

Review Article

Production prediction of avocado, banana, mango, papaya, pineapple and coffee in Oromia regional state, Ethiopia

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Received: 21-Sep-2022, Manuscript No. IJAERDOA-22-75490; Editor assigned: 26-Sep-2022, PreQC No. IJAERDOA-22-75490 (PQ); Reviewed: 11-Oct-2022, QC No. IJAERDOA-22-75490; Revised: 22-Dec-2022, Manuscript No. IJAERDOA-22-75490 (R); Published: 30-Dec-2022

ABSTRACT

This assessment was designed to generate relevant information on main fruit production and consumption trends and to provide sufficient information and analytics of future fruits production. CSA data and FAOSTAT data from 2015-2021 were used. ARIMA model was used to predict the future points of a time series data of fruits. The avocado production increment from 2014/15 to 2020/21 were 12.7%, -0.15%, 3.1%, 39.98%, 31.7% and 150% in Oromia. Banana production, area coverage, consumption, sale and exports upward trends in Oromia. Mango production was downward trends due to disease and insect pests. Papaya and coffee production trends was volatile trends. Pineapple production trends was increase from time to time. To improve fruits production launching new initiatives to make fruit production and supply chains more sustainable, managing pests and diseases of fruit crops and a fundamental shift toward more nutritious crops in more diversified cropping systems is necessary.

Keywords: Forecast, Production, Fruits, CSA, Oromia

INTRODUCTION

The agro ecological conditions of Ethiopia favour the cultivation of various fruit crops that span from highland (like apple) to lowland (such as dates and cashew nut) fruits. Abundant and suitable land with different ranges of altitude, huge irrigation potentials, and ample labor force in the different parts of the country provide opportunity to produce tropical, sub-tropical and temperate fruits [1].

Fruit crops cultivation in Ethiopia had been a routine practice from time immemorial to the present day. According to CSA about 161,470.82 hectares of land is under fruit crops out of the total cropland area under small peasant holders. Bananas contributed about 59.43% of the fruit cropland area followed by avocados that contributed 18.94% of the area. More than 14,192,409.18 quintals of fruits was produced in the country. Bananas, mangoes, avocados, papayas, and oranges took up 63.30, 10.66%, 17.29%, 5.07% and 2.81% of the fruit production, respectively. There are also medium and large commercial fruit production farms in the country, most of which are concentrated in the eastern parts of the rift valley [2].

LITERATURE REVUEW

The production of avocado has become greater source of income for those involved in the value chain [3]. In addition to good source of income for farmers, fruit growing in gardens helps to reduce family budget on purchase of fruits. Fruit production is highly intensive and the fruit industry creates employment opportunities, particularly for farming communities.

Both fresh and processed fruits have huge potential domestic and export markets. Fruits with a high potential for export markets include avocado, apple, banana, citrus, grape, guava, mango, passion fruit, pineapple, papaya and strawberry [4]. The demand for Ethiopian wine is also high for both domestic and export markets. The major export market destinations for fruits from Ethiopia are the neighbouring countries like Djibouti, Sudan and Somalia. The United Arab Emirates, United Kingdom, the Netherlands, Belgium, Yemen, Saudi Arabia, and the Russian Federation are among the dominant export market destinations [5].

Ethiopia has very limited number of agro processing enterprises. Awash Winery and Castel Winery, with other few growers are engaged in the production of grapevines for the production of

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wine, fresh table and raisin grapes [6]. Merti processing plant processes orange concentrate, marmalade squash, and guava concentrate from mango, passion fruit and papaya [8]. At present, introduction of processed fruit products are quite significant in Ethiopia. Some fresh fruits have also been imported. For instance, about 350 metric tons of apple fruits were imported annually from South Africa, Iran, China and Israel. Demonstrations of various fruits have been made and contributed to the current fruits production throughout the country. This review paper highlights the status and future prospects of fruit production, consumption, market supply and area coverage in Oromia and Ethiopia.

Avocados, for long an essential part of the diets of many Latin Americans, have now been promoted to super fruit status also in North America, Europe, and Japan and increasingly amongst China's wealthy. Rising consumption levels are currently met mainly through domestic productions and through supplies from relatively few net exporters. In 2013, only about 20% of global productions were exported to non-producer consumer countries. Production volumes range from 1.9 million tonnes (Mexico, 2016) to a couple of hundred tonnes (mostly small island states). The largest producers outside of LAC are Indonesia (305,000 t), Kenya (176,000 t), USA (173,000 t) and Rwanda (132,000 t). Yet, often high production does not translate into high exports as holds true for Indonesia and the USA. The top nine net exporting countries jointly supply 99% of global total net exports at a combined volume of about one million tonnes. Mexico is the dominant net exporter with a share of 59%, followed by Peru (12%), Chile (9%), Israel and South Africa (both 5%). Some of the leading producer/exporter countries like Peru (147%), the Dominican republic (111%) and Mexico (71%) recorded impressive production growth rates in the period 2010 to 2016. Israel, New Zealand and Brazil all recorded increases in production of about 30% over the same period. Spain and Kenya have been struggling to increase production and thus to take advantage of growing consumption levels. In general, growth in production levels seems to have been achieved mostly over the extensive margin.

According to report of MoA, projected future net export of top exporting countries can increase their exports on top of increasing productions for their domestic consumption, mainly through the conversion of (agricultural) land into avocado plantations rather than yield. Exports could more than double from around one million tonnes to nearly 2.6 million tonnes in 2030. These exports could be distributed as follows: Mexico (1 m t), Peru (600,000 t), Kenya (380,000 t), Spain 180,000 t), Chile (130,000 t), South Africa (100,000 t), Israel (95,000 t) and New Zealand (40,000 t). Therefore, to compute with this top exporting countries Ethiopia in general and Oromia in particular will be increasing avocado volume of production with quality standards by conversion of agricultural land to avocado plantations using suitability studies as a guideline. The main objectives of this

nectar [7]. Africa juice Tibila, share company produces blended assessment are:

- To generate relevant information on main fruit production and consumption trend which is essential for planning and policy direction
- To provide sufficient information and analytics of future fruits production and consumption to guide intervention decisions.

METHODS

The main source of data was the CSA data which is the most readily available and national representative source of data. Therefore, the CSA data of Meher season is used to analysis the trends of production, area, yield, household consumption, domestic sale and export of major fruit crops. FAOSTAT data from 2014/15 to 2020/21 were also used as export data in this report. For this report ARIMA model was used to forecast production, area coverage, yield, HH consumption, domestic sale and exports of selected fruit crops.

RESULTS AND DISCUSSION

Avocado production trends and forecast

The avocado production in Ethiopia is largely limited to the domestic market characterized by low farm gate prices, which has together with a lack of technical production competences, hampered investments in seedling and fruit productions. Based on CSA meher season data the area coverage and total production of avocado during the last five years showed increasing trend in small scale farms (Figure 1). In the 2014/2015 production year, 536,978 quintals of avocado was produced in the country. The production increments for avocado were 0.2%, 20%, 25.3%, 4.12%, 23.2%, 134% in 2016, 2017, 2018, 2019, 2020 and 2021, respectively in Ethiopia. The avocado production increment from 2014/15 to 2020/21 were 12.7%, -0.15%, 3.1%, 39.98%, 31.7% and 150% in Oromia.

As indicated in Figure 1 and 2 the trends for the consumption of avocado was increasing in Ethiopia in general and in Oromia in particular. This result was in line with MoA report stated that over the past 50 years, there has been a clear and steady upward trend in the consumption of avocados across all regions of the world. Consumption levels have been picking up speed recently with total volumes doubling in about 15 years (1998 to 2013), now surpassing the five million tonnes per year mark. Avocado exports in Ethiopia is not increasing as shown Figure 1 according to CSA data from 2014/2015 to 2020/21 (Figure 2).

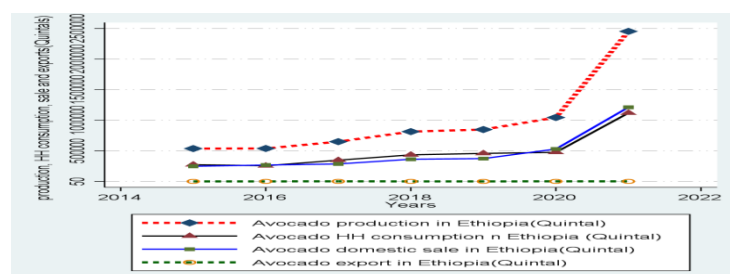


Figure 1. Avocado production, HH consumption, market supply and export trends in Ethiopia.

Source: CSA, 2014/15 to 2020/21 and FAOSTAT, 2021.

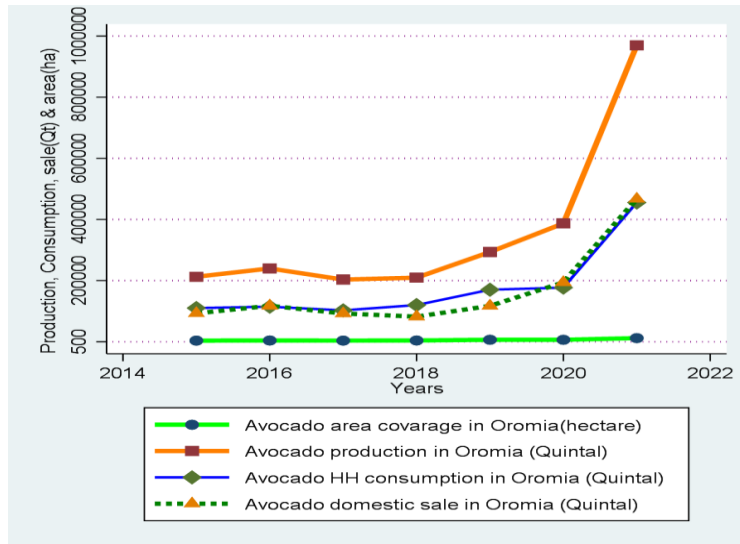


Figure 2. Avocado production, area coverage, HH consumption and Market supply trends in Oromia.
Source: CSA, 2014/15 to 2020/21.

Projected avocado production, HH consumption, market supply and area coverage from 2022 to 2030

The forecasted avocado area coverage, production, HH

consumption, domestic sale and exports for the year 2022 to 2030 were increasing as shown in Figure 3 and Table 1 in Oromia.

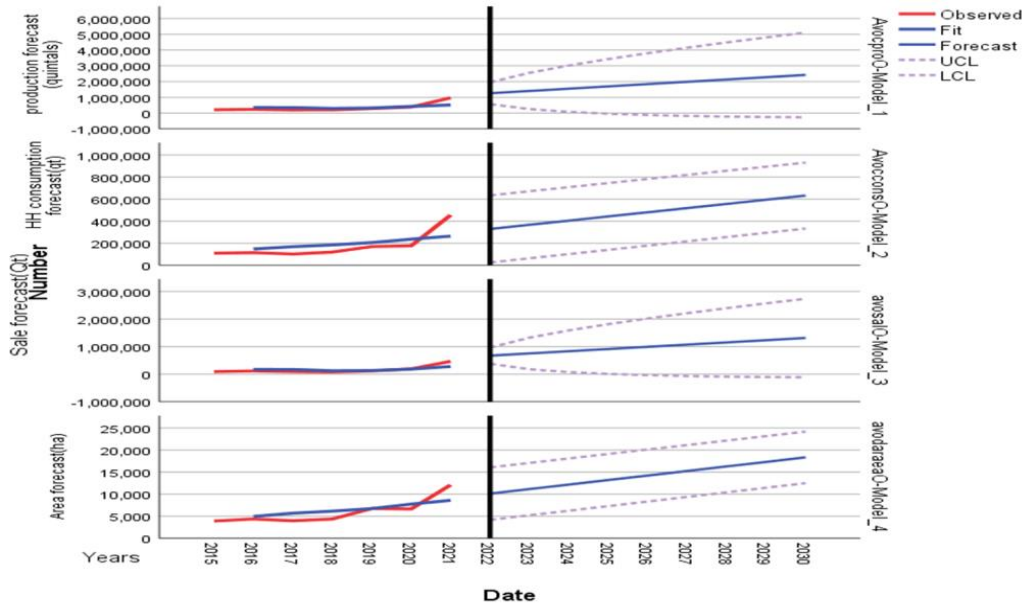


Figure 3. Avocado production (Qt), yield (Qt/ha), domestic sale (Qt), HH consumption (Qt and exports (Qt) forecasts in Oromia.
Source: Own prediction from CSA data from 2014/15 to 2020/21.

Avocado production with different scenarios

We examine two avocado production growth related investment scenarios. The first one is increasing yield from 105 quintals per hectare to 120 quintals per hectare in 2030 and the second one increasing avocado plantation area by 10 percent in each forecasted years. Predicted avocado yield will be 105 quintals per hectare in 2030 with existing production scenario and if we

assume predicted yield increased to 120 quintals per hectare in 2030 by applying recommended full package of agronomic practices then avocado production will shift from 200,000 quintals to 600,000 quintals (Figure 4). Assuming area for avocado plantation will increase by 10 percent in each year then avocado production will shift from 200,000 quintals to 400,000 quintals (Table 1).

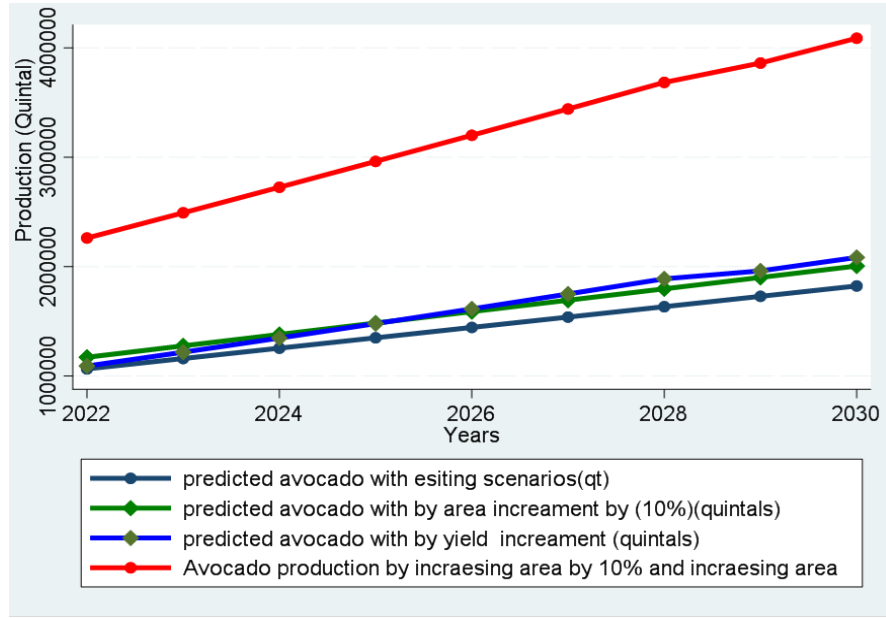


Figure 4. Avocado production by increasing land area in avocado plantation and yield increment.
Source: Own computation from CSA data.

Table 1. Avocado area coverage, production, yield, HH consumption, domestic sale and export in Ethiopia and Oromia.

Avocado							
Place	Year	Area (Ha)	Production (Qt)	Yield Qt/Ha	HH Consumption (Qt)	Sale (Qt)	Export (Qt)
Ethiopia	2015	13,798.00	5,36,978.00	39.6	2,73,482.90	2,47,493.20	100
	2016	13,665.50	5,38,246.00	39.4	2,55,882.20	2,67,562.10	550
	2017	17,834.60	6,49,821.00	36.4	3,47,004.40	2,85,401.40	940
	2018	18,021.13	8,14,318.00	45.2	4,34,438.70	3,62,127.20	513
	2019	19,758.75	8,47,936.48	42.9	4,57,885.70	3,73,092.10	200
	2020	20,875.80	10,44,919.20	50.1	4,75,542.70	5,29,251.60	840
	2021	30,587.70	24,53,356.30	80.2	11,18,485.10	12,11,958.00	604.5
	2022	29,421.72	20,51,362.96	83.1	9,50,743.90	13,37,117.40	640.7
	2023	31,796.30	22,99,075.41	88.4	10,60,563.20	14,62,276.90	677
	2024	34,170.88	25,46,787.86	93.8	11,70,382.40	15,87,436.30	713.3
	2025	36,545.46	27,94,500.31	99.1	12,80,201.70	17,12,595.80	749.5
	2026	38,920.04	30,42,212.76	104.5	13,90,021.00	18,37,755.20	785.8
	2027	41,294.62	32,89,925.21	109.8	14,99,840.20	19,62,914.60	822.1
	2028	43,669.20	35,37,637.66	115.2	16,09,659.50	20,88,074.10	858.4
	2029	46,043.78	37,85,350.11	120.5	17,19,478.70	22,13,233.50	894.6
2030	48,418.36	40,33,062.56	125.9	18,29,298.00	23,38,392.90	930.9	
Oromia	2015	3,916.80	2,12,769.00	54.32	1,10,469.67	93,192.82	
	2016	4,377.20	2,39,873.00	54.8	1,14,923.20	1,17,777.60	
	2017	3,983.80	2,03,515.00	51.1	1,02,795.43	92,680.73	
	2018	4,369.50	2,09,753.00	48	1,20,293.35	82,328.05	
	2019	6,742.50	2,93,627.53	43.55	1,70,303.97	1,17,451.01	
	2020	6,643.99	3,87,204.00	58.28	1,77,339.43	1,94,298.97	
	2021	12,088.60	9,69,594.10	80.2	4,55,612.30	4,66,956.50	
	2022	10,870.90	10,64,424.45	83	3,69,633.00	5,13,353.09	
	2023	12,003.00	11,59,254.80	85.7	4,13,295.57	5,59,749.67	
	2024	13,135.10	12,54,085.15	88.5	4,56,958.15	6,06,146.24	
	2025	14,267.20	13,48,915.50	91.2	5,00,620.73	6,52,542.82	

2026	15,399.30	14,43,745.86	94	5,44,283.30	6,98,939.39
2027	16,531.40	15,38,576.21	96.7	5,87,945.88	7,45,335.97
2028	17,663.50	16,33,406.56	99.5	6,31,608.46	7,91,732.54
2029	18,795.60	17,28,236.91	102.2	6,75,271.03	8,38,129.12
2030	19,927.70	18,23,067.26	105	7,18,933.61	8,84,525.70

Source: CSA, 20145 to 2020/21 and FAOSTAT, 2021

Banana production trends and forecasts in Oromia

Banana production, area coverage, HH consumption, sale and exports has also shown an upward trends in Ethiopia and Oromia (Figures 5 and 6). A spike in production, area and HH

consumption is observed in the years of 2016 and 2020, a fall in 2018. The percentage change of banana production were of - 7.9% from 2015 to 2016, 22.3% from 2016 to 2017, 8.3% from 2017 to 2018, 1.6% from 2018 to 2019, 7.4% from 2019 to 2020 and 66.6% from 2020 to 2021, respectively.

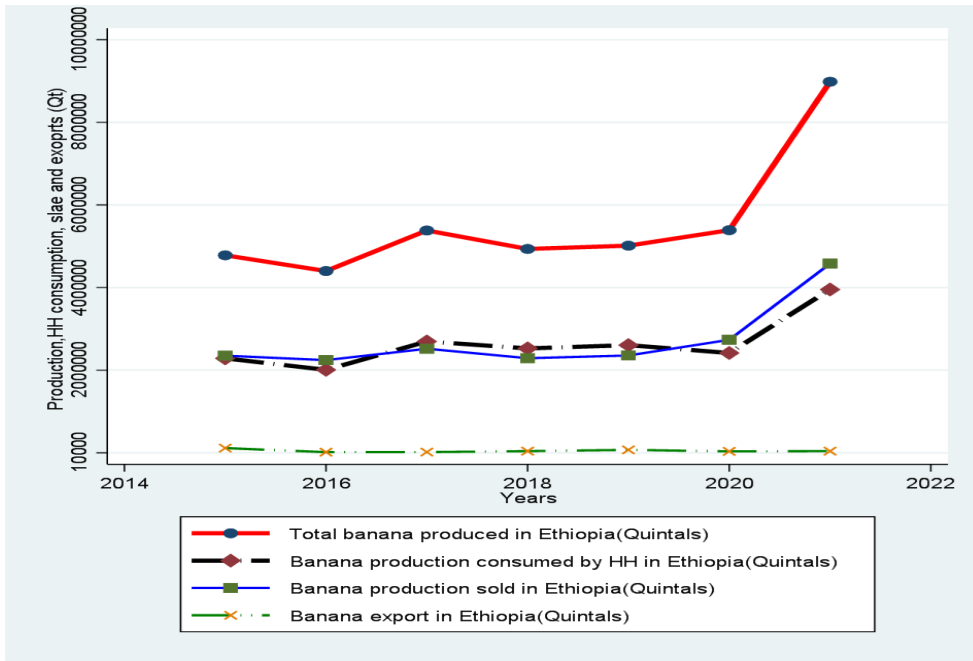


Figure 5. Trends of banana production (Qt), HH consumption (Qt), sale (Qt), and exports (Qt) in Ethiopia. Source: Own computation from CSA 2014/15 to 2020/21.

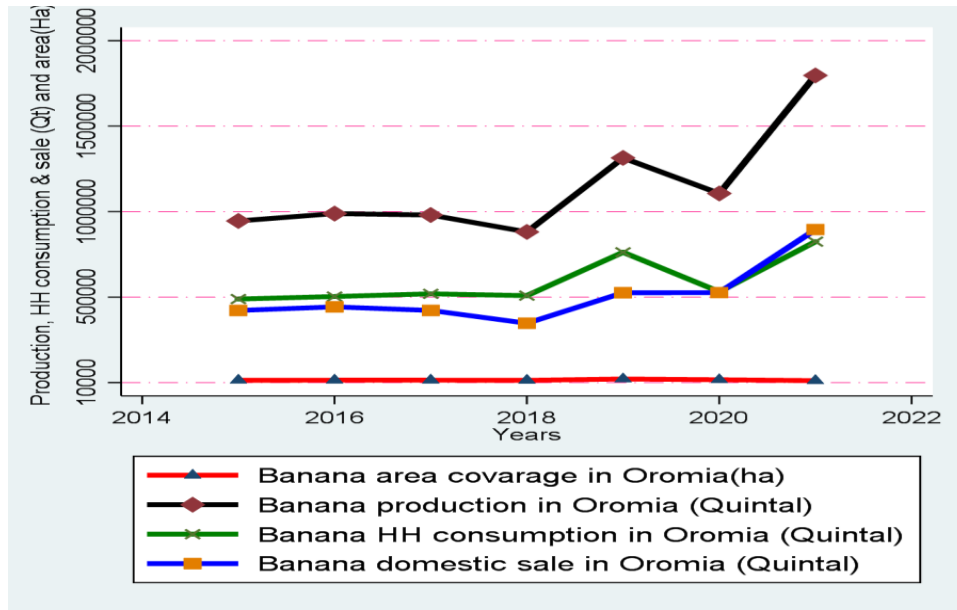


Figure 6. Trends of banana area coverage (ha), production (Qt), HH consumption (Qt) and sale (Qt) in Oromia. **Source:** Own computation from CSA 2014/15 to 2020/21.

Predicted banana production and demand

The forecasted banana in area coverage, production and domestic

sale for the year 2022 to 2030 indicated increasing trends as shown in Figure 7 in Oromia.

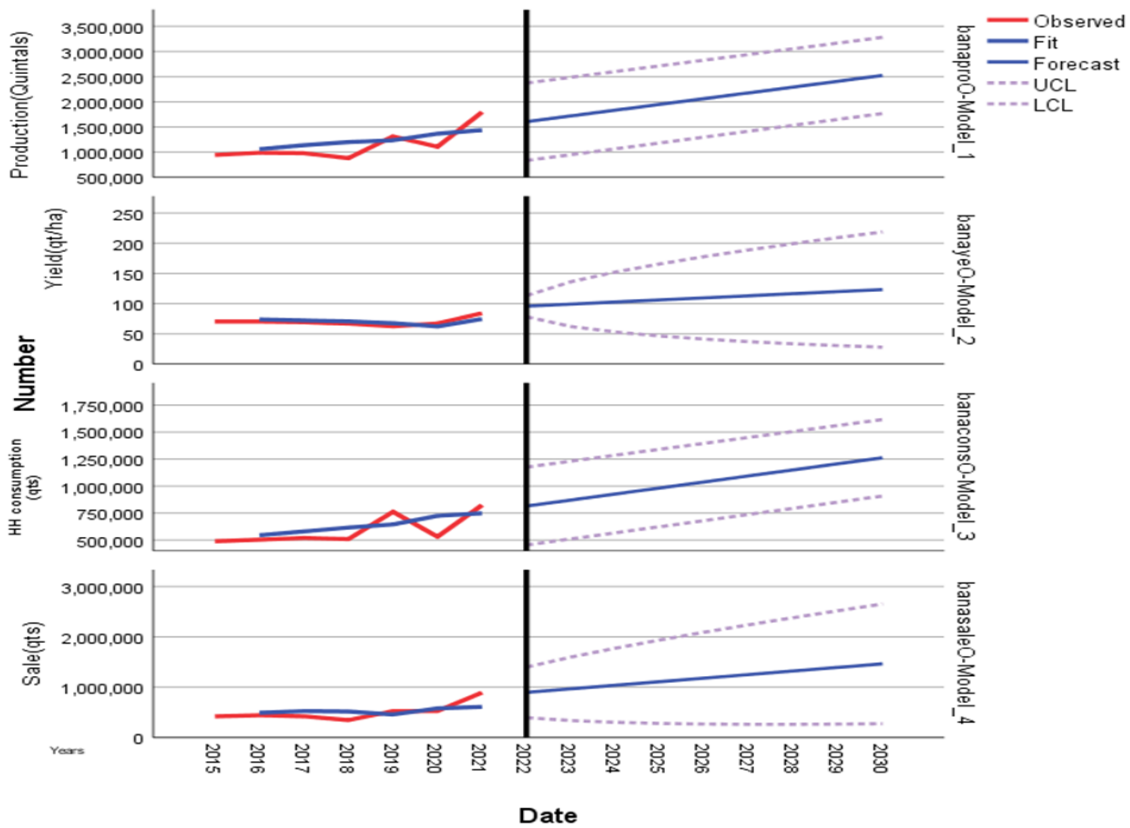


Figure 7. Banana production (Qt), yield (Qt/ha), HH consumption (Qt) and domestic sale (Qt) forecasts in Oromia. **Source:** Own computation from CSA 2014/15 to 2020/21.

Banana production with different scenarios

We examine two banana production growth related investment scenarios. The first one is increasing yield from 93 quintals per hectare to 100 quintals per hectare in 2030 and the second one increasing banana plantation area by 10% in each forecasted

years. Banana predicted yield is 93 quintals per hectare in 2030 with existing production scenario and if we assume predicted banana yield will be increased to 100 quintals per hectare in 2030 by applying full package of agronomic practice then banana production will shift from 2,420,393 quintals to 2,544,508 quintals. Assuming that area for banana plantation will be

increased by 10 percent at each predicted years and then banana production will shift from 2,420,393 quintals to 2,662,433

quintals (Figure 8 and Table 2).

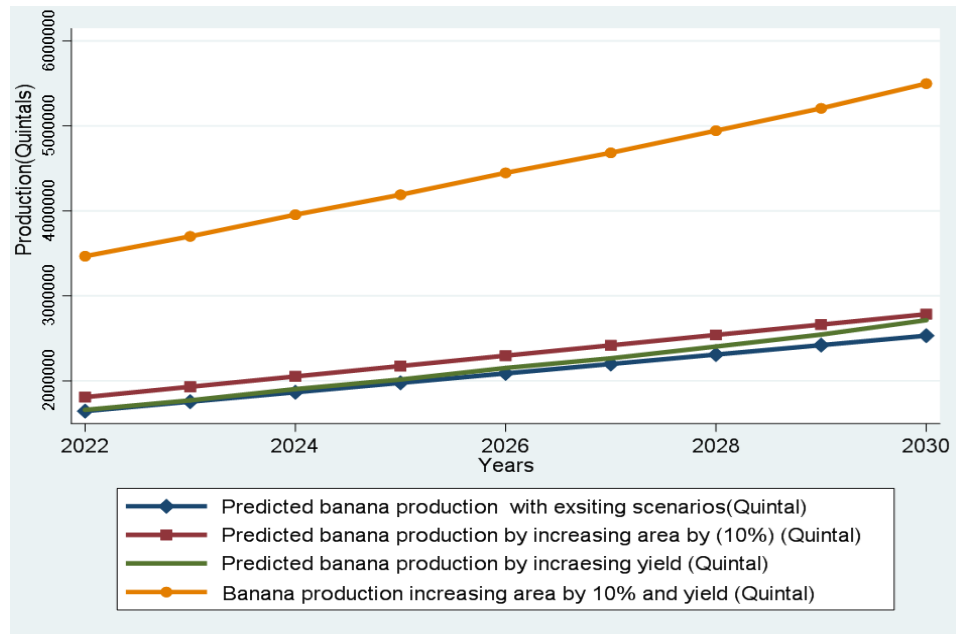


Figure 8. Banana production by increasing land area in avocado plantation and yield increment.
Source: Own computation from CSA 2014/15 to 2020/21.

Table 2. Banana area coverage, production, yield, HH consumption, domestic sale and export in Ethiopia and Oromia.

Country	Year	Area (Ha)	Production (Qt)	Yield Qt/Ha	HH consumption (Qt)	Sale (Qt)	Export (Qt)
Ethiopia	2015	53,956.20	47,82,510.00	89.41	22,87,474.50	23,52,516.70	1,15,600.00
	2016	53,688.57	44,01,344.00	81.98	20,09,653.70	22,45,126.00	17,260.00
	2017	63,212.90	53,83,023.00	85.16	26,95,817.90	25,20,331.40	18,840.00
	2018	59,298.19	49,36,022.00	83.24	25,28,230.50	22,90,807.80	42,090.00
	2019	66,081.22	50,15,286.29	75.57	26,07,948.90	23,57,184.60	72,540.00
	2020	66,839.72	53,90,277.30	80.64	24,17,539.40	27,36,643.80	35,730.00
	2021	95,954.10	89,83,548.00	93.62	39,54,557.80	45,80,711.10	41,805.40
	2022	89,700.80	77,70,997.52	93.63	35,61,688.30	48,48,728.00	41,087.80
	2023	95,219.10	82,76,411.16	93.65	37,65,093.00	51,16,744.80	40,370.30
	2024	1,00,737.40	87,81,824.79	93.66	39,68,497.80	53,84,761.70	39,652.80
	2025	1,06,255.80	92,87,238.43	93.67	41,71,902.50	56,52,778.60	38,935.20
	2026	1,11,774.10	97,92,652.06	93.68	43,75,307.30	59,20,795.40	38,217.70
	2027	1,17,292.40	1,02,98,065.70	93.7	45,78,712.00	61,88,812.30	37,500.20
	2028	1,22,810.70	1,08,03,479.30	93.71	47,82,116.80	64,56,829.20	36,782.60
	2029	1,28,329.00	1,13,08,893.00	93.72	49,85,521.50	67,24,846.00	36,065.10
2030	1,33,847.30	1,18,14,306.60	93.74	51,88,926.30	69,92,862.90	35,347.60	
Oromia	2015	13,412.90	9,45,556.00	70.5	4,88,757.90	4,21,907.10	
	2016	14,022.65	9,88,608.00	70.5	5,03,498.10	4,42,896.40	
	2017	14,149.12	9,80,171.00	69.27	5,19,196.60	4,22,061.60	
	2018	13,156.60	8,81,327.00	66.99	5,08,790.10	3,47,066.60	
	2019	20,946.64	13,14,315.50	62.75	7,62,303.00	5,25,726.20	
	2020	16,461.70	11,06,215.00	67.2	5,31,536.30	5,26,005.20	
	2021	11,510.30	17,96,986.90	84.24	8,24,457.60	8,95,079.20	
	2022	14,936.40	16,43,895.50	85.2	6,47,567.40	7,75,718.00	
	2023	15,154.80	17,54,823.80	86.2	9,16,919.30	8,35,786.50	

	2024	15,373.20	18,65,752.20	87.3	7,40,659.30	8,95,855.00	
	2025	15,591.50	19,76,680.50	88.3	10,10,011.20	9,55,923.50	
	2026	15,809.90	20,87,608.80	89.3	8,33,751.20	10,15,991.90	
	2027	16,028.30	21,98,537.20	90.3	11,03,103.10	10,76,060.40	
	2028	16,246.60	23,09,465.50	91.3	9,26,843.20	11,36,128.90	
	2029	16,465.00	24,20,393.70	92.3	11,96,195.00	11,96,197.40	
	2030	16,683.40	25,31,322.10	93.3	10,19,935.10	12,56,265.90	
Source: Own computation from CSA 2014/15 to 2020/21							

Mango production trends and forecasts

Mango production has shown ups from 2015 to 2019 and 2021 and downs in production, HH consumption and domestic sale in 2020 in Ethiopia as shown in Figure 9.

Mangos production, HH consumption and domestic sale have shown extreme ups and downs, in Oromia as shown in Figure 10. When comparing with the year mango production has spike in 2016, 2017, 2018, 2019 and 2021 and falls in 2020 in Ethiopia and Oromia.

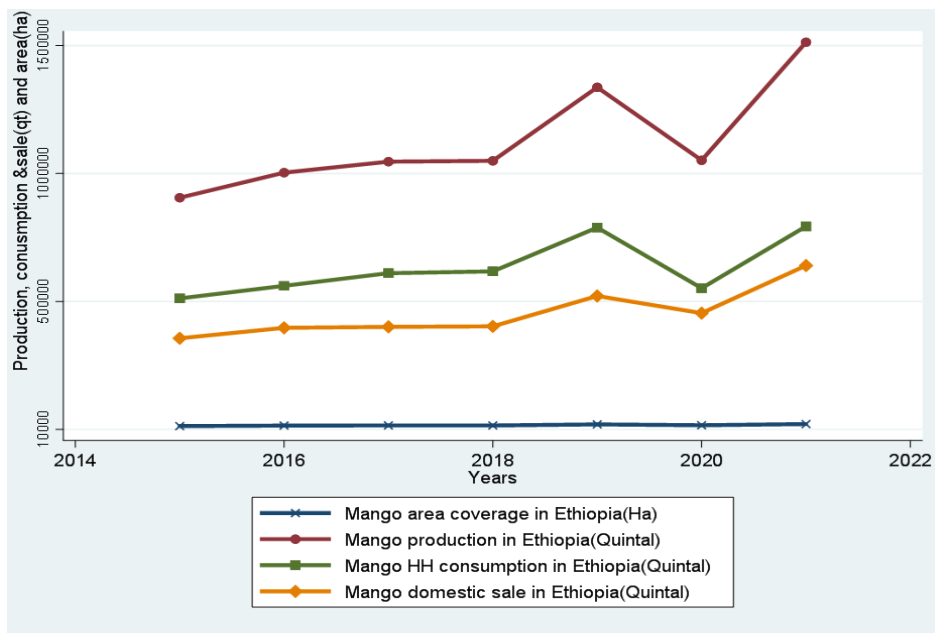


Figure 9. Trend of mango production (Qt), Yield (Qt/Ha), HH consumption (Qt), Domestic sale (Qt), and exports (Qt) in Ethiopia.

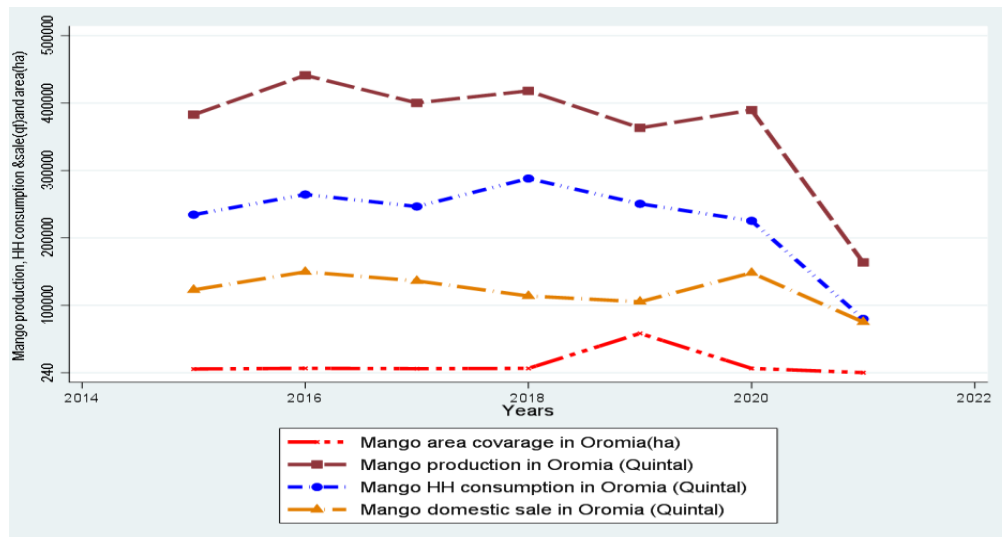


Figure 10. Trend of Mango Production (Qt), Yield (Qt/Ha), HH consumption (Qt) and Domestic sale (Qt) in Oromia.

Source: Own computation from CSA data.

Predicted mango production, HH consumption and sale

The forecasted mango production, HH consumption and sale for

the year 2022 to 2030 indicated an up and downs s shown in Figure 11 in Oromia. As indicated in Figure 11, observed value is fitted with the model.

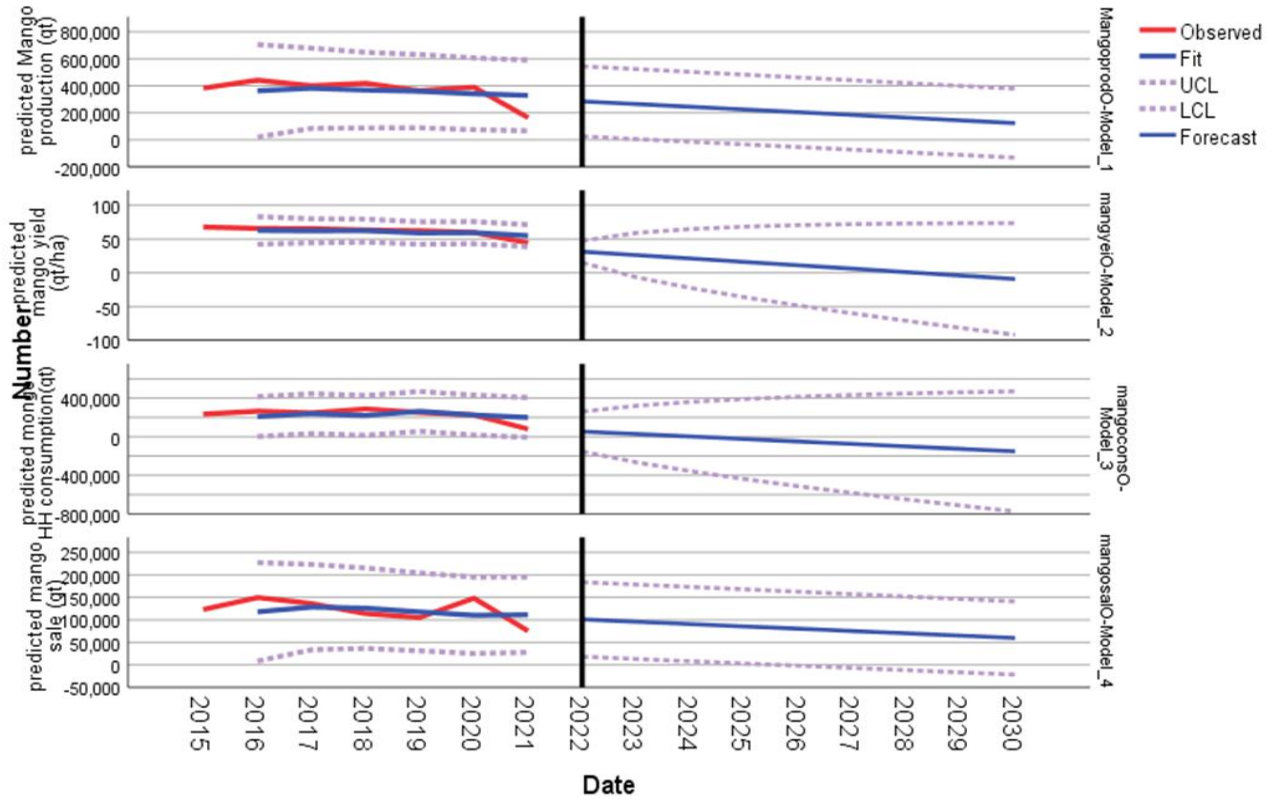


Figure 11. Mango production (Qt), yield (Qt/Ha), domestic sale (Qt) and HH consumption (Qt) forecast in Oromia. **Source:** Own computation from CSA 2014/15 to 2020/21.

Predicted mango production with different scenarios

We examine two mango production growth related investment scenarios. The first one will increase predicted yield from 23 quintals per hectare to 80 quintals per hectare in 2030 and the second one will increase mango plantation area by 5% in each forecasted years. Predicted mango yield will be 23 quintals per hectare in 2030 with existing production scenario and if we

assume mango yield will be increased to 80 quintals per hectare in 2030 then mango production will shifts from 7,530.8 quintals to 25,431 quintals. Assuming area for banana plantation will be increased by 5 percent at each year and then mango production will be remains unchanged and decreasing trend (Figure 12). This may due to high infestation of pests and disease recently found on mango production (Table 3).

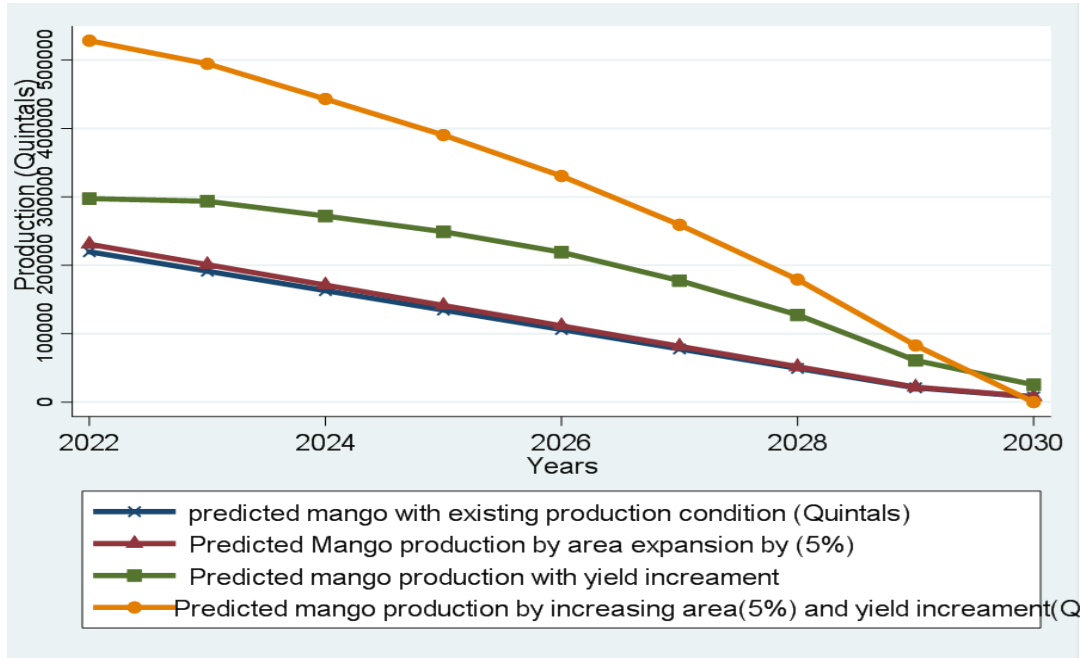


Figure 12. Mango production by increasing land area in avocado plantation and yield increment.

Source: Own computation from CSA 2014/15 to 2020/21.

Table 3. Summary of Mango production, HH consumption, domestic sale and exports trends and forecasts.

Country	Year	Area (Ha)	Production (Qt)	Yield Qt/Ha	HH consumption (Qt)	Domestic Sale (Qt)	Export (Qt)
Ethiopia	2015	12,860.50	9,05,614.00	72.3	5,12,034.20	3,56,087.40	23,810.00
	2016	14,791.20	10,03,515.00	67.85	5,61,165.60	3,97,090.90	19,600.00
	2017	15,413.76	10,46,461.00	67.85	6,10,610.00	4,00,794.60	19,290.00
	2018	15,373.04	10,49,808.00	68.29	6,17,602.00	4,02,706.30	17,920.00
	2019	19,497.92	13,37,049.26	69.68	7,88,859.10	5,21,449.20	19,960.00
	2020	16,340.90	10,51,874.10	64.4	5,51,918.30	4,54,409.60	12,260.00
	2021	20,783.10	15,13,312.40	72.81	7,93,581.00	6,40,282.50	15,435.70
	2022	18,948.10	12,54,611.86	69.1	7,15,252.20	5,36,460.40	11,382.70
	2023	23,101.80	16,58,450.99	68.9	8,45,134.10	7,17,861.50	12,633.40
	2024	21,158.20	14,12,334.68	68.8	7,87,252.00	6,14,083.80	8,580.30
	2025	25,311.90	18,16,173.82	68.7	9,17,134.00	7,95,485.00	9,831.00
	2026	23,368.30	15,70,057.50	68.5	8,59,251.90	6,91,707.30	5,778.00
	2027	27,522.00	19,73,896.64	68.4	9,89,133.90	8,73,108.40	7,028.60
	2028	25,578.40	17,27,780.33	68.3	9,31,251.80	7,69,330.70	2,975.60
	2029	29,732.10	21,31,619.46	68.1	10,61,133.70	9,50,731.80	4,226.30
2030	27,788.50	18,85,503.15	68	10,03,251.70	8,46,954.10	173.3	
Oromia	2015	5,644.50	3,82,743.00	67.8	2,34,468.40	1,22,975.30	
	2016	6,700.80	4,41,130.00	65.83	2,64,457.40	1,49,675.40	
	2017	6,111.10	4,00,265.00	65.5	2,46,563.20	1,36,250.20	
	2018	6,595.69	4,18,067.00	63.38	2,88,090.00	1,13,881.50	
	2019	58,401.10	3,63,155.20	62.18	2,50,577.10	1,05,315.00	
	2020	6,513.04	3,89,554.00	59.81	2,25,395.90	1,48,264.30	
	2021	244.4	1,63,587.30	44.42	79,879.70	75,266.50	
	2022	14,715.70	2,19,821.56	48	60,669.90	89,679.10	
	2023	16,014.90	1,91,402.51	45	41,460.00	83,445.30	
	2024	17,314.10	1,62,983.45	41.9	22,250.20	77,211.60	
	2025	18,613.30	1,34,564.40	38.9	3,040.40	70,977.90	

	2026	19,912.50	1,06,145.34	35.9	-16,169.40	64,744.20	
	2027	21,211.70	77,726.28	32.8	-35,379.30	58,510.50	
	2028	22,510.80	49,307.23	29.8	-54,589.10	52,276.80	
	2029	23,810.00	20,888.17	26.7	-73,798.90	46,043.10	
	2030	25,109.20	-7,530.88	23.7	-93,008.80	39,809.40	

Source: Own computation from CSA 2014/15 to 2020/21

Papaya production trends and forecasts

Papaya production has shown ups from 2015 to 2019 and 2021 and downs in production, HH consumption and domestic sale in

2020 in Ethiopia as shown in Figure 13. Papaya production, HH consumption and domestic sale has shown downs in 2016-2018 and up in 2020 and 2021 in Oromia as shown in Figure 14.

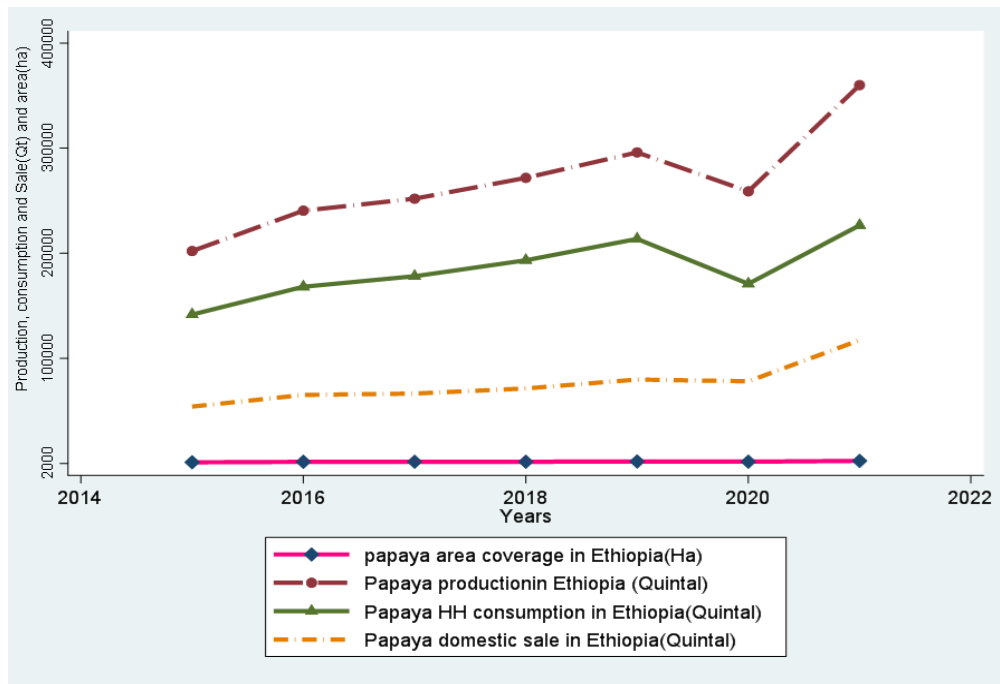


Figure 13. Trends of papaya production (Qt), yield (Qt/Ha), HH consumption (Qt), domestic sale (Qt), and exports (Qt) in Ethiopia.

Source: Own computation from CSA 2014/15 to 2020/21.

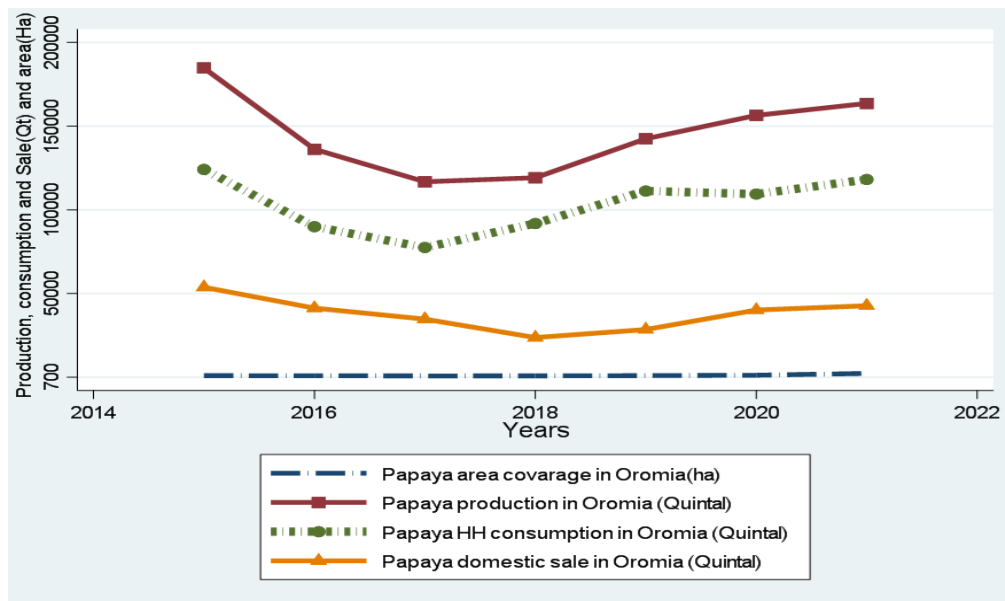


Figure 14. Trends of papaya production (Qt), yield (Qt/Ha), HH consumption (Qt) and domestic sale (Qt) in Oromia.

Source: Own computation from CSA 2014/15 to 2020/21.

Predicted papaya production, HH consumption and sale

consumption, domestic sale and exports for the year 2022 to 2030 indicated ups and downs as shown in Figure 15 in Oromia.

The forecasted papaya area coverage, production, HH

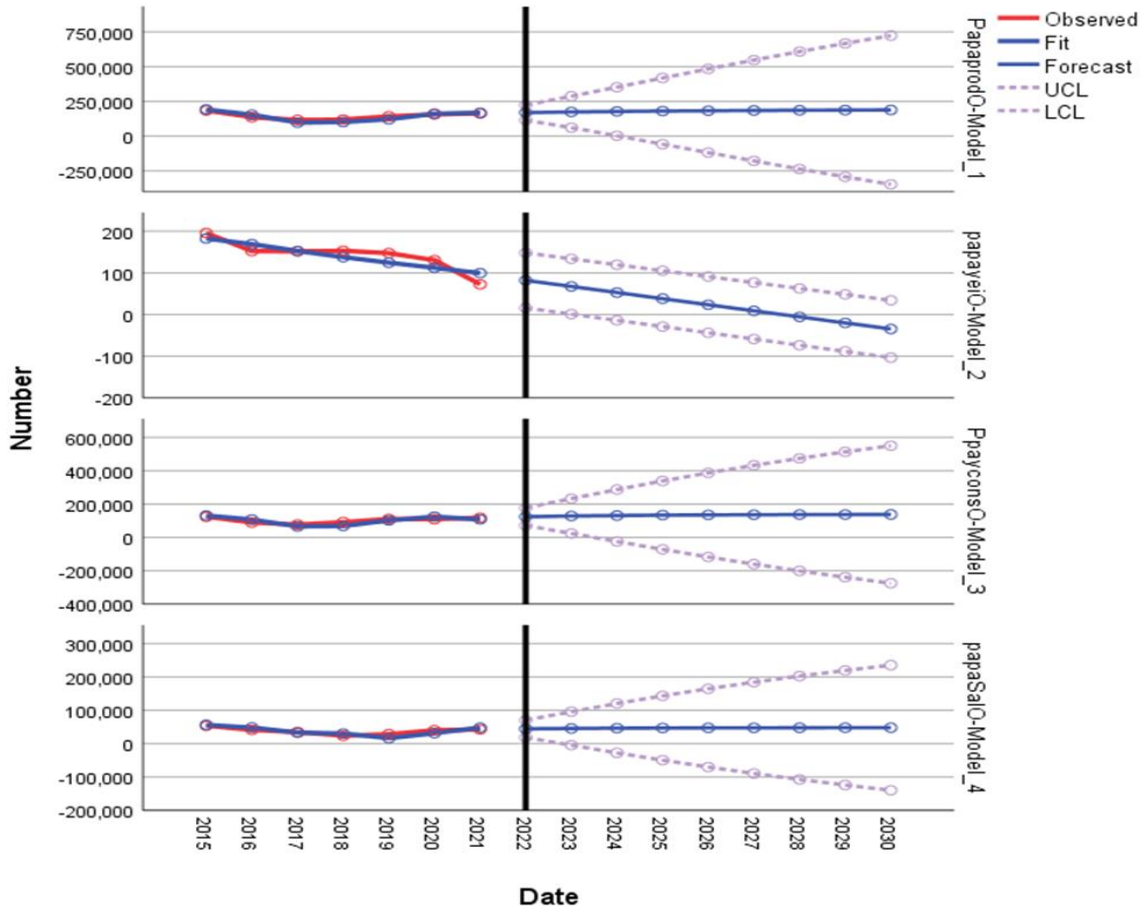


Figure 15. Papaya production (Qt), yield (Qt/Ha), domestic sale (Qt), HH consumption (Qt) forecast in Oromia.
Source: Own computation from CSA 2014/15 to 2020/21.

Papaya predicted production with different scenarios

We examine two papaya production growth related investment scenarios. The first one will increase predicted yield 30% and the second one will increase papaya plantation area by 10% in each forecasted years.

Papaya predicted production will be 162,993.1 quintals in 2030 with existing production scenario and if we assume papaya yield will increase by 30% then papaya production will be shift from 62,993.1 to 211,891.1 quintals in 2030. Assuming area for papaya plantation will increase by 10 percent at each year and then papaya production will be shifts from 162993.1 to 179292 quintals (Figure 16 and Table 4).

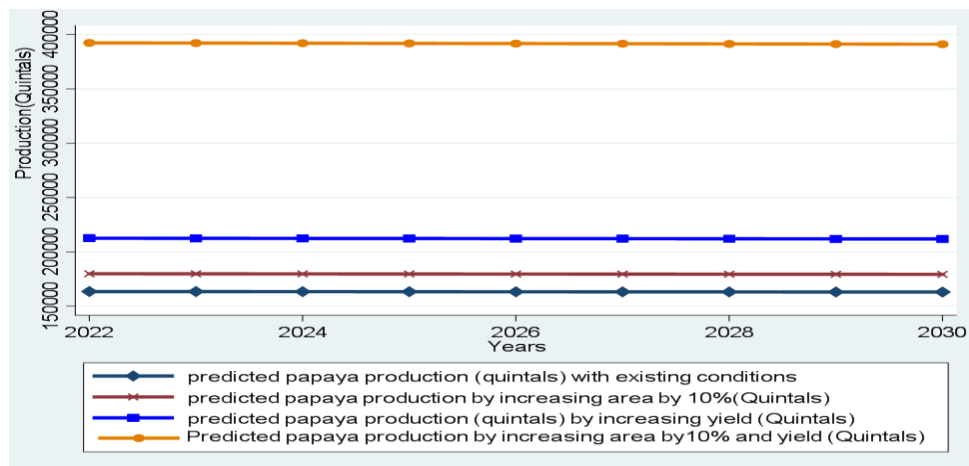


Figure 16. Papaya production (Qt) with area expansion and yield increment scenarios in Oromia.
Source: Own computation from CSA 2014/15 to 2020/21.

Table 4. Summary of papaya production, HH consumption, domestic sale and exports trends forecasts.

Country	Years	Area (Ha)	Production (Qt)	Yield Qt/Ha	HH consumption (Qt)	Sale (Qt)	Export (Qt)
Ethiopia	2015	2,434.10	4,04,351.00	171.9	2,83,490.50	1,08,487.40	7,970.00
	2016	3,338.00	4,81,156.00	144.1	3,36,424.30	1,30,537.60	11,690.00
	2017	3,489.50	5,03,962.00	144.4	3,56,401.90	1,33,197.20	9,770.00
	2018	3,484.50	5,43,550.00	156	3,86,735.80	1,42,953.70	14,530.00
	2019	4,009.60	5,92,051.00	147.2	4,27,460.80	1,59,853.80	16,570.00
	2020	3,627.30	5,17,941.20	142.7	3,41,996.60	1,56,521.80	19,000.00
	2021	5,096.10	7,20,077.70	141.3	4,53,288.90	2,34,817.30	19,467.40
	2022	4,428.10	6,23,814.80	137.4	4,31,745.00	2,22,674.80	23,442.40
	2023	5,638.30	7,86,264.00	134.08	4,79,346.20	2,38,982.40	23,548.50
	2024	5,077.30	7,03,015.00	130.78	4,74,213.50	2,55,289.90	27,523.50
	2025	6,287.50	8,65,464.10	127.48	5,21,814.60	2,71,597.40	27,629.50
	2026	5,726.50	7,82,215.10	124.17	5,16,681.90	2,87,904.90	31,604.50
	2027	6,936.70	9,44,664.30	120.87	5,64,283.10	3,04,212.40	31,710.60
	2028	6,375.70	8,61,415.30	117.57	5,59,150.30	3,20,519.90	35,685.50
	2029	7,585.90	10,23,864.40	114.27	6,06,751.50	3,36,827.40	35,791.60
2030	7,024.90	9,40,615.40	110.97	6,01,618.70	3,53,134.90	39,766.60	
Oromia	2015	945.4	1,84,700.00	195.4	1,24,173.80	53,747.70	
	2016	895.7	1,36,222.00	152.1	89,947.40	41,275.30	
	2017	771.6	1,16,789.00	151.4	77,512.90	34,698.00	
	2018	780.47	1,19,182.00	152.7	91,877.40	23,705.30	
	2019	968.5	1,42,459.50	147.1	1,11,260.90	28,491.90	
	2020	1,199.90	1,56,458.00	130.4	1,09,426.70	40,147.10	
	2021	2,258.50	1,63,587.30	72.4	1,18,142.70	42,712.60	
	2022	2,428.00	1,63,507.00	90.9	1,19,412.80	41,631.40	
	2023	2,597.40	1,63,442.80	76	1,21,343.10	40,558.30	
	2024	2,766.90	1,63,378.50	61.1	1,23,273.30	39,485.20	
	2025	2,936.30	1,63,314.30	46.2	1,25,203.60	38,412.00	
	2026	3,105.80	1,63,250.10	31.2	1,27,133.80	37,338.90	
	2027	3,275.20	1,63,185.80	16.3	1,29,064.10	36,265.80	
	2028	3,444.70	1,63,121.60	1.4	1,30,994.30	35,192.70	
	2029	3,614.10	1,63,057.40	-13.6	1,32,924.60	34,119.60	
2030	3,783.60	1,62,993.10	-28.5	1,34,854.80	33,046.50		

Source: Own computation from CSA 2014/15 to 2020/21

Pineapple production trends and forecasts

In Ethiopia, pineapple successfully grows in South and Southwestern parts as small scale farming and the yield of the crop is low about 28.1 Qt/ha and 145.1 Qt/ha in Ethiopia and Oromia, respectively in 2020/21 as compared to global average pineapple yield of 67.5 t/ha. As indicated in the Figure 17,

pineapple production, area, HH consumption and domestic sale has shown extreme ups and downs in Ethiopia as shown in Figure 17. Pineapple production has shown a spike in 2017, 2020 and 2021, and a fall in 2016, 2018 and 2019. HH consumption and sale also ups and downs trends in Ethiopia. In Oromia pineapple production was high in 2020/21 is indicated in Figure 18.

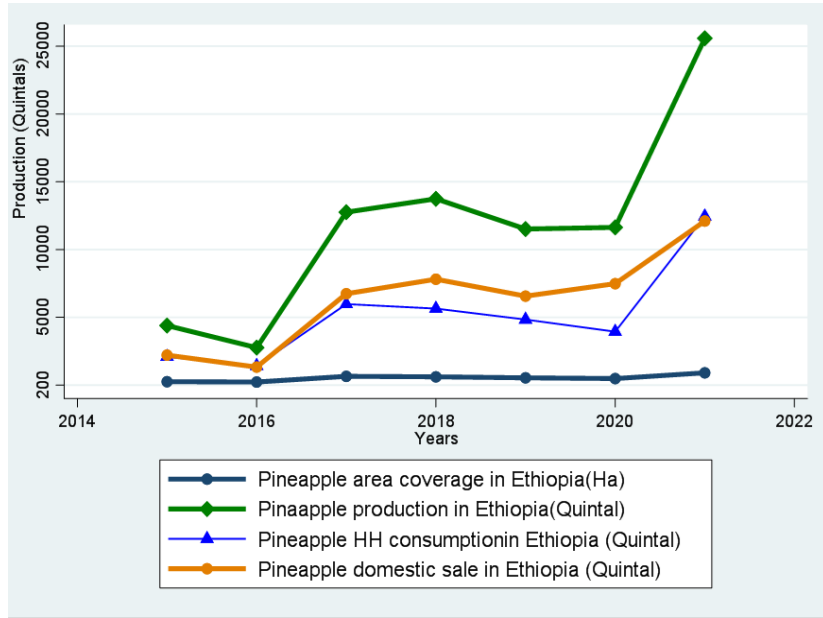


Figure 17. Trends of pineapple production (Qt), yield (Qt/Ha), HH consumption (Qt), domestic sale (Qt) and exports (Qt) in Ethiopia.
Source: Own computation from CSA 2014/15 to 2020/21.

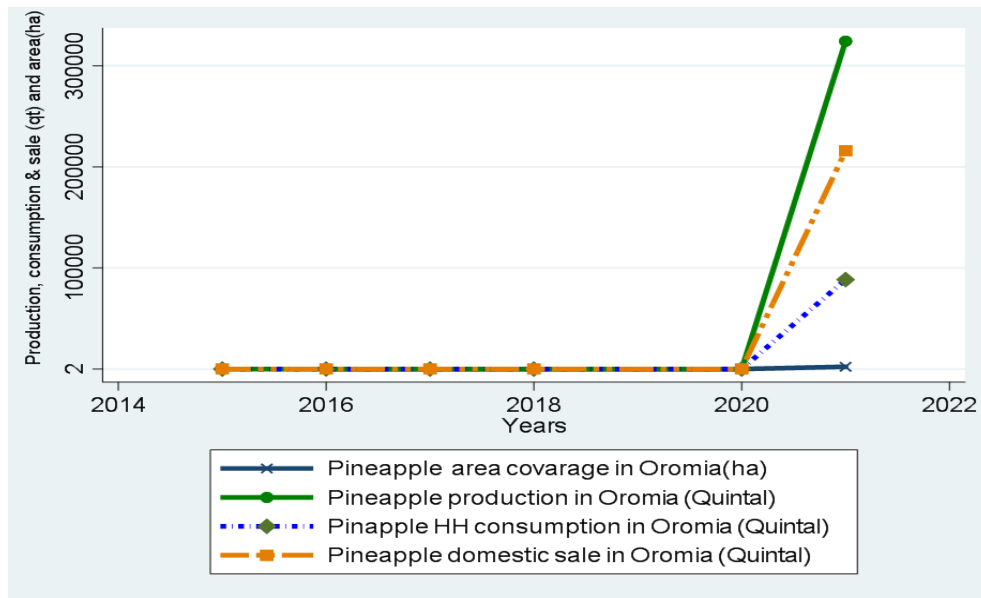


Figure 18. Trends of pineapple production (Qt), yield (Qt/Ha), HH consumption (Qt) and domestic sale (Qt) in Oromia.
Source: Own computation from CSA 2014/15 to 2020/21.

Predicted pineapple production, HH consumption and sale

The forecasted pineapple production, yield, HH consumption and

domestic sale for the year 2022 to 2030 indicated an increasing for as shown in Figure 19 in Oromia.

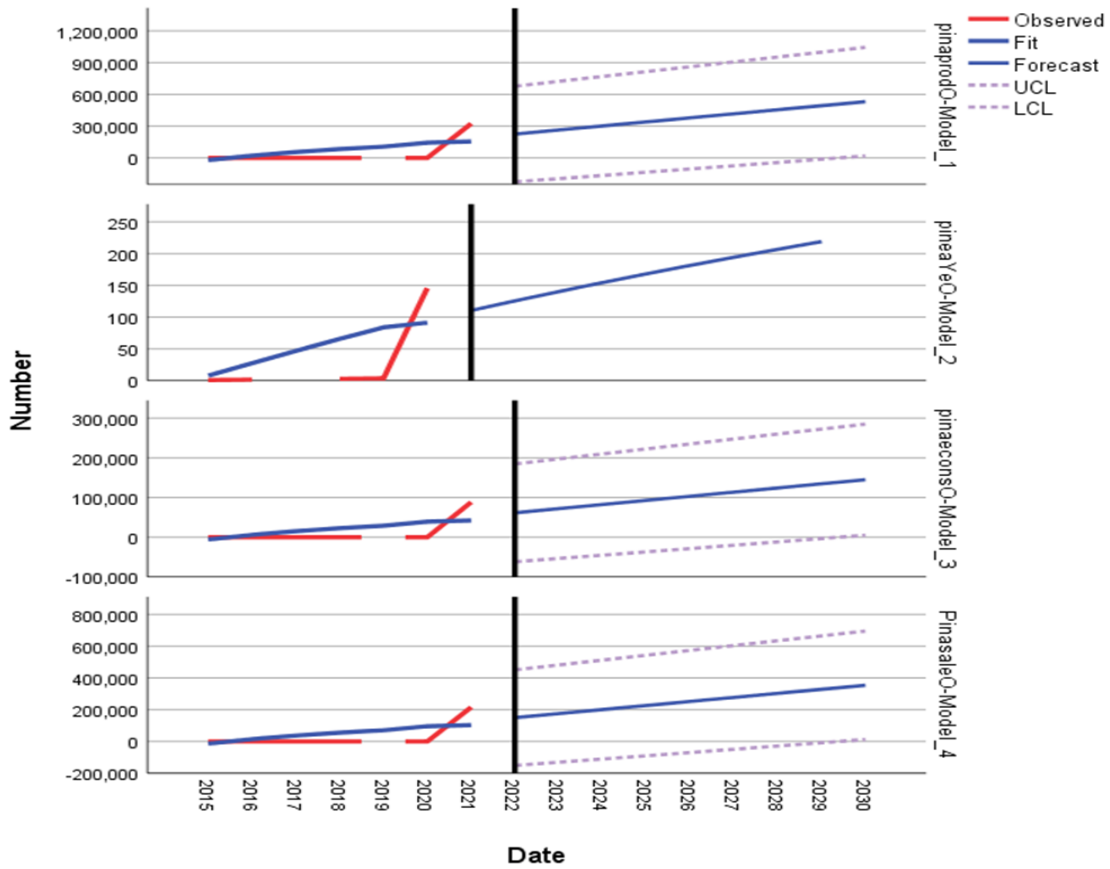


Figure 19. Pineapple production (Qt), yield (Qt/Ha), domestic sale (Qt) and HH consumption (Qt) forecast in Oromia.
Source: Own computation from CSA 2014/15 to 2020/21.

Pineapple predicted production with different scenarios

We examine two pineapple production growth related investment scenarios. The first one will be increase yield from 303.5 quintals per hectare to 318.72 quintals per hectare in 2030 and the second one will be increased pineapple plantation area by 30% in each forecasted year.

Pineapple predicted production will be 483,987.4 quintals in 2030 with existing production scenario and if we assume pineapple yield will be increased to 318.72 quintals per hectare in 2030 then pineapple production will be shifts to 559,005 quintals. Assuming area for pineapple plantation will be increased by 30 percent in each year and then pineapple production will be shifts to 532,386 quintals (Figure 20 and Table 5).

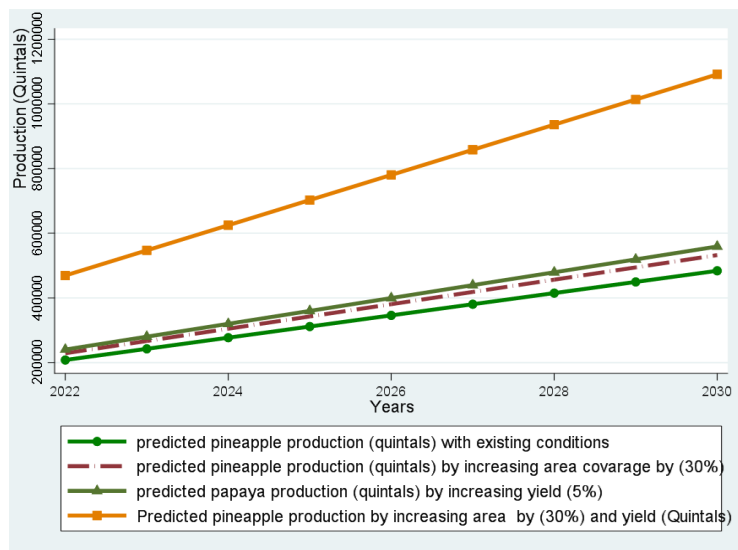


Figure 20. Pineapple production by increasing land area in pineapple plantation and yield increment.
Source: Own computation from CSA 2014/15 to 2020/21.

Table 5. Summary of pineapple production, HH consumption, domestic sale and exports trends and forecasts.

Pineapple							
Country	Year	Area (Ha)	Production (Qt)	Yield Qt/Ha	HH consumption (Qt)	Sale (Qt)	Export (Qt)
Ethiopia	2015	251.4	4,395.00	-	2,088.90	2,211.60	
	2016	226.37	2,762.00	12.2	14,191.00	1,328.30	110
	2017	645.19	12,758.00	-	5,978.40	6,741.30	20
	2018	609.8	13,746.00	22.5	5,642.70	7,813.20	10
	2019	536.41	11,516.72	21.5	4,837.00	6,564.50	20
	2020	480.9	11,638.80	24.2	3,940.90	7,483.70	30
	2021	905.5	25,589.40	28.3	12,446.70	12,103.80	
	2022	842.8	24,368.70	41.6	5,726.00	12,648.90	
	2023	927.3	27,221.00	35.2	11,455.90	14,139.60	
	2024	1,011.80	30,073.20	50.9	6,398.20	15,630.30	
	2025	1,096.30	32,925.40	44.5	12,128.10	17,121.00	
	2026	1,180.80	35,777.70	60.2	7,070.40	18,611.60	
	2027	1,265.30	38,629.90	53.8	12,800.20	20,102.30	
	2028	1,349.80	41,482.10	69.4	7,742.50	21,593.00	
	2029	1,434.30	44,334.40	63.1	13,472.40	23,083.70	
2030	1,518.80	47,186.60	78.7	8,414.70	24,574.40		
Oromia	2015		29		10.8	15.4	
	2016	70.9	67	1	37.1	29.4	
	2017		14		6	7.9	
	2018		8		5.3	2.6	
	2019						
	2020	20.27	74	3.7	36.3	37.5	
	2021	2,226.50	3,24,328.10	145.7	88,476.70	2,15,937.60	
	2022		2,08,149.41		56,787.70	1,38,583.00	
	2023		2,42,629.16		66,193.50	1,61,540.10	
	2024		2,77,108.91		75,599.40	1,84,497.10	
	2025		3,11,588.66		85,005.30	2,07,454.20	
	2026		3,46,068.41		94,411.10	2,30,411.20	
	2027		3,80,548.16		1,03,817.00	2,53,368.30	
	2028		4,15,027.91		1,13,222.80	2,76,325.30	
	2029		4,49,507.66		1,22,628.70	2,99,282.40	

Coffee production trends and forecasts

Coffee production, area coverage and HH consumption has shown increase ups and exports were up and down in Ethiopia (Figure 21). In case of Oromia coffee production, domestic sale,

HH consumption and area coverage has shown extreme ups and downs as shown in Figure 22. Production, domestic sale, HH consumption and area have shown a spike in 2016 and 2019, and a fall in 2018, and 2021 in Oromia.

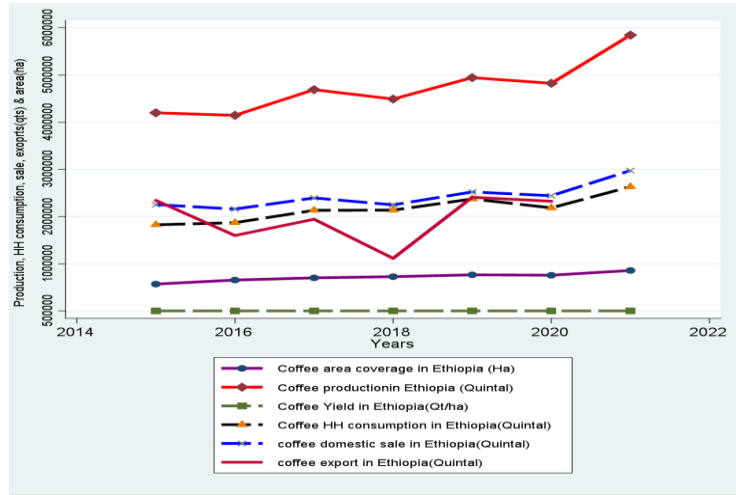


Figure 21. Coffee area coverage (Ha), production (Qt), yield (Qt/Ha), domestic sale (Qt), HH consumption (Qt) and Exports (Qt) forecast for next nine years in Ethiopia.
Source: Own computation from CSA 2014/15 to 2020/21.

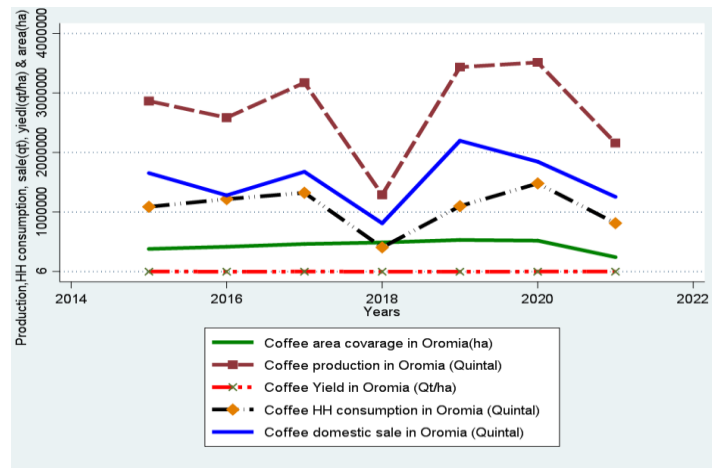


Figure 22. Coffee area coverage (Ha), production (Qt), yield (Qt/Ha), domestic sale (Qt) and HH consumption (Qt) forecast for next nine years in Ethiopia.
Source: Own computation from CSA 2014/15 to 2020/21.

Predicted coffee production, HH consumption and sale

The forecasted coffee production, HH consumption, sale and area

coverage for the year 2022 to 2030 will be slowly increasing as shown in Figure 23 in Oromia.

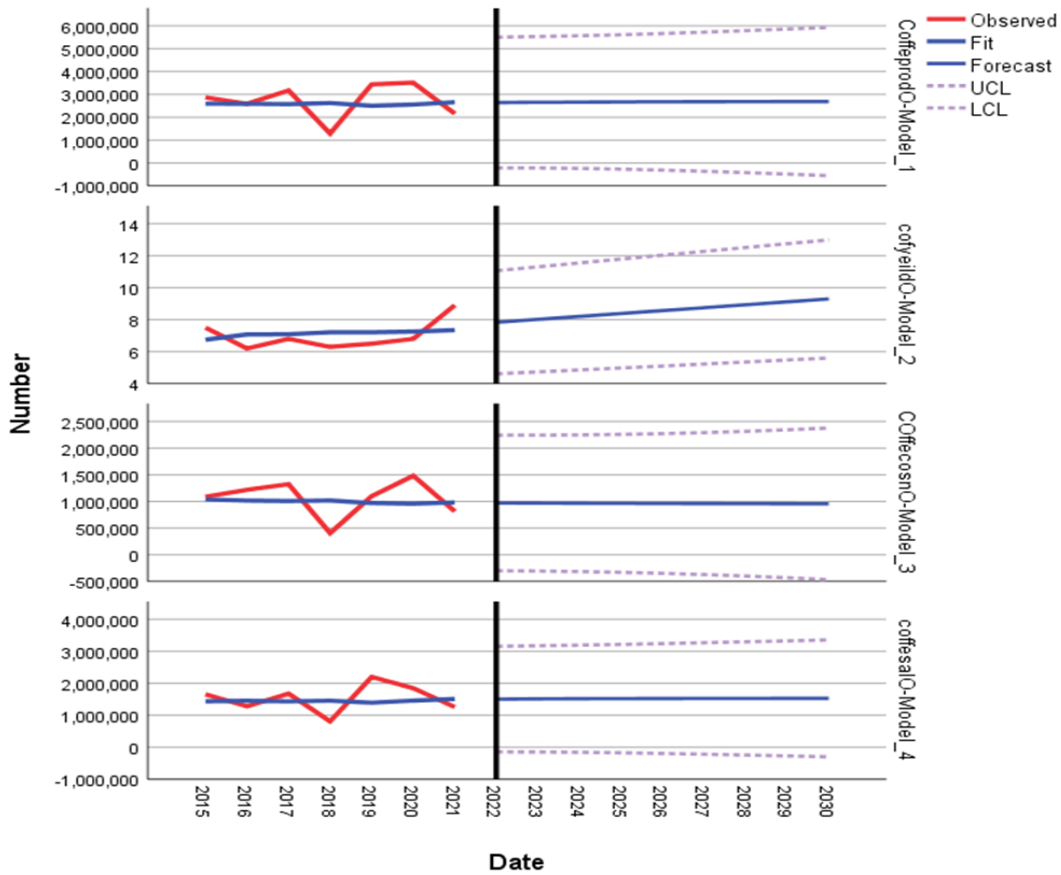


Figure 23. Coffee area coverage (Ha), production (Qt), yield (Qt/Ha), domestic sale (Qt) and HH consumption (Qt) forecast for next nine years in Ethiopia.

Source: Own computation from CSA 2014/15 to 2020/21.

Predicted coffee production with different scenarios

We examine two coffee production growth-related investment scenarios. The first one will be increased coffee yield from 10 quintals per hectare to 10.5 quintals per hectare in 2030 and the second one will be increased coffee plantation area by 10% in each forecasted year. Predicted coffee production will be

2,850,345.7 quintals in 2030 with existing production scenario and if we assume coffee yield will be increased to 10.5 quintals per hectare in 2030 then coffee production will shift from 2,850,345 to 52,999,286 quintals. Assuming area for coffee plantation will be increased by 10 percent in each year and then coffee production will shift from 2,850,345.7 to 3,135,380.3 quintals (Figure 24 and Table 6).

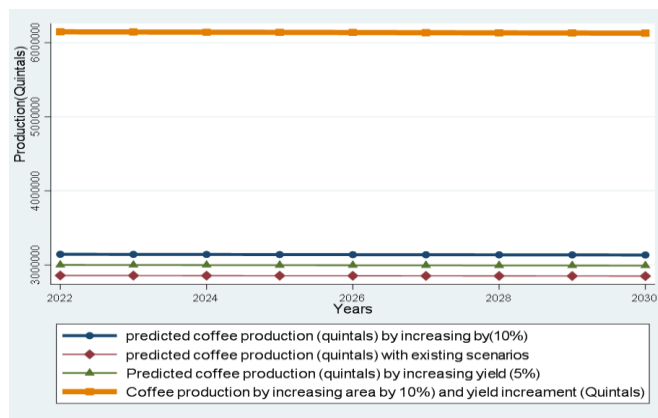


Figure 24. Coffee production by increasing land area in coffee plantation and yield increment.

Table 6. Summary of coffee production, HH consumption, domestic sale and exports trends and forecasts.

Country	Year	Area (Ha)	Production (Qt)	Yield Qt/Ha	HH consumption (Qt)	Sale (Qt)	Export (Qt)
Ethiopia	2015	5,68,740.00	41,99,802.00	7.6	18,25,653.90	22,54,033.70	23,43,280.00
	2016	6,53,909.80	41,45,965.00	6.3	18,71,074.00	21,59,219.00	15,98,150.00
	2017	7,00,474.50	46,90,911.00	6.7	21,32,019.00	23,95,179.20	19,43,400.00
	2018	7,25,961.20	44,92,298.00	6.2	21,36,536.90	22,48,395.10	11,13,900.00
	2019	7,64,863.10	49,45,743.60	6.5	23,73,956.90	25,22,329.30	24,08,830.00
	2020	7,56,852.60	48,25,605.70	6.4	21,85,034.30	24,41,756.50	23,25,470.00
	2021	8,56,853.00	58,47,895.70	6.8	26,32,722.60	29,75,409.30	
	2022	8,43,644.30	54,91,368.40	6.6	25,39,857.90	28,64,322.80	
	2023	9,37,919.10	60,83,863.20	6.5	27,94,848.70	29,65,930.00	
	2024	9,24,733.10	59,59,391.30	6.4	27,75,369.90	30,67,537.30	
	2025	10,19,007.80	65,51,886.00	6.3	30,30,360.70	31,69,144.50	
	2026	10,05,821.90	64,27,414.10	6.3	30,10,881.90	32,70,751.70	
	2027	11,00,096.60	70,19,908.90	6.2	32,65,872.70	33,72,358.90	
	2028	10,86,910.70	68,95,437.00	6.1	32,46,393.90	34,73,966.10	
	2029	11,81,185.40	74,87,931.80	6	35,01,384.60	35,75,573.30	
2030	11,67,999.40	73,63,459.90	5.9	34,81,905.80	36,77,180.60		
Oromia	2015	3,81,514.60	28,65,350.00	7.5	10,88,833.00	16,54,739.60	
	2016	4,17,557.40	25,86,655.00	6.2	12,18,056.00	12,81,688.00	
	2017	4,64,425.90	31,73,159.00	6.8	13,24,793.90	16,77,649.20	
	2018	4,89,799.40	12,91,718.00	6.3	4,07,278.70	8,12,361.50	
	2019	5,31,702.70	34,35,447.10	6.5	10,99,343.10	21,98,686.10	
	2020	5,20,911.10	35,13,708.00	6.8	14,81,730.70	18,47,507.70	
	2021	2,42,818.10	21,59,420.70	8.9	8,13,453.80	12,56,135.00	
	2022	2,37,742.90	28,58,877.14	8.6	9,58,986.90	17,61,846.60	
	2023	2,32,667.70	28,57,810.71	8.7	9,40,465.70	17,76,982.90	
	2024	2,27,592.50	28,56,744.29	8.9	9,21,944.60	17,92,119.20	
	2025	2,22,517.30	28,55,677.87	9.1	9,03,423.50	18,07,255.50	
	2026	2,17,442.20	28,54,611.44	9.3	8,84,902.30	18,22,391.80	
	2027	2,12,367.00	28,53,545.02	9.4	8,66,381.20	18,37,528.10	
	2028	2,07,291.80	28,52,478.60	9.6	8,47,860.10	18,52,664.40	
	2029	2,02,216.60	28,51,412.17	9.8	8,29,338.90	18,67,800.70	
2030	1,97,141.40	28,50,345.75	10	8,10,817.80	18,82,937.00		

Source: Own computation from CSA data and FAOSTAT, 2015-2030.

CONCLUSION

This assessment was focused on production prediction of avocado, banana, mango, papaya, pineapple and coffee in Oromia. The main objective of this assessment was to generate relevant information on main fruit production and consumption trend which is essential for planning and policy direction and to provide sufficient information and analytics of future fruits production and consumption to guide intervention decisions. For this study we mainly used the area and production of major crops survey report of the CSA from 2015-2021 and FAOSTAT from 2015-2021 for export of commodity at national level. Autoregressive Integrated Moving Average (ARIMA) model was used to predict the future points of a time series data of fruits. The avocado production increment from 2014/15 to 2020/21

were 12.7%, -0.15%, 3.1%, 39.98%, 31.7% and 150% in Oromia. Banana production, area coverage, consumption, sale and exports has also shown upward trends in Oromia. Mango production was downward trends due to disease and insect pests. Papaya and coffee production trends were up and down (volatile trends). Pineapple was an emerging crop and production trends was increase from time to time. Based on the results possible recommendation/suggestion given are:

- Increasing the sustainable production of fruit is necessary because the current supply does not meet regional, national and global nutrition requirements.
- Initiatives to make fruit production and supply chains more sustainable can be particularly strategic points for penetrating to global market and meet demand of agro industrial park developed in our country

- Managing pests and diseases in fruit crops is a significant issue for small scale growers that can be best addressed through IPM strategies (mango and others).
- A fundamental shift toward more nutritious crops in more diversified cropping systems is necessary.

Acknowledgment

I would like to thank Oromia agricultural research institute for budget support and other facilities. Special thanks goes to CSA and BoA to allow me to use online available data. I also thank FAOSTAT to use online data and information.

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