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ASSESSMENT OF THE PRODUCTION AND IMPORTANCE OF COWPEA [*VIGNA UNGUICULATA* (L.) WALP]: CASES FROM SELECTED DISTRICTS OF SOUTHERN ETHIOPIA

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ABSTRACT

Cowpea (*Vigna unguiculata* L.Walp) is an important legume in the hot, dry tropics and subtropics of sub-Saharan Africa, serving a multiple role for the livelihoods of millions of relatively low-income people. The entire plant can be used for either human or livestock consumption and with considerable drought-tolerating capacity. Tender young leaves, green pods and matured seeds are used as human food. Moreover, the crop serves for sustainable soil fertility improvement due to its excellent nitrogen-fixing capacity. However, its production and utilization are limited in Ethiopia partly due to dependence on the conventional agronomic practices and lack of information on its wide ranging uses. This study was conducted to assess the cowpea agronomy and the contributions the crop has in the livelihoods of farmers at Loka-Abaya and Humbo districts of Southern Ethiopia. Multi-stage sampling techniques were employed to achieve the set objectives. Both primary and secondary data were collected to solicit the required information. The data were subjected to descriptive and inferential statistics such as multiple linear regression model using the SPSS Software version 20 and STATA 13. Multiple linear regression model results showed that education, land size, climate information access, credit access, lack of market chain, availability of seed of improved varieties, and pests significantly (P<0.001) affected cowpea production in the studied areas. The trend analysis showed that the cowpea yield and production area coverage is increasing in Humbo District whereas, a decreasing trend was observed at the Loka Abaya. According to the household interview data, about 76 % of the respondents reported a decrease in the cultivated area of cowpea. According to the respondents, lack of access to improved seed and lack of extension support services contributed 79 % and 73 %, respectively to the low yield observed in the area. The majority of the respondents cultivate cowpea as intercropping and rotation with cereals and in the main field with the main purpose to replenish soil fertility (97 %). On the other hand, 62 % of the respondents cultivate cowpea for home consumption. According to the survey result, 48 % of the respondents use the matured grain for consumption. The production trends of the cowpea are highly variable mainly due to less attention paid by the extension systems to boost the yield of the crop, reliance of farmers on local varieties, pest occurrence and poor market chain. Therefore, modern production technologies including the supply of improved varieties of seed with their full production package should be introduced to the area so as to improve the yield and optimize its contribution towards achieving food security.

Key words: Agronomy, Climate variability, Food security, Humbo, Loka-Abaya, Semi-arid

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INTRODUCTION

Change in precipitation, increasing temperatures and variability caused by climate change will depress crop yields in many countries, over the coming decades [1]. This is particularly true in low-income countries, where their adaptive capacities are low and their economies largely depend on weather-sensitive agricultural production systems which are largely vulnerable to climate change. Under such scenarios, understanding farmers' responses to climatic variation is very crucial in designing appropriate coping strategies and identifying the alternative crop species which are resistant to the changing climatic conditions [1].

Cowpea (*Vigna unguiculata* L.Walp) is an important grain legume largely grown in warm regions of Africa, Asia and North and South America [2]. Its wider ecological adaptation makes it a crop of choice during this era of climate change. It is reported to be well adapted to high temperatures and drought conditions [3].

The global impact of climate change together with other environmental factors such as water unavailability, reduced land cover, declined nitrogen availability and cycling has increased concerns about achieving food and nutrition security, especially among the poor communities [4]. To alleviate this situation, cowpea is gaining popularity in developing countries, especially in arid regions due to its resistance to drought and having higher nutritional values [5].

In Ethiopia, cowpea is recently becoming among the most commonly cultivated lowland pulse crops [6]. However, the crop is not yet widely adopted compared with the role the crop has during the climate change periods including exellent nitrogen fixation, high nutritional value and adaptation to stressed environments. It plays a vital role in the livelihood of many of the poor people in the country. Rural families derive food, animal feed and cash income out of cowpea crop [7]. Moreover, the crop provides nutritious grain and serves as inexpensive source of protein [8]. It is grown in the rift valley areas of Ethiopia for its fodder and grain value [9]. The crop is widely intercropped with a large number of crop species, particularly cereals [10].

Cowpea is grown in drought-prone areas of southern Ethiopia, due to its excellent response to drought conditions[11]. The main growers in the region include Konso, South Omo, Wolaita and Sidama zones. These zones are endowed with the potential agroecologies for cowpea production [10]. However, its production potential is constrained by a lack of improved varieties, poor agronomic practices, disease and pests. Assessing the existing cowpea production systems, its utilization and the major production constraints is crucial to establish basic information for further research and policy directions, thereby optimizing the contribution of the crop for the improvement of the community's livelihood in light of the existing climate change and soil fertility problems. Therefore, the current study aimed at assessing the agronomic practices employed by cowpea growing farmers, and the role of cowpea towards achieving food security during the climate change periods in the selected cowpea growing districts of Southern Ethiopia.

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MATERIALS AND METHODS

Description of the study areas

The survey was conducted in the semi-arid parts of Sidama Zone (Loka Abaya Districts) and Wolaita zone (Humbo District), respectively in Southern Ethiopia.

Loka Abaya is one of the 23 districts of Sidama Zone in the South Nations' Nationalities and People's Region of Ethiopia. Geographically, it is located at 6°17'25"N and 37°49'44"E and the total area of the district is about 1,190 km^2 and its altitude ranges from 1500 – 1768 meters above sea level [11]. The major part of the district is characterized by semi-arid agroecology which constitutes 15 Kebeles (the smallest administration units) along with a few sub-humid areas which include about ten Kebeles. Based on the census conducted by the Central Statistical Agency of Ethiopia, it has a total population size of 124,771 of whom 63,050 are men and 61,661 are women and one percent of its population are urban dwellers [12]. Mixed crop-livestock farming is the most important livelihood for the community.

Humbo is one of the districts in Wolaita zone, Southern Ethiopia. It is located 430 km southwest of Addis Ababa, the capital city of Ethiopia. The district has 39 rural and 2 urban Kebeles. It has a total population size of 144,739 (72,729 male and 72, 011 female) and from the total population, 136,843 are rural while only 7,896 were urban dwellers. Geographically, located at 6°43'44"N latitude and 37°45'51"E longitude with an altitudinal range of 1500 – 2500 meters above sea level [10]. The agro-ecology of the study district consists of 70% lowland or '*Kola'* and 30% midland or '*Woina Dega'*. The mean annual temperature is 22 °C. The rainfall is erratic with an annual average of 843-1403 mm. The land escape is characterized by hilly terrain traversed by large plains, valleys, and gorges. The total land area of the district is 859.4 km^2, and crop-livestock production is the most important economic sector. Cereals like maize, sorghum, teff and legumes such as haricot bean, cowpea, and root crops such as sweet potato, enset, and onion are the main crops grown in the area. Soil erosion, fragmented land size and erratic rainfall have negatively affected crop production [13]. The cowpea crop can suitably grow in these areas since the crop has the capacity to adapt to the stressed environments.

Research design, data type and sources

The cross-sectional survey research design was used and questionnaires, key informant interviews (KII) and focus group discussions (FGD) were implemented to solicit both quantitative and qualitative data. The primary data were generated from sampled households, focus group discussions and key informants. The secondary data were obtained from the agricultural office report and Ethiopian meteorological agency.

Sampling procedures and sample size determination

To achieve the set objectives, the study used a multi-stage sampling technique, which combines both purposive and random sampling (probability and non-probability method). The two districts (Loka Abaya and Humbo) were selected purposively since these areas have been prone to climate change; which is expressed by the frequent drought and excessive flood experienced in the area, and the potential for cowpea production. The two Kebeles from the Loka Abaya and three Kebeles from the Humbo Districts, were selected by using stratified simple random sampling techniques based on the agro-ecology and cowpea production potential.

The cowpea-growing households (HHs) were selected by using systematic random sampling techniques with the help of Kebele development agents (DAs). Totally, 184 sample households were selected from the five kebeles in the two districts (Table 1). The simplified formula provided by Yeman was used to determine the required sample size at 95 % confidence level, 5 % degree of variability and 7 % level of precision [14].

Data collection methods

Household survey
Semi-structured questionnaires were prepared both for qualitative and quantitative data collection and the farmers were interviewed on issues related to the agronomic practices and socio-economic contributions of cowpea crop in the study area. The interview schedule was pre-tested among 40 randomly selected households from non-sampled Kebeles having similar characteristics to the sampled household.

Key informant interviews (KII)
A total of 17 KII were conducted to share the farm experience on cowpea adaptability, agro-ecology, agronomic practices and food security concerns. DAs, Kebele administers, elder informants and district livestock and fishery resource development office experts were involved in the interview. Accordingly, 5 DAs, 5 Kebele administrators, 5 elders' informants and 2 district livestock and fishery resource office experts were involved during the interview process.

Focus group discussions (FGDs)
A total of 5 FGDs were conducted at each Kebele. A single FGD having 6 household head members. The FGD members were selected purposively based on cowpea farming experience, age, residential of the area, inclusive of both sexes. The discussions focused on the cowpea agronomy and its socio-economic importance for the livelihood of the farmers in the area. Suitability of cowpea during the time of climate change was also addressed in the discussion.

Field observation
Field observation of the cowpea growing farms was conducted throughout the crop growing season (cropping to harvesting) to confirm the validity of the information obtained from the primary and secondary data sources. During field surveys, transect walks were conducted in the selected Kebeles with the guidance of the Kebeles' leaders, voluntary farmers and DAs.

Data analysis
The data generated from both primary and secondary sources were subjected to analysis based on the suitability of the analysis tools for the data type. Linear trend analysis was used to analyze the rainfall and temperature trends for the past 30 years and the production trends of cowpea. Descriptive statistics were used for assessing

cowpea agronomy and the socio-economic importance of the crop. Multiple linear regression analysis was implemented to identify the factors influencing farmers' cowpea production using IBM SPSS (Statistical Package for Social Sciences) version 20 and STATA version 13.

Explanatory variables

For this study, the major variables expected to influence the production of cowpea are categorized under household characteristics, socio-economic characteristics and institutional factors.

RESULTS AND DISCUSSION

Profile of the sample respondents

The total households included in this study were 184, of which 51 (28 %) were from Loka Abaya district (Jirmancho and Sala-Kabado Kebeles) and 133 (72 %) from Humbo district (Abala-Kolshobo, Abala-Faracho and Abala-Longena Kebeles). From the sampled households 178 (97 %) were male-headed and 6 (3%) were female-headed households. This conforms to the common thinking that male-headed households mainly practice agricultural activities. The age group categories of 15-29, 30-45, 46-60 and above 60 constituted 17 (9 %), 129 (70 %), 32(17 %) and 6(3 %), of the respondents, respectively. The maximum and minimum ages of respondents were 64 and 18, respectively. This indicates that all the respondents were within the productive age, which will be taken as an opportunity to improve cowpea production and productivity by engaging the available human labour in the farming system.

Among the respondents 7(4%), 172(93%) and 6(3%) were single, married and widowed, respectively (Table 2). Therefore, these results confirmed that most of the respondents weremarried, indicating that they are expected to be responsible and have the probability of producing crops such as cowpea to feed their families. The household size of the respondents ranged from 1- 5 people (Table 2). The majority of the household (53 %) sizes were within the ranges of 3-5. This indicates optimal availability of family labor for producing the cowpea to the level that it contributes to addressing food security challenges prevailing in the area. On the other hand, the high protein content of the cowpea crop will provide an opportunity to address the nutrition insecurity of these large sized families.

Education status of the sample respondents

About 23 % of the respondents were illiterate, who did not read and write, whereas, the vast majority (62 %) attended at least lower class. Only 5 % of the respondents attended a second level class (Table 3). Having a majority of the farmers as illiterate might be the reason for the lower search for improved technologies including improved crop varieties and climate information. According to Humbo district office of agriculture and rural development report, the head of a household is the key decision-maker in the family [15]. Therefore, the more educated he or she wasthe more he or she was likely to be aware of information and technologies [16]. According to Yamane [16], education level of farmers influences agricultural production.

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Cowpea production trends

Cowpea is known for its diversified uses in the study area. However, obtaining well-documented information on its agronomic production packages remains a problem. Lack of comprehensive information on the production status of cowpea in Africa including Ethiopia was also reported eslsewhere [17], which is in suport of the current research result. During the current study, only six years' (2012 – 2017) data were available to be used for trend analysis. The data for the six years indicated a decreasing and slightly increasing trend in area coverage for cowpea production in Loka Abaya and Humbo districts, respectively (Figures 1 and 2). The lack of comprehensive and long-term data might be attributed to the low education level of the farmers and inefficient agricultural extension system to have an established data system. Lack of information and extention support on the production sytem in turn constrains the farmers from expanding the production of cowpea and to benefit from the multiple roles the crop can serve for the rural poor.

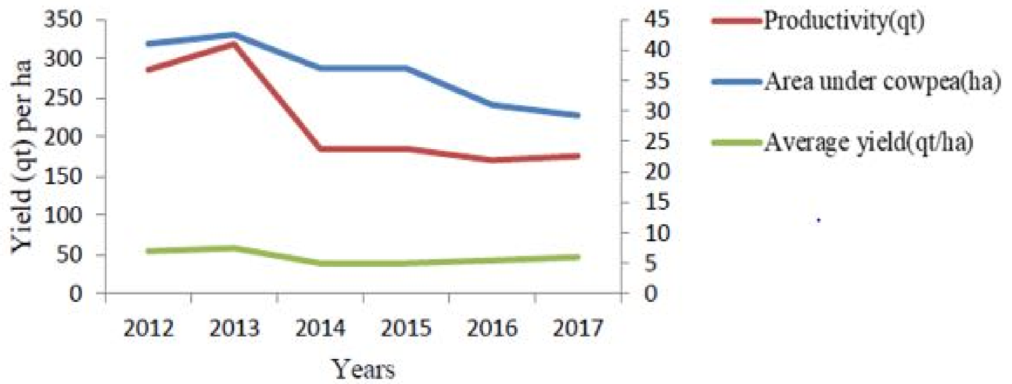

Figure 1: Cowpea production trends at Loka Abaya District (2012- 2017)
Note: qt – quintal, 1qt is equivalent to 100 kg

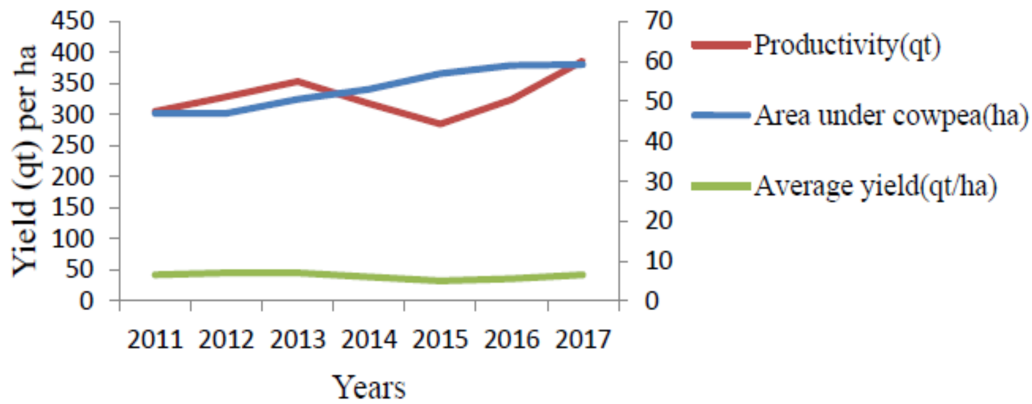

Figure 2: Cowpea production trend at Humbo District (2012- 2017)
Note: qt – quintal, 1qt is equivalent to 100 kg

The result from the secondary data sources also agrees with the data obtained from the household survey. Of the total respondents, 43 (23%) and 140 (76%) responded that cowpea production was increasing and decreasing, respectively (Table 4). The

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respondents mentioned less extension support and lack of a market chain as one reason for the shrinking area coverage of cowpea, where only 49 (27 %) of the respondents reported receiving extension support on the cowpea production package (Table 4). A similar finding, where lack of extension support affecting crop productivity was reported elsewhere [18]. The FGD also stated that 'even if the cowpea had multi-purpose uses, it had not been given due attention by the concerned administrative units.' In line with the interview result, the focus groups outlined a lack of extension support, lack of access to the market chain and lack of improved varities seed supplier as priority problems for the declining cowpea production in the area.

Cowpea agronomy

Inproved cowpea varities were introduced in the Humbo and Loka Abaya districts in 2007 by World Vision, SOS-Sahel Ethiopia and Agricultural Cooperative Development International. They distributed a small amount (less than 0.25 kg) of cowpea to selected farmers to promote the crop with adaptive capacity in drought-prone areas [19].

According to the focus group discussion, cowpea planting commences towards the end of June, right after the first substantial rains of the main season have fallen. It is also reported that producing cowpea without fertilizer application is a common practice and that the crop also performs substantially well without external fertilizer input. In agreement with the current findings, in the developing world cowpea is grown during the main rainy season and rarely during the dry season and this is done without the use of chemical fertilizers [7]. This indicates that the crop is able to meet its N requirement via biological nitrogen fixation, reducing the cost for chemical fertilizer use and the contribution of agriculture for climate change. A similar finding was reported in another study [20].

All the respondents produced cowpea under a rain-fed system. The majority of the respondent farmers grew a local variety of cowpea. In line with this observation, the reliance of farmers on the local varieties of cowpea was reported elsewhere [21]. Low cowpea yields can be attributed to the use of local varieties, late maturity and susceptibility to water scarcity [22]. This observation suggests the need for the introduction of improved varieties with higher yield potential and resistance to the stress factors for those cowpea-growing areas. Cowpeas were cultivated by intercropping with maize and sorghum as component crops and sole cropping systems, in the study sites (Table 5). About 77 % of the small-scale farmers produce cowpeas in the entire parcel of their farm lands, whereas only 5% of the large-scale farmers allotted their farms for cowpea production. About 17% of the respondents were also found to produce cowpea in their home gardens. Home-saved seeds from the informal seed system is reported to be used by 60%, while 23% of the respondents obtained seeds from the local market. The remaining 16% of respondents obtained their seeds from other sources (Table 5). In agreement with this observation, dependance on the informal seed system by Ethiopian farmers was also reported elsewhere [23]. On top of this, the seed of cowpea is susceptible to storage pests [23]. The use of seed from an informal seed system coupled with traditional storage facilities create favorable conditions for weevil attack, which in turn causes weak field performance of the crop and storage loss (Figure 3).

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Figure 3: Temproral or traditional storage system practiced by cowpea-producing farmers in the study areas, Southern Ethiopia

Socio-economic importance of cowpea

Cowpea is an important food legume, used as a leafy vegetable in many African countries. In this study, the KII confirmed the multiple uses of cowpea in the study area. The discussion with the key informant (KI) outlined the diverse use of the crop and its ability to give yield under water stress conditions, early maturity and adaptation to the less fertile soils. The findings of Senaratne *et al.* [22] agreed with the current finding, indicating the suitability of the cowpea crop for multiple uses, poor soils, water stress and its service to food and nutrition security. However, the lack of improved varities, extension support and diseases limited further expansion of the cowpea production especially in Loka Abaya District.

According to the household survey, the local cowpea landraces named '*Lalu atera'* and '*Eqae*' produced in Loka Abaya and Humbo, respectively were reported to be used for different purposes including food, feed, income sources and soil fertility improvement. In the study area, farmers mainly used the seeds of cowpea for food and leaves as fodder for their livestock (Table 6). In line with the present study, another study reported the use of cowpea as a source of food, feed and an income-generating commodity for the farming communities [24].

As a source of food, cowpea grain is boiled in preparation for human consumption and the food is locally known as 'nifro' and 'Kik Wet' in Amharic, 'buusho' in Sidama language, and 'Poche' in Wolayita language (Table 6). The focus group discussion also confirmed similar responses of respondents. On top of these, in the cropping system, cowpea serves to replenish soil fertility. In harmony with the current findings, Keller reported the multiple uses of cowpea crops [24].

Determinants of cowpea production

To identify the individual influence of variables hypothesized based on the household cowpea production, multiple linear regression models were used. Thirteen variables were hypothesized to determine the household cowpea production in the study area. Before running the multiple linear regression models, all the hypothesized explanatory variables were checked for the existence of a multi-co linearity problem.

The study used the variance inflation factor to investigate the degree of multi-colinearity among continuous explanatory variables and contingency coefficient among discrete (dummy) variables. Statistical Package for Social Sciences(SPSS) was employed to compute the variance inflation factor (VIF) and contingency coefficient (CC) values. When the value of VIF is greater than 10, it shows the existence of multi-co linearity. Since the value of variables included in the model is not greater than 10, there is no problem with multi-co linearity. Likewise, the values of CC were not greater than 0.75. Hence, multi-co linearity was not a serious problem both among the continuous and discrete variables. The overall goodness of fit of the regression model is measured by the coefficient of determination (R^2). It indicates the proportion of the variation in the dependent variable that is explained by the explanatory variables. R^2 lies between 0 and 1, the closer it is to 1, the better the fit.

Multiple linear regression analysis

In this section, multiple linear regression analyses were carried out to identify the major factors that influence the cowpea production in the study areas.

According to the results of multiple regression analysis, the adjusted R-squared value of the regression model was 0.669, indicating that about 67 % of the variance in cowpea production was explained by sex, age, education, family size, farm experience, land size, climate information, credit, market chain, seed supply, extension support, pests and soil fertility.

Likewise, the F-value with its corresponding significance (F=29.43, P<0.001) indicated that the model is statistically significant when all independent variables were included. Table 8 also showed that out of the thirteen variables which were included in the model, seven were found to have a significant effect on cowpea production. These were education, land size, climate information, credit acess, market chain, seed supply and pests. The above discussions were based only on the following variables that showed statistical significance.

Education level: The education level of the cowpea producer household head refers to the number of years they attended formal schooling. It had a positive effect on cowpea production. It is statistically significant at 0.1 % significance level. The model output verifies that one additional formal year education level leads to the cowpea producer household to increase yearly cowpea production by 0.111 units. The positive and significant relationship indicates that the level of education is a significant factor for cowpea production. Education level of the farmers was highly correlated to productivity [27]. This could have been due to better understanding and application of

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agricultural inputs because of better exposure and higher income levels, which determines the affordability of production inputs.

Land size: It refers to the land allotted to cowpea production in hectares and it is hypothesized that as land allotted for cowpea production increases the yield also proportionally increases. Regarding this variable, Table 8 shows that cowpea land size has a positive and significant effect on cowpea production. The results of the beta coefficient (β=0.295, P<0.001) showed the amount of increase in cowpea production that would be predicted by one unit increase in the cowpea land size. This indicated that for every unit increase in land size, farmers increased the cowpea production cover by 0.292. Confirming this result, a previous finding showed that landholding size has a greater contribution to production and yield [28].

Climate information: It refers to the information that is available for farmers about the climate. Access to climate information had a positive and significant effect on cowpea production. The results of the beta coefficient (β=0.075, P<0.001) indicated that the increase in cowpea production resulted from one-unit increase in access to climate information. The regression coefficient indicated that for every unit increase in access to climate information, a 0.075 unit increase in cowpea production is predicted. In connection with this finding, a former finding argued that access to climate information enables the farmer to prepare for their adaptation strategy and minimize the climate change effect [29].

Credit: It refers to the status of the farmers based on their credit utilization. It helps the farmers to buy farm implements for land preparation and planting, production inputs and transport to the market during production and harvesting time, respectively. In this regard, the regression coefficient and p-value (β =0.058, P<0.05) show that provision of credit has a statistically significant effect on cowpea production. The regression coefficient shows that a one-unit increase in the provision of credit leads to a 0.058 unit expected to change given that other variables in the model are held constant. Nkwasibwe found out that customized farm credit helps individual producers to purchase inputs such as fertilizers and seeds to increase agriculture productivity [30].

Market chain: the market chain has a positive and significant effect on cowpea production. The results of the regression coefficient (β =0.087, P<0.01) indicate that a one-unit increase in the market chain brings a 0.087 unit increase in cowpea production. Consistent with this finding, availability of market chains encourages more production for the market by improving transparency of the market systems, reducing the riskiness of participating in the markets and transmitting market signals more effectively to farmers and traders [31].

Seed supply: Access to seed supply has a positive and significant effect on farmers' cowpea production. The result of the beta coefficient indicates the amount of increase in farmers' cowpea production that would be predicted by a one-unit increase in the access to seed supply and interpreted as for every unit increase in access to seed supply brings a 0.182 unit increase in farmers' cowpea production. In connection to this finding, Ken *et al.*[32] argued that the production performance of farmers can be influenced by the input availability. They further explained that improved seed enabled farmers to produce more .

Pests and disease: it has a negative and significant effect on cowpea production. The results of the beta coefficient (β =-0.164, P<0.001) indicates the amount of decrease in cowpea production that would be predicted by one-unit increase in pests and disease. The values of the beta coefficient indicated that for every unit increase in pests and disease, a 0.164 unit decrease in cowpea production was predicted. Insect pests are major constraints to cowpea production in West Africa and damage by insect pests on cowpea can be as high as 80–100%[33].

CONCLUSION

Cowpea plays an important role in the study areas and the zones, which also have suitable agro-ecology for cowpea production. However, cowpea production is constrained by a lack of improved varieties, poor agronomic practices, disease and pests. Therefore, a survey was performed with the objective to assess the agronomic practices employed by farmers, and the role of cowpea crop towards achieving food security especially during the climate change periods in the selected cowpea growing districts of the Southern Ethiopia.

The results of this study confirmed that cowpea plays an important role for the livelihoods of the farmers in the study areas. Its ability to withstand marginal ecological conditions and its high food and feed value makes it a commodity that can turn around the fortunes of smallholder farmers in the study areas. Cowpea is reported to contribute to soil fertility improvement when included in the intercropping, crop rotation, and sole cropping. It is used as a component crop in the legume cereal intercropping, thereby improving nutrient supply for the cereals. In the study areas, cowpea is mainly used for human food in the forms of boiled grain (‘nifro’), ‘kik wot’ and ‘pochee’. The boiled grain is mixed with ‘kocho’ for home consumption. Results from the analysis of multiple linear regression showed that education, land size, availability of climate information to farmers, credit, market chain, seed supply and pests significantly affected the production expansion and yield of the crop. However, its production trends are highly variable mainly due to less attention paid by the extension systems to expand the production and boost the yield of the crop, reliance on local varieties, pest incidence and poor market chain. Therefore, to optimally utilize the multiple roles the crop has, it is wise to recommend that due attention be given by the extension system and introduction of improved production packages including improved cowpea varieties for the study sites and similar agroecologies.

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Table 1: Selected Kebeles and household sizes contributed for the sampled respondents, 2018, Ethiopia

Kebeles	Districts	Household size	Sample size
Jirmancho	Loka Abaya	257	24
Sala Kabado	Loka Abaya	289	27
Abela Kolshobo	Humbo	456	43
Abela Faracho	Humbo	460	44
Abela Longena	Humbo	478	46
Total		1940	184

Table 2: Sex, age, marital status and family size of the sample respondents, survey, 2018, Ethiopia

Variables	Loka Abaya District				Humbo District							
	Kebele				Kebele							
	Jirmancho		Sala - Kabado		Abala - Kolshobo		Abala – Faracho		Abala- Longena		Total	
Sex	N	%	N	%	N	%	N	%	N	%	N	%
Male	24	13	26	14	41	22	43	23	44	24	178	97
Female	-	-	1	1	2	1	1	1	2	2	6	3
Total	24	13	27	15	43	24	44	24	46	26	184	100
Age												
15-29	4	2	2	1	1	1	7	4	3	2	17	9
30-45	19	10	21	11	39	21	20	11	30	16	129	70
46-60	1	1	4	2	1	1	13	7	13	7	32	17
>60	-	-	-	-	2	1	4	2	-	-	6	3
Total	24	13	27	15	43	24	44	24	46	26	184	100
Marital status												
Single	1	1	1	1	2	11	-	-	3	2	7	4
Married	23	123	25	14	39	21	43	23	41	22	171	93
Divorced	-		-		-		-		-	-	-	-
Widowed	-	-	1	1	2	1	1	1	2	2	6	3
Total	24	13	27	15	43	23	44	24	46	25	184	100
Household size												
1-2	8	4	4	2	6	3	9	5	12	7	39	21
3-5	11	6	13	7	31	17	23	13	19	10	97	53
>5	5	10	10	9	6	20	12	17	15	17	48	26
Total	24	13	27	15	43	23	44	24	46	25	184	100

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Table 3: Educational characteristics of the sampled respondents, field survey, 2018, Ethiopia

Educational level	Sample size	Percentage
Illiterate	43	23
Grade 1-4	114	62
Grade 5-8	17	9
Grade 9-10	10	5
Total	184	100

Table 4: Cowpea production status and attributing factors, field survey, 2018, Ethiopia

Variables	**Sample size (n=184)**	**Percentage**
Cowpea area coverage in ha		
Increasing	43	23
Decreasing	140	76
I don't know	1	1
Do you earn extension support on cowpea production?		
Yes	49	27
No	135	73
Do you have access to formal seed supply?		
Yes	38	21
No	146	79
Do market chain available for cowpea produce?		
Yes	67	36
No	117	64

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Table 5: Agronomic practices for cowpea production, field survey, 2018, Ethiopia

Agronomic practices	Response	Sample size (n=184)	Percentage
Seed source	Home saved seed	111	60
	Local market	43	23
	others	30	16
	Total	**184**	**100**
Planting method	Broadcasting	4	2
	Row planting	180	98
	Total	**184**	**100**
Cropping system	Sole cropping	51	28
	Intercropping	124	67
	Sole and intercropping	9	5
	Total	**184**	**100**
Do you practice rotation	Yes	70	38
	No	114	62
	Total	**184**	**100**
Why cowpea in rotation system	To replenish soil fertility	179	97
	To control pest infestation	4	2
	To control weeds	1	1
	Total	**184**	**100**
Where do you grow cowpea?	Main field/small scale	142	77
	Home garden	32	17
	Main field/large scale	10	5
	Total	**184**	**100**

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Table 6: Uses of cowpea in the surveyed locations, field survey, 2018, Ethiopa

Variables	Sample size (n=184)	Percentage
Why do you produce cowpea?	**184**	**100**
For home consumption	114	62
For market	29	16
Both for consumption & market	41	22
Which parts of cowpea used for consumption?	**184**	**100**
Matured grain	89	48
Both grain and leaves	70	38
Others	25	14
Why cowpea in crop rotation system?	**184**	**100**
To replenish soil fertility	179	97
Reduce pest infestation	4	2
To suppress weed	1	1
Food types made from cowpea?	**184**	**100**
'Poche'	82	45
'Nifiro'	51	28
'Kik wet'	43	23
Others	8	4

Table 7: Results of Multiple Linear Regression analysis, 2018, Ethiopia

Cowpea production	Coef.	Std. Err.	T	*p*>t	95% Conf.	Interval
Sex	-0.0527	0.0584	-0.9	0.367	-0.0168	0.0625
Age	0.0091	0.0179	0.51	0.608	-0.0261	0.0445
Education	0.111	0.0169	6.88	0.000	0.0791	0.1448
Family size	-0.0065	0.0175	-0.37	0.709	-0.0411	0.028
Farm experience	0.0135	0.0179	0.73	0.466	-0.0223	0.0486
Land size	0.2915	0.0203	14.33	0.000	0.2513	0.3317
Climate information	0.075	0.0218	3.43	0.001	0.0318	0.1182
Credit	0.0579	0.0235	2.46	0.015	0.0118	0.1044
Market chain	0.0874	0.0279	2.94	0.004	0.0287	0.146
Seed supply	0.1822	0.0256	7.11	0.000	0.1316	0.2328
Extension support	0.0543	0.0737	0.74	0.462	-0.0918	0.1998
Pest	-0.0164	0.0325	-5.04	0.000	-0.2281	-0.0997
Soil fertility	0.001	0.0716	0.02	0.988	-0.1402	0.1428

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