensive technologies. Malaria exerts a significant negative impact on crop production. Another important potential effect is the reduction in investments in agriculture due to high expenditures on malaria treatment and prevention. In the West-Omo zone rural areas farmers are struggling with the worms. This is due to a lack of pure drinkable water in their environment and using rivers for drinking purposes.

This implies that households inflicted with malaria and other diseases were less productive compared with healthy households. Malaria morbidity also reduces output by increasing absenteeism from work, and by reducing work capacity or efficiency of individuals, leading to a decrease in hours worked (Table 9).

3.7. Crop marketing challenges

Poor infrastructure: the other market constraint faced by farmers was the poorly maintained agricultural infrastructure such as farm access roads and the poor road infrastructure network from the district to main market centers. Rural roads are important for delivering goods and services required for agricultural production and transporting outputs to markets and processing facilities. However, the rural road and infrastructural facilities in the study area are almost in bad condition which leads to high marketing costs for those agricultural producers. These present major constraints in improving agricultural productivity in general as it makes the transaction cost of doing business high for farmers. As indicated in the table, in Bench-Sheko, Kaffa, West-Omo, and Shaka zones 84.3%, 86.6%, 87.9%, and 90.3% reported that there was an infrastructure Problem in the study area (Table 10).

Also, the availability and cost of transport in another constraint in marketing products in the study area, the primary and main means of transport for most of the producers were hand caring and donkey, and farmers can walk up six hours to get their produce to the market. Moreover, due to a lack of adequate storage facilities and infrastructure access (road, market, and transport, etc.), farmers do not deliver their products to the market at a fair price at the right place and right time. Village markets exist in some of the kebeles or neighboring kebeles. The main open market, however, is found in the capitals of the woredas. All-weather road access is limited in some mid and high-land woredas.

Poor market linkage: the main constraint on agricultural crop producers that hinder more production, productivity, and more market supply was the lack of market linkage among market chain actors. Distance from producers' houses to the nearest market also the factor which may determine producers can supply fewer products to the market. The farther from the market the higher would be the transportation cost and opportunity time spent so that it makes a marketed surplus of agricultural products to be supplied in smaller quantity (Table 10).

Agricultural crop producers in the study have no organization that could strengthen their bargaining power to sell their output to the market. That is starting from production up to marketing, every farmer produces and sells on an individual basis which was open to any buyer due to lack of cooperation and due to lack of market linkage. The producers are a price taker rather than a price setter and which leads almost all agricultural crop producers can deviate from competitive market norms. This indicated that the market linkages among smallholder crop producers are inefficient and non-competitive.

Lack of Credit Service: Farmers complained that they did not have sufficient money and when they get money, the interest rate was very high to get credit from Omo Micro Finance. There is no enough credit access available for farmers in woredas such as Semen Bench, Gorche, Malga, Wondogenet, Gedeo, and Debub Bench. In Yeki where credit service is available such as through Omo microfinance institutions, farmers have no access to credit due to a lack of awareness on credit service by such institutions and fearing risks of credit return in cases of crop failure (Table 10). Lack of credit services, input supply systems and lack of stock of appropriate technologies can be limiting factors for agricultural development.

3.8. Econometric analysis of crop productivity, efficiency and its determinants

Seven variables were used to analyze crop productivity in the study areas. From these variables, five variables were significantly influence crop productivity in the study areas (Table 11).

	Number of obs = 380
	Wald chi2 (7) = 68.98
Log likelihood = −329.29879	Prob > chi2 = 0.0000

Land size: this variable is a continuous variable and significant at less than one percent significance level and the coefficient of a variable is positively related to crop productivity. The coefficient of this variable indicated that a one percent increase in land size will increase crop productivity by nine point eight percent.

Local seed: this variable is significant at less than one percent significance level and negatively related to crop productivity. The coefficient of the variable indicated that a one percent increase in the local seed will decrease crop productivity by seven point six percent.

Improved seed: this variable is significant at less than one percent significance level and positively related to crop productivity. The coefficient value revealed that a one percent increase in improved seed varieties increases crop productivity by eight point six percent.

Table 10. Marketing challenges of crops.

No.	Constraints	Zones				
		Bench-Sheko	Kaffa	West-Omo	Shaka	Average
		Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
1	Lack of infrastructure access	70 (84.30)	145 (86.60)	73 (87.90)	47 (90.30)	84 (87.3)
2	Poor market linkage	45 (54.20)	106 (64.40)	58 (69.80)	32 (61.50)	60 (62.5)
3	Lack of credit access	60 (72.30)	100 (59.80)	64 (77.10)	38 (73.07)	66 (70.6)
Total		83	167	83	52	

Source: Authors survey result, 2020.

Repetition of Weeding:- this variable is significant at less than a one percent significance level and its coefficient is positive revealing that is a positive relationship between crop productivity per hectare and the number of times weeding is repeated on a given plot. The coefficient of weeding suggested that a one percent increase in weeding increases crop productivity by sixteen point six percent.

Labor force: this variable is significant at less than ten percent significance level and its coefficient is positive, showing that there is a direct relationship between crop productivity per hectare and the labor force employed for crop production. The value of the coefficient revealed that a one percent increase in labor will increase crop productivity by eight point two percent.

3.8.1. Estimation of farm-level efficiency

The mean level of technical efficiency of crop producers was about 51.3%, with the minimum and maximum efficiency levels of 48.9% and 53.8% respectively (Table 12). This indicates that there is no wide difference among crop producers in the study area and there exists room for improving the current level of crop production efficiency by enhancing the level of farmers' technical efficiency. The mean level of technical efficiency further showed that the level of crop output of the sample respondents further tells us that the level of the sample respondents can be increased by 46.7 % if appropriate measures are taken to improve the level of efficiency of honey growing farmers.

3.8.2. Determinants of technical inefficiency in crop production

To analyze determinants of technical efficiency of crops, twelve variables were used. From these twelve variables, education level, extension service Distance from the farm, cooperative membership soil fertility number of livestock, and access to credit were factors identified for crop efficiency (Table 13).

Education level: this variable is significant at a one percent significance level and shows a negative relationship with crop inefficiency. This implied that a one percent increase in the education level of respondents will lead to reducing crop inefficiency by six percent.

Extension service: this variable is strongly significant at less than one percent significance level and negatively associated with crop inefficiency which revealed that a one percent increase in extension service will reduce inefficiency by thirty-five point nine percent.

Distance from the farm:- it is significant at less than a one percent significance level and positively associated with crop inefficiencies which showed that with a one percent increase in the distance from home to the farm, crop inefficiency will increase by four percent.

Access to credit: this variable also significant at a one percent significance level and has a negative relationship with crop inefficiency. It indicated that a one percent increase in credit access will reduce crop inefficiency by four percent.

Cooperative membership:- this variable is significant at less than one percent significance level and negatively associated with crop inefficiencies. As farmers tend to be cooperative members, crop inefficiency will be reduced by nine percent.

Total livestock unit: this variable is significant at a one percent significance level and as hypothesized the sign of the coefficient is negative which implied that a one percent increase by livestock number will increase crop efficiency or reduce crop inefficiency by twenty-nine point five percent. This is because farming activity required an active labor force and livestock for land preparation, sowing, and planting.

Soil fertility: this variable is a dummy variable, which is significant at less than one percent significance level and negatively associated with crop inefficiency. It revealed that the soil status of the respondent is fertile; crop inefficiency was reduced by four percent.

Table 11. Factors influencing crop productivity.

Yield	Coefficient	Std. Err.	Z
Land size***	0.099	0.038	2.61
Local seed***	−0.076	0.026	−2.92
Improved seed***	0.086	0.037	2.85
Fertilizer	0.154	0.166	0.93
Tillage repetition	0.117	0.076	1.54
Weeding repetition***	0.166	0.059	2.82
Labor force*	0.082	0.045	1.82
_cons***	−56.41	20.98	−2.69
/lnsig2v |***	−3.39	0.299	−11.31
/lnsig2u |	−0.03	0.097	−0.27
sigma_v	0.183	0.027	
sigma_u	0.987	0.048	
sigma2	1.008	0.091	
Lambda	5.368	0.064	

*, ** and *** means significant at 10, 5, and 1%, respectively.
Source: Own survey result.

Table 12. Crop technical efficiency level.

	Mean	Std. Err.	95% Conf. Interval)	
Efficiency	.513	.012	.489	.537

Table 13. Determinants of technical inefficiencies.

Variables	Coefficient	Standard deviation	Z
Agro ecology	−0.046	0.215	−0.22
Sex	0.208	0.326	0.64
Age	0.015	0.012	1.29
Education level**	−0.061	0.029	−2.08
Family size	0.032	0.051	0.65
Extension service***	−0.359	0.063	−5.69
Distance***	0.041	0.011	3.63
Access to credit **	0.007	0.035	2.02
Cooperative membership***	−0.091	0.021	−4.94
Number of livestock***	−2.952	0.269	−10.97
Soil fertility***	−0.041	0.011	−18.32
Income	−2E–05	9.3E–05	−0.24

*, ** and *** means significant at 10, 5, and 1%, respectively.
Source: Own survey result.

4. Discussions

One of the production challenges in the study area was the Problem of the supply and use of improved seeds and fertilizers. This finding was consistent with the finding of (Taffesse et al., 2012; Ellis-Jones et al., 2013; Mesfin and Zemedu, 2015; Olkie et al., 2017; Diriba, 2020). Lacks of wide adaptive improved varieties are the major production problem in Ethiopia (Yimer and Babege, 2018). In support of this argument, Merga and Haji (2019) reported that the challenges of farmers for improved crop use was less availability and inappropriately following the packages recommended by the researcher. According to the report of FAO (2011), fewer than 5% of farmers had access to improved seeds. A problem in the supply of improved seed varieties forced farmers to produce local seed varieties that are susceptible to diseases and Pests. In support of this statement, Tesfaye (2016) stated that the use of local varieties is the most important factors which lead to the low yield of potato in Ethiopia. Findings by Amare et al. (2014) indicated that the lacks of improved varieties are one of the challenges that hinder crop expansion. The demands of improved seeds are consistently greater than the capacity of research centers to produce them in sufficient quantities (Alemu et al., 2008).

Regarding the use of Fertilizer, about 95, 95, 94, and 97% of respondents from Bench-Sheko, Kafa, Sheka, and West-Omo Zones respectively, indicated that supply and use of Fertilizer as one of the major constraint in crop production. Different studies identified availability and low-level use of agricultural inputs (Fertilizer, Pesticide, Improved Seeds) as constraints of Crop production in Ethiopia (FAO, 2011; Mesfin and Zemedu, 2015; Taffesse et al., 2012; Ellis-Jones et al., 2013; Yimer and Babege, 2018; Diriba, 2020). Non- use of Fertilizer was reported as a constraint by Lyimo et al. (2014). The main reason for poor fertilizer application habits was a supply Problem and farmers' beliefs. Most South-Western Zones (Kafa, Former Bench Maji, and Shaka) Farmers believe that the soil does not need the recommended amount of fertilizers (Olkie et al., 2017).

The Education level in the study area was low and affects the ability and skills of farmers to adopt new technologies and innovations to increase production and productivity and consequently to supply more products to the market. This finding is in line with the finding of Lyimo et al. (2014) which indicated a lack of Know-how as one of the major constraints in the use of improved seeds in Tanzania. Most respondents raised the issue of poor extension service as one of the major constraints of crop production in the study area. The status of Extension Workers named as Development Agents (DAs) in Kafa 34.95%, Sheka 14.79 %, Bench-Sheko 40.75 %, and West-Omo 74.5% were below standard (below Diploma level). This result was supported by Belay (2002) indicated that many of the extension agents are certificate holders with very limited technical and communication skills. The study conducted by Belay and Abebaw (2004) indicated that extension workers lack practical skills. Hence, Farmers' confidence in extension workers is reducing from time to time. Unavailability of enough development agents that were required per Kebele was also another factor related to poor extension service observed in the study area. The shortage of extension workers was recognized as one of the most serious problems of agricultural extension (Belay, 2002). And also there was a Problem with the supply of inputs for extension workers in southwest Ethiopia. Extension workers are working under difficult and disadvantageous conditions (Belay, 2002; Asayehegn et al., 2012).

Most of the respondents reported that the occurrence of diseases and pests highly influence crop production in the study area. *Late blight* is a major production constraint wherever tomatoes and potatoes are grown (Derso and Zeleke, 2015). *Late blight* threats increased Potato production seriously (Yimer and Babege, 2018). *Bacterial wilt* hampered the productivity of Enset in southwest Ethiopia. Enset bacterial wilt disease was the major enset production constraint observed in the study area. Bacterial wilt is a production Problem was reported by different studies (Guchi, 2015; Tesfaye, 2016; Olkie et al., 2017; Yimer and Babege, 2018). The study conducted by Haile et al. (2020) indicated that the average disease occurrence and severity across study areas ranged from 23.67 to 31.92% and 49.58–62.50% respectively, where the highest and lowest percentage was observed in the Semen-Bench District of Bench-Maji Zone and Andiracha District of Sheka zone respectively. The disease was considered as a serious enset production problem and in some fields; its loss may reach up to 100% (Tariku et al., 2015). In addition to the loss of productivity, the disease has a social impact by neglecting the farmer with an infected field from social work to avoid contamination through farm tools (Wolde et al., 2016).

Soil acidity was stated as a constraint in the study areas affecting the productivity of crops. Soil acidity affects approximately 50% of the world's potentially arable soils (Kochian et al., 2004; Dai et al., 2017). Haile et al. (2017) estimated that approximately 43% of the country's agricultural land is influenced by soil acidity. Soil acidity is one of the most yield-limiting factors that affect crop production and productivity (Bekele and Höfner, 1993; McLaren and Cameron 1996; Beyene, 1987; Mamo and Haque, 1991; Sumner and Noble 2003; Zelleke et al., 2010; Yirga et al., 2019; Fageria and Nascente 2014). The yields of crops grown in acidic soils are very low (Yirga et al., 2019).

The outbreak of human diseases like malaria and other diseases in some parts of southwest Ethiopia was reported as crop production constraints. Malaria exerts a significant negative impact on crop production, in support of this argument; Kioko (2013) revealed that a 10% increase in malaria prevalence would result in a 2.76% reduction in crop output, while a 10% increase in the prevalence of other diseases reduces crop output by 0.18%. This implies that households inflicted with malaria and other diseases are less productive compared with healthy households. This result agreed with the finding of Ajani and Ashagidigbi (2008) which indicated that Malaria at the farmer level affects the productivity of the producer and their assets acquisition capacity. Malaria undermines their labor output, interrupts the production cycle, and causes resources to be diverted from farm inputs (Girardin et al., 2004). Less malaria means people can work their fields more consistently, with better harvests.

The crucial factor for the decrease in production and productivity of crops in Kafa, Sheka, Bench-Sheko, and West-Omo zones was the raise of conflicts at different times. This result was in line with the finding of Teodosijevic (2003) indicates a significant loss in production due to conflict. According to the same source, Agricultural and food production levels are on average about 10 percent lower during the conflict. Messer et al. (1998) revealed that during periods of conflict, crop production drops an average of 12.3 percent each year. Chemical fertilizers and improved seed supplies were the inputs most affected by the conflict. Different researches indicate that crop output may drop significantly in areas affected by conflict, due to adverse effects on labor supply, access to land, and access to credit and/or direct effects on capital such as theft and destruction (Nillesen, 2016; Blattman and Miguel, 2010; Rockmore, 2015; Munoz-Mora, 2016; Martin-Shields and Stojetz, 2019).

The poorly maintained agricultural infrastructure such as farm access roads and the poor road infrastructure network from the district to main market centers were found as marketing challenges of crops. Poor infrastructures and high transportation costs affect market participation (Barrett, 2008; Chipasha et al., 2017; Fischer and Qaim, 2012; Kaganzi et al., 2009; Markelova et al., 2009; Shiferaw et al., 2011, 2016). Transportation is mentioned as a Problem in the rainy season and this leads them to sell their crops at a cheaper price (Olkie et al., 2017). Rural Ethiopia that covers the vast majority of the population is still typified by a lack of roads and services (Diriba, 2020; Kayira, 2019). There is no immediate market to which farmers deliver their products particularly for avocado and orange fruits. Thus, lack of market linkage is one of the constraints in many woredas such as Debub Bench, Bursa, Gorche, Malga, Wondogenet, Debub Ari, Menit Goldia, and Chena. Most of the irrigated crops are perishable and can easily be rotten (Olkie et al., 2017). Lack of credit services also affects agricultural productivity and marketing in the study area. Lack of rural financial services and credit facilities affects the Agricultural sector in Ethiopia (ATA, 2014; Diriba, 2020). The institutional support services of credit are important for crop productivity (Kayira, 2019). Therefore, the market supply will increase. Smallholders who have access to credit for input purchase and supply systems have used fertilizer and chemicals more intensively and attained higher crop productivity per hectare of land (EEA/EEPRI 2006; Spielman et al., 2012; Tesafa and Abera, 2014). If crop productivity increased, market supply will increase. The research results indicated that farmers could achieve a yield advantage of 17–41% in Sorghum, 110–113% in barley, and 19–32% in Teff production through the use of improved seeds over the current national average yield of 23.69, 19.65, and 15.75 quintals per hectare (q/ha) respectively (CSA 2015).

The increase in land size will increase crop productivity in the study area. This result is in line with the result of Weldegebriel (2014); Plessis (2003) and Aschalew (2020). And also, the increase in local seed usage habits will decrease crop productivity while improved seed variety will increase crop productivity. Repetition of weeding activity will increase crop productivity. This result is similar to the result found by Bempomaa and Acquah (2014); Aschalew (2020). Weed control during the first 6–8 weeks after planting is crucial because weeds compete vigorously with the crop for nutrients and water during this period (Plessis 2003). The existence of the Labor force also increases crop productivity in the study area.

The mean level of technical efficiency of crop producers was about 51.3%, with the minimum and maximum efficiency levels of 48.9% and 53.8% respectively. This result was smaller than the finding of Bempomaa and Acquah (2014); Ayinde et al. (2015); Belete (2020) which revealed 33%, 69%, and 69.03% mean technical efficiency level.

It indicated that the farmers who achieved a relatively higher education level are believed to have higher exposure to agricultural technology and agricultural technology adoption possibility. According to the findings of Beyan Ahmed and Geta (2013) and Liu et al. (2017), better-educated farmers are more likely to adopt modern equipment efficiently. The finding of Nchare (2007) revealed a negative relationship between the educational level of farmers and the technical inefficiency of coffee production in Cameroon. Extension service is also negatively related to technical inefficiencies and in line with the finding of Hailemariam et al. (2020). Distance from the farm positively relates to technical inefficiencies. This result is in line with the finding of Kudama (2019). Access to credit reduces technical inefficiencies of the crop. The study conducted by Beyan Ahmed and Geta (2013) in the Gerawa district, Belete (2020) in the Guji zone, and Bempomaa and Acquah (2014) conducted in Ghana was in line with this finding. According to the finding of Tru (2009) and Kudama (2019) cooperative membership affects technical inefficiencies negatively. When the number of livestock of farm households increased crop technical inefficiencies will decrease. This result is in line with the finding of Belete (2020) and Beshir (2016).

5. Conclusion

The main objective of this study was to assess production potential and major bottlenecks of the crop sector in the Bench-Sheko, Kafa, Shaka, and West-Omo zones of southwest Ethiopia. Primary and Secondary sources and qualitative and quantitative data types were used. The data were collected from 385 producers. In the study area, the cereal crops like maize, sorghum, wheat, barley, teff, finger millet, rice, faba beans, field pea, haricot bean, and sesame were produced. The study area was also known for root and tuber crops like Enset, Taro, Anchote, Yam, Cassava, Sweet potato, and Potato production. Onion, Cabbage, Beetroot, Carrot, Tomato, Pepper (green), Ethiopian cabbage, and Garlic were produced potentially from vegetables. In southwest Ethiopia, Avocado, Mango, and Banana were produced in all zones of study areas, while Pineapples, Papaya, Orange, Lemmon, Guava, and Apple were produced in the Kafa zone. The major bottlenecks of crop production identified in this study were poor extension service which resulted in a low attitude of farmers towards improved technology use, low supply and use of improved seed varieties (94.5%), low supply and use of fertilizers (95%), knowledge and skills gap of farmers (80.1%), poor extension service (57.3%), soil acidity (94.8%), crop diseases and insect pest (77.8%), conflict (84.9%) and the outbreak of human diseases (60%). Marketing challenges identified in the study area were poor infrastructure (87.3%), poor market linkage (62.5%), and lack of credit services (70.6%). The cobb Douglas model result indicated that crop productivity was influenced by the land size, local seed, improved seed, repetition of weeding, and Labor force. Determinants of technical inefficiency were determined by the stochastic frontier model. The result indicated that education level, extension service, distance from the farm, access to credit, cooperative membership, total livestock unit, and soil fertility were significant variables. Therefore, improving extension service and skill of farmers through practical based training and building capacity of extension workers and services to enhance the attitude of farmers towards technology use and proper crop management practices, timely provision of farm inputs like fertilizer, improved seed, lime, mulching, compost, and farmyard manure, improving road and market access and provision of credit services to producers, resolving conflicts and providing enough health services in the rural areas were some of the recommendations forwarded to alleviate crop production and marketing challenges in the study areas.

Declarations

Author contribution statement

All authors listed have significantly contributed to the investigation, development and writing of this article.

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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