



Major Root and Tuber Crops Production in South Omo Zone, Southern Ethiopia

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Abstract

Increasing production and productivity of agriculture in general and root and tuber crops in particular require a strong linkage between the agricultural and non-agricultural sectors. The growing in agriculture sector does not occur without non-agricultural sectors. The major root and tuber crops production and productivity in South Omo Zone, Southern Ethiopia is very low in relation to the land coverage under the crops, due to poor and under recommended rate of improved agricultural technology utilization and low skill of management and related practices by the producers. To solve these root and tuber related problems and increase the production and productivity of the crops, strong and result based farmers training centers and interlinked research extension system are important and strongly interconnected. This study was conducted in five districts of South Omo Zone namely Debub Ari from agricultural based, Malle and Bena-Tsemay from agro-pastoral, Hammer, and Dasenech from pastoral. The districts are selected purposively based on root and tuber crop production potential. The result shows that the area coverage, production and productivity of the major root and tuber crops decreases from time to time and their diseases and pests increase thoroughly. Farmers in the study area should use disease resistance varieties and the production inputs at a recommended rate and time. The major root and tuber crops that are grown in the study area are sweet potato (*Ipomoea batatas*), potato (*Solanum tuberosum*), cassava (*Manihot esculenta*), taro (*Colocasia esculenta*), and enset (*Ensete ventricosum*).



Article History

Received: 10 July 2021

Accepted: 19 August 2021

Keywords

Area Coverage;
Inputs Used;
Production;
Productivity;
Root;
Tuber Crops.

Introduction


Agriculture is mainly considered as one of the strong options and key instruments for spurring sustainable growth and economic development of

ones country, poverty reduction, and enhancing food security problems especially in developing countries like Ethiopia. Agriculture is the core component and mainly employs more than 65% of

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Doi: dx.doi.org/10.12944/CARJ.9.2.02

productive labor force especially in Africa.¹ The sector has been identified as one of the main source of income generation for most rural households in the continent. Africa in general and Sub-Saharan Africa in particular ranks the highest in the world in terms of the proportion of people living in absolute poverty, and the agriculture sector has been identified as one of the main sector for reducing the extreme poverty and promoting economic growth and generally leads to the development of the region.² However, this explained that there is a high need to improve the production and productivity of the sector that have higher impacts on the aggregate economic development of Africa in general and Sub-Saharan African countries in particular and ultimately to reduce the number of people living in poverty.

Ethiopia is one of the countries having fastest economic growth in the recent years sub-Saharan Africa countries shows a median growth domestic product (GDP) increase rate of 8.3% that is consistent with the annum and the agricultural sector in the region has been a dominant contributor sector having a median contribution of 45.4% to the overall GDP of the country within the years 2002 and 2011.³ Agriculture is one of the core component and main driver of Ethiopia's economic growth and enhance long-term and sustainable food security. The contribution of the sector were very high: 15 to 17 percent of the Government of Ethiopia's expenditures are committed to the agriculture sector. Agriculture directly employs 80 percent of the labor force, 43 percent of gross domestic product of the entire country (GDP), and over 70 percent of the total export value relies on the sector.⁴

In general these include agriculture's contributions to socio-economic development through income generation, enhance food security, and serve as household livelihoods, poverty alleviation, gender empowerment, and more it contributes to environmental sustainability.⁵ Particularly in Ethiopia, small land holder farmers cultivate approximately 95 percent of the total area under production and produce more than 95 percent of the total agricultural output of the country.⁶ The major part of the agricultural sector consists of smallholder farmers operating on an average of less than 2 hectares of land.⁷ On the other hand, the production and productivity of the sector was almost stagnating over the last few decades.

Agriculture in general is one of the most and highly important sector in Southern Nations Nationalities Peoples Regional State (SNNPRS) economy. In Ethiopia it plays significant role and will continue to play importantly to the overall economic development of the region. However, the agricultural production system in Ethiopia in general and in the region in particular is at its subsistence level. The livelihood of more than 93% of the people living in the region depends on agricultural sector, but still food insecurity problems are increasing at a shocking rate. This is due to the prevalence of rapid natural resource degradation.⁸ Also, the agricultural production activities in Ethiopia as a whole and Southern region in particular have been taking place under widely dynamic bio-physical and climatic change and variability contexts such as physio-graphic, agro ecology, climate, and soil conditions. The success and fail in agricultural sector is then strongly influenced by the topographic settings features, degree of human interference, and underlying biophysical features of the country.^{9, 10}

The food insecurity problems in the country as a whole and in southern region in particular caused by complex man-made and natural factors ranging from occurrence of drought, degradation of natural resources, lack of improved and appropriate agricultural technologies, weak institutional linkage and support, and lack of alternative employment for the productive labor force.¹¹ Also, the farming practices in the region brought disturbances to the entire ecosystems particularly on soils by disrupting the stable natural biochemical processes of the nutrient recycling, this leads to rapid nutrient depletion in the soil and attributing to changes in the external landscape characteristics of the area.^{12, 13} The production root and tuber crops contribute to the highest share of traditional food system for peoples living in Ethiopia. The major root and tuber crops found entirely in Ethiopia include; enset, potato, taro, yams, cassava, and sweet potato.¹⁴ currently, these major root and tuber crops are mainly used as a major staple diet in South and Southwestern part of the country especially South Omo Zone. There are many realistic reasons to enhance and encouraging such root and tuber crops production and productivity in Ethiopia. First and most importantly, they are one of the most and highly adaptable crops to harsh environments and staples to address food security problems for millions of peoples living in

the country, and gives high yield per a unit area of cultivable land. This may have a great meaningful and significant contribution to avoid the entire country chronic food insecurity problem. Second, these root and tuber crops are nutritionally rich staple foods crops that mainly contribute protein, vitamins (A and C), zinc, and iron to solve the dietary demand problem of the people in the country.^{14, 15} However, the nation in general and the region in particular still highly suffers from malnutrition problems, for example, vitamin A deficiency.¹⁴ The third important reason is that some of the root and tuber crops are suitable for double cropping to overcome food security problems. For example, from the root and tuber crops potato and sweet potato are the main short cycling root and tuber crops with three to four months of cropping cycle which are well and highly suited to the double cropping seasons particularly in rain-fed areas of the entire country.^{14, 15} Fourth, root and tuber crops highly insure sustainable food availability in the country throughout the year. In this case these major root and tuber crops even with longer cropping cycles are quite very essential in the country. The longer cropping cycle of the major root and tuber crops such as yam, cassava, potato, sweet potato and enset for instance play a vital role in environmental protection and annual cycle of food availability in the area. In addition, most of these major root and tuber crops that are known for their climate resilient and withstanding the unforeseen climatic change and variability conditions. For instance, among this crops enset is one of the best crop that is drought tolerant and enhance food security problems, where it supplements high human calorie food requirements of more than 20 million people in Ethiopia. This crop also has high potential in other regions of sub-Saharan African countries, where it is known as awild plant by the peoples in the region.¹⁶

The five major root and tuber crops produced in the area (sweet potato, potato, cassava, taro, and enset) contributing the major part of root and tuber crops production and productivity in Southern region of Ethiopia in general and South Omo Zone in particular. The other major important crops grown in the Zone, like cereal crops, pulse and oil crops, fruits, and vegetables play their great role to enhance food security in the area. So; this paper highlights the production and productivity of major root and tuber crops in South Omo Zone of Southern Ethiopia. This

research was conducted in two agro-pastoralists, two pastoralists and one agricultural farming system based districts of the Zone such as; (Malle and Bena-Tsemay from agro-pastoralists, Hammer, Dasenech from pastoral, and Debub Ari from agricultural) of South Omo Zone with addressing the following objectives: (1). To analyze the area coverage, production and productivity of the major root and tuber crops (2). To distinguish the major diseases and insect pests of the major root and tuber crops (3). To assess diseases and insect pests' management mechanisms of major root and tuber crops.

Methodology

The study was conducted in South Omo Zone, SNNPRS in Ethiopia. The Zone is astronomically located at 4°27'-6°26' North and 34°57'-37°49' East bordering with Gamo, Gofa and Keffa zones; Konta and Besketo special districts to the North part; Konso Zone and Derashe special districts to the East; Borana Zone to the Southeast; Kenya to the South; Sudan to the Southwest, and Mirab Omo Zone to the West. The total land coverage of the Zone is 22,360.76 Km² and lies at an altitude which ranging from 380 to 3,300 m.a.s.l.¹⁷

This study was conducted in five major root and tuber producing districts such as (Malle, Bena-Tsemay, Hammer, Dasenech and Debub Ari,) of the Zone. These five districts were selected purposively based on their agricultural practice and crop production from eight districts that are found in the Zone. From the eight districts found in the study Zone one agrarian district and two pastoralist districts were selected by probability sampling method respectively, whereas the two agro-pastoralist districts were taken purposively because there are only two agro-pastoral districts in the Zone. The study was conducted by Jinka Agricultural Research Center agricultural economics and gender issue researcher. Before start to conduct the study, the researcher made short discussion with other researchers on the preparation of checklist and questioner that helps to cover the study areas in accordance with the study objectives.

Based on the prepared checklist and questioner, in collaboration with each district Agricultural and natural resource management office key informant interview was made and data were collected from previously documented hard and soft copy materials

with the help of Zonal and Districts crop extension and protection experts in the Zone from the year (2005-2009 Ethiopian calendar or 2013-2017 Gregorian calendar) on wards. SPSS version 23 and Excel 2013 were used to analyze the data by using simple descriptive statistics such as mean and percentage.

Results and Discussion

Trends in the Area Coverage of Major Root and Tuber Crops

The majority of farmers found in Ethiopia in general and South Omo Zone in particular are smallholder farms. These farms, having though small land are often the fragmented ones, they produce mostly for own consumption and generate only a small amount of marketed surplus.¹⁸ Root and tuber

crops are grown mostly in different agro-ecologies zones and the production systems contributing to more than 240 million tons annually and covering approximately about 23 million hectares in the country. The aggregate value of major root and tuber crops such as; yam, cassava, potato and sweet potato mainly exceeds all other African countries staples food crops, including cereal crops (cereals annually produced on average of about 169 million tons on 108 million hectares of coveredland.¹⁹ Among the major root and tuber crops sweet potato accounts largest acreage followed by enset, potato, cassava and taro respectively. Fig1 below shows the percentage of area coverage under major root and tuber crops in five consecutive years (2005-2009 Ethiopian calendar or 2013-2017 Gregorian calendar).

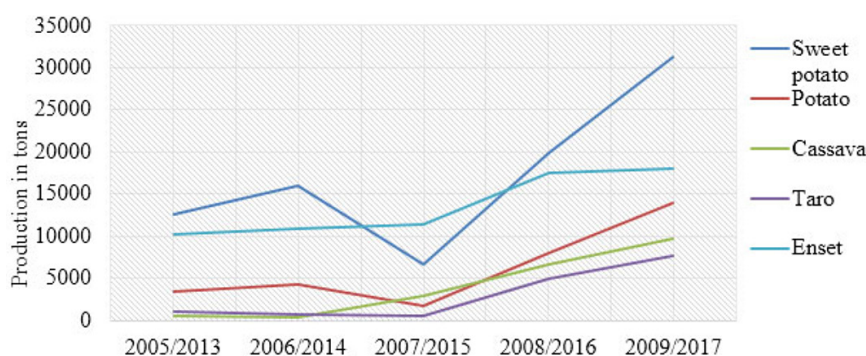


Fig. 1: Area coverage of major root and tuber crops in percent

Source: Woreda and Zonal Agriculture and Natural Resource Management Office

As shown in Fig 1 above, out of the total area under major root and tuber crops in the year 2005/2013, the area under sweet potato, potato, cassava, taro and enset were 57.81%, 17.37%, 2.29%, 5.03% and 17.5% respectively. In 2006/2014 the area of potato and enset increased to 21.5% and 18.13% 2.39%, while the area of sweet potato, cassava and taro declines to 55.83%, 1.2% and 3.34% respectively. In 2007/2015 the area of cassava, taro, and enset increases to 17.29%, 4.05%, and 128.24% while the area of sweet potato and potato declines to 41.43% and 8.99% respectively. From 2008/2016-2009/2017 the area under sweet potato and potato increased from 37.17% to 50.23% and 15.04% to 17.03%, while the area under cassava, taro, and enset declined from 17.27% to 16.74%, 13.94% to 6.77%, and 16.58% to 9.24% respectively.

Production Trend of Major Root and Tuber Crops

Ethiopia has highly diverse agro-ecological zones and climatic conditions that are suitable for various crops including root and tuber crops production.²⁰ the major root and tuber crops contribute the highest share in the traditional food system of many people living in Ethiopia, especially, these crops play a vital role to enhance the food security problems of the people in south and south western part of Ethiopia.⁹ The major indigenous root and tuber crops of the country in general and South Omo Zone in particular include: Sweet potato, Potato, Cassava, Taro and Enset.²⁰ Fig 2 below shows the production of major root and tuber crops in the study area from 2005-2009 Ethiopian calendar or 2013-2017 Gregorian calendar.

As shown in Fig 2 above the production of major root and tuber crops such as sweet potato, potato, cassava, taro, and enset were 12498 tons, 3330 tons, 493.43 tons, 1007.12 tons, and 10190.14 tons respectively in 2005/2013. In 2006/2014 the production of sweet potato, potato and enset were increased to 15923 tons, 4323 tons and 10930.43 tons respectively. While the production of cassava, and taro declined to 328.05 tons, and 667.09 tons respectively. In 2007/2015 the production of sweet

potato, potato, and taro declined to 6579.94 tons, 1750 tons, and 495 tons, while the production of cassava and enset were increased to 2893 tons and 11340 tons respectively. From 2008/2016-2009/2017 the production of all the major root and tuber crops produced in the area such as sweet potato, potato, cassava, taro and enset were increased from 19864.82 tons to 31312.7 tons, 7945 tons to 13867 tons, 6550.33 to 9686.8 tons, 4931 to 7568 tons and 17535 tons to 180455 tons respectively.

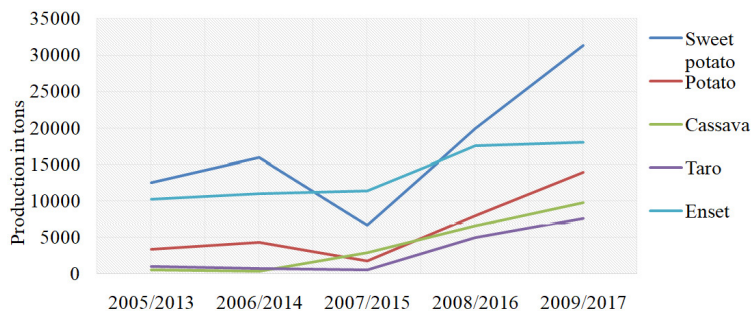


Fig. 2: Production of major root and tuber crops in tones

Source: Woreda and Zonal Agriculture and Natural Resource Management Office

Productivity Trend of Major Root and Tuber Crops

There are many basic reasons to encouraging the production of root and tuber crops in Ethiopia. The first and most important one is, they are among one of the most adaptable crops to harsh environments and staples to address food security problems for millions of people, and produce more food per unit area of the covered land. The contribution of this crops may have a significant role to avoid chronic food insecurity problems happening in Ethiopia. Second, these root and tuber crops are nutritionally rich staple food crops that provide protein and vitamins (A and C), zinc, and iron towards supplementing the dietary

demands of the people in the country.^{14,15} However, the nation in general and study area in particular still suffers from malnutrition problems, for example, like vitamin A deficiency.¹⁴ The production and productivity of the major root and tuber crops have been decreasing due to dramatic decline in the area of land under root and tuber crops cultivation except sweet potato, no improved seeds for the crops and to lesser degree due to decrease in the productivity of land. Fig 3 below shows the productivity of major root and tuber crops in the study area from 2005-2009 Ethiopian calendar or 2013-2017 Gregorian calendar.

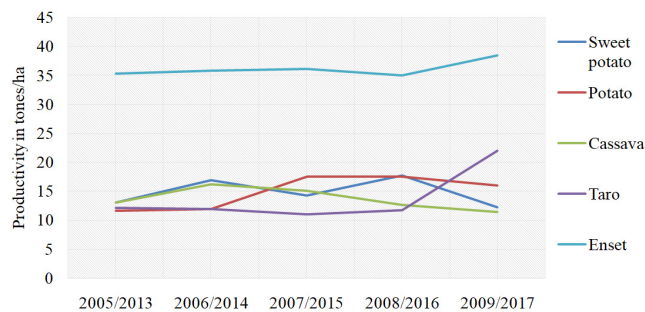


Fig. 3: Productivity of major root and tuber crops in tones/ha

Source: Woreda and Zonal Agriculture and Natural Resource Management Office

As shown in Fig 3 above the productivity of major root and tubercrops such as sweet potato, potato, cassava, taro and enset in 2005/2013 were 13.4t ha⁻¹, 11.64t ha⁻¹, 13.07t ha⁻¹, 12.13t ha⁻¹, and 35.26t ha⁻¹ respectively. In 2006/2014 the productivity of sweet potato, potato, cassava and enset increased to 16.94t ha⁻¹, 11.95t ha⁻¹, 16.2t ha⁻¹ and 35.26t ha⁻¹ whereas only the productivity of taro decline to 11.87t ha⁻¹. In 2007/2015 the productivity of potato and enset increased to 17.5t ha⁻¹, and 36.12t ha⁻¹ while the productivity of sweet potato, cassava and taro declined to 14.29t ha⁻¹, 15.05t ha⁻¹ and 11t ha⁻¹ respectively. From 2008/2016-2009/2017 the productivity of taro and enset increased from 11.71t ha⁻¹ to 22t ha⁻¹ and 35t ha⁻¹ to 38.48t ha⁻¹ while the productivity of sweet potato, potato and cassava declined from 17.7t ha⁻¹ to 12.26t ha⁻¹, 17.5t ha⁻¹ to 16.01t ha⁻¹ and 12.56t ha⁻¹ to 11.38t ha⁻¹ respectively.

Source And Utilization of Inputs for Major Root and Tuber Crops

Most of the time the estimation of agricultural inputs market demand for the farmers of Ethiopia are mainly based on the entirely official projections and plans that are developed at the local (kebele)

administrative level and then transmitted accordingly through official channels to Zonal and Regional Office levels, and then aggregated at national level to produce the overall estimates of the type and quantity of the inputs (but not include the preferences of farmers for specific varieties or traits) of seed that needs to be supplied to farmers in the coming season.²¹ Yet, there are many shortcomings in seed quality, quantity supplied and timeliness of delivery system have been the main longstanding issues in Ethiopia. Poor quality seeds such as; poor cleaned, seeds that have been broken, seeds that have low germination rates, and the presence of mixed seeds have been reported in ESE-supplied seed in the country.²² In addition, reports also indicate that there are common of seed being distributed after the optimal planting time of the crops or of varieties being distributed are not appropriate with the changes and wants of farmers' expectations of seasonal, weather and climatic conditions at the farm level.^{22, 23, 24} Table 1 below indicates, in the study area producers' uses most of the local inputs for root and tuber crops. Exceptionally they use improved seeds for sweet potato and potato and fertilizer for potato only. Table 1 below shows the type of inputs farmers use in the study area.

Table 1: Inputs used to increase production and productivity

Type of Crop	Name of Crop	Type of Seed	Name of Variety	Seed Source	Fertilizer Used in (Kg)	
					NPS	Urea
Root and Tuber crops	Sweet potato	Improved/ Local	Hawassa 84/Local	Farmers/Research center	No	No
	Potato	Improved/ Local	Belete/Local	Farmers/Research center	No	No
	Cassava	Local	Local	Farmers	No	No
	Taro	Local	Local	Farmers	No	No
	Enset	Local	Local	Farmers	No	No

Source: Woreda and Zonal Agriculture and Natural Resource Management Office

In the study area farmers uses local seeds for the production of root and tuber crops except sweet potato and potato, sometimes they used improved Hawassa 84 improved seed for sweet potato and Belete for potato in the study area. The source of seed for improved root and tuber crops were from Jinka agricultural research center whereas for others were from local sources. The farmers in the study

area do not use fertilizer for the production of root and tuber crops.

Diseases and Pests of the Major Root and Tuber Crops and their Controlling Methods

Crop production and productivity especially root and tuber are mainly affected by biotic factors. Among the biotic factors economically important ones are

endemic diseases and insects pests which result in huge yield losses are common problems in root and tuber crops. Diseases and insect pests attacking root and tuber crops under field conditions have been identified in Table 2 below. Diseases and insect pests

affecting the major root and tuber crops are mole rate and fungi for sweet potato, powdery mildew, and alternaria species for potato, mole rate for cassava and taro and enset in addition to mole rate bacterial wilt for enset respectively.

Table 2: Disease and pests of major root and tuber crops and their controlling methods

Type of crop	Name of crop	Diseases/pests affecting them	Controlling methods
Root and tuber crops	Sweet potato	Mole rat and fungi	Mechanical and chemical
	potato	Powdery mildew, alternaria species	Mechanical and chemical
	Cassava	Mole rate	Mechanical and chemical
	Taro	Mole rate	Mechanical and chemical
	Enset	Mole rate and Bacterial wilt	Mechanical and chemical

Source: Woreda and Zonal Agriculture and Natural Resource Management Office

As shown in Table 2 above root and tuber crops producers undertake many activities to control the various diseases and insect pests that affect the crops to enhance production and productivity of the major root and tuber crops. Among the methods, producers in the study area use improved seeds that are resistant to disease, increasing the frequency of tillage, and mainly by using crop rotation and shifting cultivation in the study area, also that of mechanical and chemical as well as that of cultural methods widely used.

Conclusion and Recommendations

In the study area root and tuber crops production sector enhances food security and increases the household's income, despite improper land use system and diverse agro-ecologies in the Zone, the production and productivity of the crops became low. Root and tuber crops production have the highest impact on poverty reduction. The highest number of people depend of root and tuber crops production in the study area, but the production system in the area is still at its subsistence level. Much effort has been needed to produce, use and adapt improved root and tuber crop technologies that would help to increase the production and productivity of the sector, but still now only few technologies can be adopted by the end users in the study area. There are various number of root and tuber crops production problems in the study area which occurs at different section of production systems

like improved agricultural input utilization (seed and fertilizer), the land fragmentation, pests and diseases occurrence, climatic change and variability and drought. Root and tuber crop producers in South Omo Zone do not use improved agricultural technologies at a recommended rate for all of the crops they produced. Farmers should be provided improved agricultural technologies at a right time to enhance the production and productivity. To increase the production and productivity of the major root and tuber crops introduction of improved packages of modern inputs like disease resistant seeds, fertilizers, pesticides and chemicals that dramatically increases the production and productivity of the crops, use at recommended rate and at a right time to enhance food security problems. To timely address the production packages to the concerned smallholder farmers, interconnected and strong public interventions were crucial, so there should be strong relationship and interconnectedness between the research, extension, and the small land holding farmers who are involved in the production system to alleviating production and technological problems. Finally the adoption of improved root and tuber crops production technologies which helps to increase the production, productivity and marketing are very essential in the study area as well as in the country in general as a result smallholder farmers use inputs at recommended based on amount of land, market demand and other natural and manmade factors which affects the production productivity of the crops.

Acknowledgements

The authors thank Southern Agricultural Research Institute, Jinka Agricultural Research Center for supporting and guiding for the completion of this research work. The authors also thank Farmers, respective districts and zonal agricultural and natural resource management office.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Conflict of Interest

The authors do not have any conflict of interest.

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