



Research Article

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Sesame Production, Challenges and Opportunities in Ethiopia

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Abstract

Oilseeds are the second most export crops next to coffee in Ethiopia. Among the different oil crops, sesame is the second most important agricultural commodity next to coffee in foreign exchange earning to more than \$449 million. It is the most ancient oil crop adapted to tropics and sub-tropics around the world. Sesame grows in Tigray, Amhara, Gambella, Benshangul Gumuz, Somalia, SNNP and Oromia regions in Ethiopia. However, productivity of sesame is very low due to several reasons. Traditional production technology, weeds, insect pests and diseases, climate change impacts, domestic and global market fluctuations and low research and expert knowledge and skill, are among the major challenges for sesame production in Ethiopia. On the contrary, vast area for sesame cultivation, irrigable area, low labor, government initiation in support of the commodity and varietal diversity are the production opportunities for production of sesame in Ethiopia. Hence; the national productivity of sesame is 730kg/ha. These necessitates improving the production techniques, improve productivity, and developing varieties with higher productivity potential, wider adaptability, application of improved crop protection techniques, and capacity building for experts on agronomic practices; will have vital role in providing modern sesame production systems in Ethiopia.

Keywords

Sesame crop, production, opportunity, challenges, Ethiopia

Introduction

Sesame (*Sesamum indicum* L., $2n=26$) grouped under the family Pedaliaceae; is the most ancient oil seed known and used by man (Kafiriti and Decheers 2001). It is called 'Queen of oil seeds' due to its high quality polyunsaturated stable fatty acid, which restrains oxidative rancidity (Reddy 2006, Gururajan *et al.* 2008, Balasubramanian and Palaniappal 2011); it is also stable due to the natural antioxidants sesamol and sesamolinal that reduce the rate of oxidation (Terefe *et al.* 2012). The crop is grouped in the Pedaliaceae family and adapted to hot areas (Reddy 2006). In Ethiopia, its demand for food and animal feed makes it very expensive when compared with other oil crops such as vegetable oils. The sesame oil cake is an important byproduct for animal feed; especially, for dairy production in rural and urban areas where other source of feed are limiting.

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Globally, sesame is produced over an area of 8.8mha and annual production around 2.8mt with average productivity of 382kg/ha; whereas, in Africa, average productivity ranges from 300 to 500kg/ha in pure stand; but under good management it reaches as high as 3000kg/ha (Kafiriti and Deckers 2001). In Africa, Sudan is the major sesame producer followed by Nigeria, Somalia, Uganda and Ethiopia. Sesame is the second export crop next to coffee in annual export indicating with the highest 14% of the total world export of the crop (Monitor Group 2012). Due to the increase in price as a result of increasing demand for the crop, production of sesame is increasing in Ethiopia. Ethiopia's export share 1.5% in volume and 1.9% in value to World market in 1997 had grown to 8.9% and 8.3% in 2004 respectively (Abera 2009). Sesame plays a significant role in the livelihood of sesame growing farmers in Ethiopia. In the western part of Tigray (Humara, Welkayit and the Tahtay Adiabo), Amhara (Wollo and Metema), Benshangul and Gambella, farmers produce sesame as a major cash crop. In Ethiopia, sesame occupied 0.62% (about 73,687.7 hectares) of the total area covered by grain crops and 1.61% (about 3,277,409.22 Qt) of total grains produced during 2010/11(CSA 2011). The total area cultivated, production (which is 5.87% of the total World production) and productivity (which is 140.12% higher than the world record 5.176Qt/ha) in Ethiopia during 2012 was 337,505ha, 44783 tons and 7.253 Qt/ha respectively (FAOSTAT, 2013). It has been indicated that the productivity of sesame varieties is very low when compared with other crops (Abate 2015, Abera 2009, Kafiriti and Deckers 2001). It has been utilized for thousands of years in Ethiopia through traditional expellers like camel driven traditional expeller called 'Mogue'; and locally, sesame oil costs up to 30 Ethiopian Birr for 300ml of oil. The domestic demand of the oil is due to its high quality oil for consumption. The byproduct sesame cake is also an important livestock feed for dairy production especially, during the offseason when other green fodders are inadequate. So, the main objective of this paper is to assess sesame production in Ethiopia, and specifically with the following specific objectives,

1. Assess the productivity of sesame across the sesame growing areas in Ethiopia,
2. Assess the opportunities, challenges and future prospectus of sesame production in Ethiopia under varying soil-climate dynamics,
3. Assess the domestic and world sesame marketing,

Sesame production in Ethiopia

Oil seeds are a mainstay of the rural and national economy in Ethiopia. The oilseeds sector is one of the fastest growing sectors; which is the second export and



Table 1. World sesame Production, Productivity and Area Coverage in 2013

S. No.	Countries	Production (tonnes)	Productivity (Kg/ha)	Area harvested (Ha)
1	Myanmar	890,000	583.3	1590000
2	India	636,000	341.9	1860000
3	China, mainland	588,000	1312.5	448000
4	Sudan (former)	562,000	260.5	2157540
5	United Republic of Tanzania	420,000	666.7	630000
6	Ethiopia	187,121	661.3	282950
7	Uganda	180,000	620.7	290000
8	Nigeria	165,000	485.3	340000
9	Mozambique	110,000	523.8	210000
10	Burkina Faso	95,000	593.8	160000

Source: <http://faostat.fao.org/site/567/DesktopDefault.aspx?PageID=567#ancor>;

Table 2. Sesame Production by region in Ethiopia 2014/15

Region	Area (Ha)	Production (ton)	Productivity (ton/ha)
Tigray	120,855.45	850,45.133	0.704
Amhara	169,988.58	1,122,09.218	0.66
Oromia	82,018.04	602,76.539	0.735
Benshangul Gumuz	40,722.60	278,09.345	0.68
SNNP	6,365.70	31,65.097	0.497

incoming earning sector, which of over three million small, medium and large scale Ethiopians are involved (Haile 2009, Gelalcha 2009). Sesame production in the world is estimated at 2.25 million tons, of which 70% is consumed in the producing countries; with annual trading volume estimation of 600,000 mt worth US\$500 million (Haile 2009). Ethiopia is one of the major sesame growing and exporter countries in Africa, exporting huge produce to the world market. It grows as a major crop in Tigray, Amhara, and Somalia, and in some areas in the Southern nations, nationalities and people (SNNP).

Sesame varieties

Some literatures indicate that sesame might be originated in Eastern Africa, mainly, Ethiopia. Hence, Ethiopia is rich in sesame genetic diversity. There are several varieties under cultivation and trial for various agronomic parameters under different climatic and soil conditions. There are different cultivated varieties which are stable for their oil and/or seed at different agro-ecologies (Abate 2015, Chemedo *et al.* 2014) and similar marker assisted characterization of sesame varieties for conservation and improvement has been tested (Weldesebet 2014). The rich genetic variability in Ethiopia will have fundamental use in enhancing the genetic variability and sesame cultivation across the various agro-ecologies. Molecular breeding will have the front lead to conventional breeding for improved sesame production in Ethiopia, and enhancing crop productivity to utilize the crop potential under improved agronomic practices.

Challenges and Opportunities for sesame production in Ethiopia

Opportunities and values for sesame production in Ethiopia

The diversified agro-ecology in Ethiopia is suitable for sesame production. Several sesame varieties are cultivated in Ethiopia. The opportunities and future prospectus of sesame production in Ethiopia is indicated as follows.

Land suitability for sesame production: there is huge area in different regions in Ethiopia for sesame production (Tigray, Amhara, Benshangul Assosa, Gambella, Oromia, Somalia and SNNP regions),

Sesame market demand: there is good demand for Ethiopian sesame in the world market. China, Israel, US America, and Egypt are among the importers of Ethiopian sesame.

There are few varieties under research and verification in different research centers across the country, and disseminating these varieties to farmers and growers will be encouraging. Promoting sesame research and development, giving attention with the contribution of the crop to the country will help improve production and productivity of the crop. Yet, the crop has got less emphasis regardless of its foreign currency.

There is high labor source for the peak periods (planting, weeding and harvesting)

Table 3. Sesame varieties in Ethiopia

Name	Adaptation area	Altitude (m)	Rainfall (mm)	Seed color	Yield (kg/ha)		Oil content (%)	Days to maturity
					Irrigation	Rain-fed		
Adi	Irrigated valley (Awash and Shebelle), and low rainfall areas	300-750	irrigated	White	16-20	5	42-48	85-90
Abasena	High rainfall (Wellega and Benshangul Gumuz)	500-1200	>700	Gray	12-14	9	44-48	110-120
Kelafo-74	Irrigated valleys	<500	Irrigated	Blackish	10-12	6	42-46	110-120
Argene	Irrigated valleys	350-750	Irrigated	Deep gray	15-18	-	42-48	90-100
Serkano	Irrigated valley	360-750	Irrigated	White-brown	15-18	-	42-51	90-100
Tate	Hareghe and Southern region	600-1200	600-800	Dull white	15-18	7	47-49	110-120
Ahadu	Moisture stress areas of welo	1400-1600	750-950	Brown	-	7-10	49-51	105-115
Borkena	Moisture stress areas of welo	1400-1600	750-950	Brown	-	6-8	47-48	105-120
Obsa	East and west welega	1250-1650	700-1100	White-tan	-	8-10	52-54	130-150
Dicho	West welega	1250-1650	700-1100	white	-	8-10	51-52	120-140
Humera-1	West Tigray	600-1100	400-650	white	-	8-10	54-56	100-120
Setit-1	Kafta Humera	600-800	400-650	white	-	7-10	52-54	100-110
Barsan	Somali region (Gode Kelafo)	500-700	<450+irrigated	Brown	7-8	-	46-47	80-90
Lidan	Somali region (Gode Kelafo)	500-700	<450+Irrigated	Brown	7-8	-	46-47	80-90

Credit and support by government for investment: the government of Ethiopia has the interest to support and promote the oilseed production and value addition processing. So, credit facilities, infrastructure and land for investment on the sector have got emphasis by government. There are steps ahead by the government to control illegal creditors which incur higher interest, with some studies indicating to up to 300% and above.

Water availability for irrigation: there are perennial rivers for irrigation on sesame and other crops production in Ethiopia. Awash river in Afar, Omo river in Gambella and Tekeze river in Tigray, and underground aquifers are underutilized. Ethiopia has large area to be cultivated under irrigation conditions. According to El Naim *et al.* (2010) sesame crop can perform well under irrigation conditions with higher water use efficiency of 1.8 to 1.6 m³/Kg.

Prevailing challenges for sesame production in Ethiopia

Drought

Sesame production is carried out under rain-fed conditions. However, due to climatic variability production and productivity of sesame is affected. Prolonged dry spell leading to drought is commonly experienced in the dry land areas of Ethiopia. Soil moisture stress particularly during the early growth stages affect sesame crop establishment followed by the mid to end growth stages causing considerable yield loss. So, this is a big challenge in Ethiopia in boosting the productivity and production.

Weeds

Broad leaf weeds, grass weeds from the *Gramineae* family affect growth and development of sesame in the sesame growing areas in Ethiopia through competing for growth resources such as light, moisture and nutrients in the soil. In the sesame growing areas in Ethiopia, about 98 species of weeds from 31 families have been identified; with grasses, sedges, bind weeds and broadleaf weeds

dominantly growing in different regions around the country (Terefe *et al.* 2012). Sesame seedlings are sensitive to weed competition during the early growth stages; so sesame seedlings have to be hand weeded at least two times at 10-15 and 30-45 days after emergence (Terefe *et al.* 2012). Sesame yield loss may vary based on several factors such as tillage, pre and post emergence herbicide application, and growing conditions. According to Terefe *et al.* (2012) yield loss due to weed infestation in Metekel, Humera, and Werer under irrigation recorded 42, 83 and 92% respectively.

Insect pests

Webworm (*Antigstra catalaunalis*), seed bug (*Elasmolomus sordidus*), gall midge (*Asphondilia sesami*), green vegetable bug (*Nezara viridula*), grasshoppers, African bollworm (*Helicoverpa armigera*) and crickets are the major pests of sesame in Ethiopia (Terefe *et al.* 2012). According to Elamin *et al.* (2015) sesame seed bug is very damaging postharvest pest sucking the oil content which reduce the oil content. Insect pests such as termites, aphids, jassides, whitefly, moths (warehouses) and red flour beetle affect sesame in Ethiopia.

Diseases

Sesame crop is affected by several diseases in the Ethiopia. Bacterial blight (*Xanthomonase sesami*), leaf spot (*Pseudomonase sesami*), phyllody (Phytoplasma transmitted by vector) causing deformation of leaves and flowers, and wilting (*Fusarium oxysporium* f. *sesami*) are the major diseases of sesame in Ethiopia.

In addition to the weeds, insect pests and diseases; the following factors are considered as challenges to sesame production and low productivity in Ethiopia.

Drought: unpredictable onset and cessation of rainfall in Ethiopia affect production, productivity and quality of sesame. Even though sesame is highly drought tolerant crop, prolonged dryspells during its early growth stages affect growth and development. Cessation of rainfall during the mid growth stages (flower initiation and grain filling) deter pollination and seed set. El Nino impacts during 2015 (AKLDP, 2015) affect sesame production in Ethiopia, with complete crop loss in Humora vicinity.

Low productivity of sesame varieties: naturally sesame is low yielder but the productivity of sesame varieties in Ethiopia very low when compared with other countries'.

Market fluctuation (domestic and world market)

Traditional production system: Poor management practices by farmers and investors. Farmers use traditional plowing system, oxen or donkey or camel driven plow; which is labor intensive incurring high cost of production, shallow till and difficult for row plantation and fertilizer application.

Less attention to sesame research when compared

to other crops like maize and wheat though it is major export commodity next to coffee.

Lack of improved technologies (planting, harvester): Majority of sesame growers are farmers whom cannot afford modern planting and harvesters and threshing machines.

Lack of improved facility

Poor fertilizer response of sesame crop

Shattering: natural sesame capsules crack and shed seeds when they reach maturity and harvesting is late. Considerable amount of sesame yield is lost from shattering, even harvested and bundled locally called 'Hilla'. Collecting harvest on a smooth floor or plastic sheets is a good remedy.

Smallholder farming

Sesame production in different areas in Ethiopia is carried out by different land holdings. Big investors holding in hundreds of hectares, whereas, small scale farmers own even less than ten hectare of land, where in some areas with pieces of land on different locations, which incur extra production cost, and uneven crop management. Small scale farming accompanied with backward production system led sesame production productivity very poor. The productivity of sesame in most areas under farmers management is less than 10Qt/ha. Investors use extensive production system instead of intensive production, which production is poor regardless of the size of the field. According to Bikora (2010) traditional tillage practices under small scale farming in Ethiopia led to low production and productivity of sesame in Ethiopia. Generally, the challenges for sesame production are (USAID, 2012);

Inability to distribute and/or finance inputs to sesame out-growers;

Low capacity and productivity of smallholder farmers and cooperatives;

Environmental factors: particularly drought or excessive rainfall causing water logging are major environmental factors causing crop failure and/or productivity;

Facilities example hulling companies; and High inflation.

Sesame export and marketing

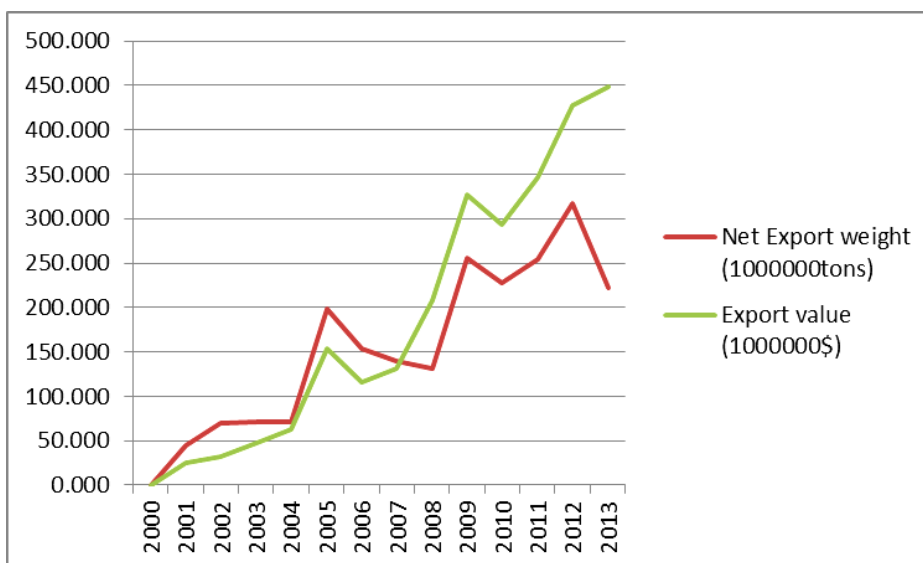
Sesame is the leading oil crops produced in Ethiopia and the second most export commodity contributing the country's export earnings. The world sesame seed production, productivity and area covered in 2012 was 4441620 tons, 558.5 Kg/ha and 7952407 hectare respectively and the production, productivity and area coverage in Ethiopia within the same year was 181376 tons, 757.2 Kg/ha and 239532 hectare respectively www.faostat.org.

Table 4. Sesame export and export value from 2000 to 2014

Year	Net Export weight (1,000,000tons)	Export value (1,000,000USD)
2000	0.603	0.425
2001	45.297	25.699
2002	70.391	31.839
2003	71.342	47.886
2004	71.708	62.913
2005	197.988	153.727
2006	153.661	115.957
2007	139.653	131.297
2008	131.689	208.457
2009	255.783	327.261
2010	228.039	293.564
2011	253.633	346.119
2012	317.653	426.895
2013	222.294	449.003

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Fig 1. Sesame export and export value from 2000 to 2014 (Personal elaboration of Table 4)



China is the largest importer of Ethiopian sesame seeds. In 2010, Ethiopia's sesame seed exports topped \$303 million, accounting for 14% of world sesame exports and making Ethiopia the third largest global exporter next to Nigeria and India (Monitor Group, 2012). In 2014 Ethiopia exported 346,833 tons of sesame seeds earning \$ 693.5 million revenue. However, in 2015 sesame foreign export declined by 24% due to bad weather in deteriorating quality of seeds and decreased price and excess supply of sesame seeds www.capitalethiopia.com. El Nino episode in Ethiopia during 2015 cropping season will affect the national production of sesame; in some parts of sesame growing areas around the country. So, it is important to expand the export of sesame to other countries, and improve quality and supply of the commodity. Ethiopian sesame is exported as raw seeds. Ethiopian sesame seed importers

purchase raw sesame seed and, process by hulling, crushing, grinding and value adding, and re-export to Japan, Korea and Europe and the United States (Monitor Group 2012). To improve the revenue of sesame from foreign export, it is important to invest on value addition and postharvest processes. Sesame value added products have higher bargaining power and attraction in the world market.

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