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Scientific Journal of Animal ScienceJournal homepage: www.sjournals.com**Original article****Study on the current status of feed ingredient production, supply and marketing in Ethiopia****Demissie Negash^{a,*}, Tadesse Teshome^a, Daniel Temesgen^b**^aEthiopian Meat and Dairy Industry Development Institute, Bishoftu.^bEthiopian Society of Animal Production.

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ARTICLE INFO

Article history,

Received 06 February 2022

Accepted 14 March 2022

Available online 20 March 2022

iThenticate screening 09 February 2022

English editing 12 March 2022

Quality control 19 March 2022

Keywords,

Animal feed ingredients

Oil crops

Cereals

Price

ABSTRACT

This study was conducted from March-July 2021 to assess status and dimension of feed ingredient production price and marketing constraints and to identify the major factors or reasons contributed to the development of these problems particularly for the past five years. Check list, informant discussions with relevant stakeholders were used to collect suitable data and information. This study was revealed that production and market supply of cereals and oil crops were non significantly ($P>0.05$) different from 2017-2020. Annual growth rate of production and market supply for soya bean, niger and linseed were very low in 2019/20 than the previous year. Niger and Sesame was produced and supplied to the market significantly ($P<0.05$) in large volume in comparison to other oil crops for the past aggregate five years followed by soya bean with the value of 285,749.3, 180,116.5; 250,123.7, 171,775.7 and 130,771.5, 77,803 tons respectively. The exported soya bean was 62.4, 37.6, and 1.5% higher than the soya bean brought to the market in the years of 2017, 2018 and 2019 respectively. The study shows that there were a gap between design capacity and performance of oil industries from 2016-2020 with the value of 522,997, 611,997, 638,197, 754,497 and 967,603.4 tons respectively. As the market supply of wheat was compared with the design capacity and current performance of all flour industries in the country, there was an average deficit of

1,500,000 tons of wheat from 2017-2020 with a minimum and maximum of 500,000 and 2,100,000 tons in 2016/17 and 2020/21 respectively. Generally, demands for feed ingredients by feed processing industries were increased from 120,897 to 574,734 tons between the study periods. From this study, it is possible to conclude that scarcity of wheat and oil crops in the market, absence of maize for flour and feed industries and presence of illegal marketing in the value chain were some of the main factors for price increment of feed ingredient.

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1. Introduction

In developing economies, the livestock sector is evolving in response to rapidly increasing demand for livestock products due to the human population growth, higher prosperity and urbanization (Thornton, 2010). Animal feed and nutrition are the essential link in the livestock production chain that is between crop cultivation and animal protein production and processing. Surging demands and struggling supplies result in stressed surroundings in which animal feed operators and farmers need to balance their activities continuously, taking into account animal performance as well as customer, consumer and societal demands (Hartog and Sijtsma, 2012). Earlier study FAO (2009) indicated that producing the additional food needed to feed all people and livestock in 2050 will require a 9 percent expansion of arable land, a 14 percent increase in cropping intensity and a 77 percent increase in yields.

Ethiopia is a country with largest livestock population in Africa and with a huge livestock genetic diversity. However, due to various factors, the country is far beyond the utilization of these huge resources. In the second Growth and Transformation Plan (GTP) of 2015, Ethiopian government has identified livestock sector as a new source of economic growth. The rationale in using livestock sector as a growth driver emanates from the unexploited potential of the sector and a wide range of agro-industries to be created along the path of market led economy and commercialization. In order to achieve the GTP plan on livestock sectors, feed sub-sector is central for all livestock commodities and is a key pillar of livestock growth and transformation from various perspectives. From economic point of view, about 70 percent of the cost of animal production is feed and suggesting economic feasibility of animal agriculture is mainly a function of quantity and quality of nutrients and the science of feeding. Thus feed is a point of convergence and a critical commodity for which all livestock species compete and it is a major pillar towards ensuring economic, social and environmental goals of livestock production (Makkar, 2016).

Historically, the development of feed processing plants in Ethiopia dates back to the beginning of modern livestock husbandry in the early 1950's followed by establishment of feed processing enterprises during the socialist regime. As a follow up of the new economic policy since 1991, the feed processing enterprises operated by government were privatized and a number of feed processing plants of various capacities came into operation (Seyoum et al., 2018). Currently feed manufacturing industries are facing an ingredient supply and high price increment. This issue needs attention of policy makers, development agencies and the private sector concerned to draft short and long term intervention plans to minimize the effects on the general economy, consumers and private sector to survive in the face of this harsh marketing realities.

1.1. Statement of the problem

In the recent years supply and price situation of feed ingredients have shown a steady decrease but the dimension of this general trend was highly aggravated in the last one or two years probably due to current development related to the general inflation of food commodities in the country negatively affecting the feed and animal production sub-sector as well (Harinder, 2020). Commercial feed processors and modern poultry, dairy and beef farms which are seriously confronted by this supply and escalation of price are voicing their concern requesting the responsible government bodies to intervene to solve this issue through forming positive environment that encourages both private sectors involved in feed manufacturing and modern animal production. Hence, this study was initiated with the following objectives:

1.2. General objectives

Assessing the current feed ingredient supply, price and market related constraints. Specific objectives of the study are:

- Studying the current status and dimension of feed ingredient supply , price and marketing constraints
- Indicating the major factors or reasons contributed to the development of these problems particularly for the past five years

2. Materials and methods

The study was undertaken from March-July 2021 in selected areas of the country. In this study data were collected from different private and farmers Union ingredient suppliers, flour and oil industries, associations. Besides, data were collected from feed processors, livestock farms like poultry, dairy, beef and others. The methodology employed during the course of the study is indicated as follows:

- Basic information were collected by using check list
- Informant discussions were used to understand details of particular issues regarding key challenges and strategic directions of feed processing plants
- Desk review were made from print media including published and unpublished materials, websites and others

2.1. Data source

Primary and secondary data were collected from feed processors, feed ingredient suppliers, poultry, dairy and beef farms, Government organizations, different associations, previous studies, different reports, prospective plans.

2.2. Data type used for the study

Data were collected on production, consumption, market supply, seed and others for wheat, maize and oil crops from production year of 2016/17-2020. Similarly, design capacity and current performance of oil and feed industries for the past five years were collected. Feed ingredient price data for the past five years were collected.

2.3. Statistical analysis

A Generalized linear model (Proc GLM) procedure of SAS (SAS, 2008) was used for the analysis of cereals and oil crops production and utilization from 2016-2020. The effects of year and crop type were included in the model. Then the analyzed data were organized using descriptive and inferential statistics. When there was significant difference of dependant variables among independent variables mean comparison was undertaken using Tukey-test at P value of 95%. The model was: $Y_{ijm} = \mu + T_i + K_j + e_{ijm}$

3. Results and discussion

3.1. Compound feed ingredient

The main compound feed ingredients are maize, mineral, vitamin, oil seeds, lime stone, salt and flour industrial byproducts. The supplements can further segmented into Vitamins, Amino Acids, and other Supplements. Compound feed for dairy, beef, Poultry, and others farm animals. Agro-industrial by-products make the major inputs required by the feed processing plants. These include oilseeds and cereal ingredients supplied from oil and flour industries. The production performance of the feed processors varies depending upon the supply of these inputs.

3.2. Trend of production and market supply (sale) of oil seeds feed ingredients from 2016-2020

Oil seed production, utilization and rate of production trend in the last five years are indicated in Table 1 and 2. In the base year (2016/17) of the study 81243.1 tons of soyabean was produced in the country and of these 48204.8 tons or 59% was brought to the market. In the same production year twenty two percent (22.34%) of the produced soyabean was consumed by primary producers and the rest were used for wage, animal feed, seed and

others (CSA, 2018). Similarly, in the production year of 2016/17, 302462, 87912, 129636, 7954, 267867 and 43402 of noug, linseed, ground nut, sunflower, sesame and rapeseed were produced in Ethiopia. From the above produced oil seeds 64.86, 29.82, 58.34, 29.31, 69.02 and 35.97% respectively were brought to the market. From these oil seeds noug, sesame and groundnut were produced in higher amount in their order of importance whereas; large quantity of sesame, noug and soyabean were brought to the market in their order of importance. This shows that soyabean (which is the major feed ingredient from oil seeds in compound feed) ranked fifth in production but third in sell from all the seven oil seeds considered in this study. Majority of linseed and sunflower produced were consumed by the primary producers and only 1/3 of the productions were brought to the market in 2016/17 production year.

From all oil seeds, sunflower production were increased in 2017 by 20.40% from the previous year of 2016 and ranked first followed by Ground nut and Soyabean with production increment of 11.98 and 9.30% respectively. With regards to oil seed brought to the market, groundnut was increased by 14.17% and higher in 2017 than the previous year of 2016 and ranked first followed by soya bean and noug seed cake with 10.45 and 4.60% increment respectively. However, for the other oil seeds of rapeseed, linseed, sesame and sunflower were less supplied to the market in 2017 as compared to 2016 with annual rate of growth of -36, -15.40, -12.15 and -10.89 respectively. In this result production of safflower and linseed were increase in 2017 as compared to 2016 but those produced Safflower and linseed were not brought to the market. This implies that the scarcity of oil seed in the market could affect oil production and as a result would reduce oil seed cakes which are used as oil feed ingredient to prepare compound feed for animal feed.

In 2017-2018 annual growth rate of soyabean was 68% and higher than the previous year and it ranked first followed by rape seed and linseed with 16.27 and 11.28% increment respectively. In the same year (2017/18) Sesame oil seed (mostly not demanded for animal feed in Ethiopia) was the lowest produced with -21.19% from the previous year of 2016/17. In 2018 more percentage of Soyabean (the major oil cake used for poultry feed and most of the feed industries produce poultry feed) was brought to the market with annual growth rate of 67.44% than 2017 and ranked first followed by linseed and rape seed with 24.45 and 16.37%. As compared to 2017 more amount of oil seeds were brought to the market in 2018. This implies that more oil seed were supplied to oil industries and as a result more oil feed ingredients were produced for compound feed production in 2018.

In 2019 the major oil seeds (soyabean, noug and linseed) that are used for animal feed as oil seed cakes were reduced in production from the previous year of 2018. The lowest annual growth rate of production and market supply from the previous year was exhibited by linseed, soyabean and noug seed with -18.80, -15.94 and -1.63% respectively. This implies that major oil seed that are used as oil feed ingredient for animal feeds were in short supply in 2019 as compared to the previous year. This reduction of production in major oil seeds may be a major cause for increment of animal feed and compound feed price in 2020. This study also evidenced the highest inflation rate on feed ingredients in 2020.

The major oil seed produced and brought to the market was sesame with annual growth rate of 30 and 38.03% respectively as compared to 2018. However, the increment of sesame in the market could not be benefited the animal feed sector because this oil seed cake is less utilized as oil seed feed ingredient for compound feed. In this regard, Ethiopian oil seed annual report (2020) described that the current domestic consumption and utilization is small as compared to production, and consumption is expected to rise in the future thanks to local and international demand.

This study indicated that average growth rate for both production and market supply for noug, rapeseed, safflower, and linseed seed were declined from the base year(2016/2017) to 2020/2021 (Table 2) and it implies that major oil seeds used for animal feed ingredient were in scarce supply for feed industries. The slow growth in the volume of production and lower market supply of oil seed directly contributes to shortage of raw material for oil processing industries and as a result may increase the competition between local oil processors and exporters.

In 2020 large quantity of soyabean was produced and brought to the market as compared to the study period of the previous years (Table 1). Similarly, the average growth rate of soyabean was very high between 2016 and 2020. The increment of soya bean for the last five years was supported by the study of Ethiopian oil seed annual report (2020) and stated that soyabean production has been rapidly increasing over the last two decades. Most of this growth in production was due to an expansion in the area planted, especially from commercial farms.

Table 1

Oil seed production and utilization in Ethiopia (2016-2020) (tone).

Oil type	Year	Prod	Consu	Sale	Wage	AnFe	Other	Seed
Soyabean	2016	81243.1	18156	48204.8	1112.92	487.41	1015.44	12266.5
Soyabean	2017	88811.9	21641.3	53246.3	284.17	44.4015	1411.97	12183.8
Soyabean	2018	149470	34636.2	89157.4	1905.55	224.183	1987.75	21558.9
Soyabean	2019	125636	27611.9	74557.3	2801.39	314.058	1344.17	19006.8
Soyabean	2020	208697	45867.1	123849	4653.48	521.691	2232.84	31572.7
Noug	2016	302462	64508.7	196188	2298.48	30.2432	6562.77	32874.4
Noug	2017	323313	76600.4	205227	4332.82	55.231	3589.13	33563.2
Noug	2018	296486	70361.9	185735	3392.9	325.955	4548.56	32121.4
Noug	2019	291666	69409.6	180494	2770.55	320.801	5716.09	32955
Noug	2020	214819	51121.9	132938	2040.58	236.278	4210.04	24272.2
Linseed	2016	87912	48492.3	26224.1	439.56	26.3736	1643.95	11085.7
Linseed	2017	88210	53128.9	22184.8	564.544	43.121	1164.37	11167.4
Linseed	2018	98160.5	55111	27608.7	560.779	1546.98	1783.86	11549.1
Linseed	2019	79703	42852	25470.5	414.414	127.512	1888.77	8949.75
Linseed	2020	80464.7	43261.5	25713.9	418.375	128.731	1906.82	9035.28
Groundnut	2016	129636	30814.5	75642.6	1335.25	259.272	2255.67	19328.7
Groundnut	2017	145173	35683.5	86363.4	725.865	53.452	2250.18	20150
Groundnut	2018	144156	35309.5	85208.2	1102.3	158.5	2536	19841.3
Groundnut	2019	156548	38287.7	92009.5	1612.28	172.185	3083.68	21382.3
Groundnut	2020	205028	50098.3	120539	2112.21	225.576	4039.85	28012.4
Sunflower	2016	7954	4666.61	2331.32	23.0666	29.2618	178.965	754.039
Sunflower	2017	9577	6686.66	2077.25	1.9154	31.1423	159.936	651.236
Sunflower	2018	8054.27	5347.94	1905.24	1.6078	31.3521	159.172	608.954
Sunflower	2019	9378.62	6051.74	2269.28	1.9142	37.3269	219.176	799.179
Sunflower	2020	4287.37	2711.18	1102.39	0.85756	16.7224	98.1906	358.031
Seasame	2016	267867	51484	184882	2544.74	133.934	3160.83	25661.7
Seasame	2017	255903	65050.5	162422	2072.81	25.5903	3198.79	23133.6
Seasame	2018	201665	41059	136144	2873.73	30.2498	2309.06	19248.9
Seasame	2019	262654	40186.1	187929	5358.14	52.5308	2731.6	26396.7
Seasame	2020	262529	40094.8	187502	5345.98	524.115	2725.4	26336.8
Rapeseed	2016	43402	23554.3	15611.7	91.1442	8.6804	711.793	3424.42
Rapeseed	2017	32866	19637.4	9872.95	88.7382	16.433	430.545	2819.9
Rapeseed	2018	38216	22706	11489.6	80.2536	22.9296	617.188	3299.95
Rapeseed	2019	42046	24840.8	12651.6	63.069	29.4322	807.283	3653.8
Rapeseed	2020	12575.8	7429.78	3784.06	18.8637	8.80305	241.455	1092.84

Source: CSA

Table 2

Growth rate of production and sale of oil seeds from 2016/17-2020/21.

Oil seed	Annual growth rate prod(%) (2016/17-2017/18)	Annual growth Rate of market supply (%) (2016/17-2018/19)	Annual growth rate prod(%) (2017/18-2018/19)	Annual growth rate of market supply (%) (2017/18-2018/19)	Annual growth rate prod(%) (2018/19-2019/20)	Annual growth rate of market supply (%) (2018/19-2019/20)	Annual growth rate prod (%) (2019/20-2020/21)	Annual growth rate of market supply (%) (2019/20-2020/21)	Five years growth rate of production	Five years growth rate of market supply
Soyabean	9.32	10.45	68.30	67.44	-15.94	-16.37	66.11	66.11	156.80	156.9
Noug	6.90	4.60	-8.30	-9.50	-1.63	-2.82	-26.34	-26.35	-28.90	-32.23
Linseed	0.34	-15.40	11.28	24.45	-18.80	-7.74	0.95	0.95	-8.47	-1.94
Groundnut	11.98	14.17	-0.70	-1.34	8.60	7.98	30.96	31.00	58.15	59.35
Sunflower	20.40	-10.89	-15.90	-8.28	16.44	19.10	-54.28	-51.42	-46.10	-52.71
Seasame	-4.46	-12.15	-21.19	-16.18	30.24	38.03	-0.05	-0.23	-2.00	1.42
Rapeseed	-24.27	-36.76	16.27	16.37	10.02	10.11	-70.09	-70.09	-71.02	-75.76

3.3. Mean comparison of oil crops production and utilization in the study periods

Production and market supply of all oil seeds were not significantly different in the study periods of 2016-2020 (Table 3). This indicates that there was no significant production increment and market supply for all oil crops in the study periods. However, there was significant difference on production and market supply among oil crops within the five years and large quantity of niger and sesame were produced and supplied to the market followed by ground nut and Soya bean. The lowest production and market supply was observed on sunflower and rapeseed. The higher attention given for sesame, niger, groundnut and soyabean on production and supplied to the market by the farmers could be due to the high demand from the local and foreign market. This implies that, in order to improve supply of oil crops for oil industries, animal feed industries and export, investment and stakeholders should give priority for the production of sesame, niger, groundnut and soyabean than the other oil crops. In support of this the study Ethiopian oil seed annual report (2020) indicated that post expects production of soybeans and Niger seed to increase to meet the growing demand for cooking oil and livestock feed, most notably soybean meal for poultry production.

Table 3

Least square mean and mean comparison of oil production and utilization in the study period.

Mean comparison for oil crops production and utilization among the study periods						
Oil crops	Years	Variables				
		Production	Consumption	Market supply	Wage	Seed
	2016	131496.62 ^a	34525.20 ^a	78440.58a	1120.737a	15056.48a
	2017	134836.22 ^a	39775.53 ^a	77341.91a	1152.981a	14809.87a
	2018	133743.92 ^a	37790.22 ^a	76749.78a	1416.730a	15461.22a
	2019	138232.99 ^a	35605.69 ^a	82197.32a	1860.251a	16163.35a
	2020	141200.20 ^a	34369.22 ^a	85061.40 a	2084.334a	17240.03a
		NS	NS	NS	NS	NS
Mean comparison for average cereals production and utilization in the five years						
Soyabean	2016-20	130771.55bc	29582.50cd	77803.03b	2151.50abc	19317.72b
Niger	2016-20	285749.28a	66400.51a	180116.50a	2967.06ab	31157.22a
Linseed	2016-20	86890.02cd	48569.13b	25440.42c	479.53cd	10357.45c
Groundnut	2016-20	156108.02b	38038.69bc	91952.62b	1377.57bcd	21742.94b
Sunflower	2016-20	7850.25e	5092.82e	1937.09c	5.87d	634.28d
Sesame	2016-20	250123.66a	47574.89b	171775.73a	3639.07a	24155.54ab
Rapeseed	2016-20	33821.15de	19633.65de	10681.99c	68.41d	2858.18cd

3.3.1. Soya bean production and utilization

High Soybean production and market supply in the study periods had responded to growing local demand for cooking oil, soy-based foods, and livestock feed. Future production is expected to continue its upward climb to respond to rising demand. Soybean production has been rapidly increasing over the last 5 years (Table 4 and Figure 1). Most of this growth in production was due to an expansion in the area planted (Ethiopian Annual Oilseeds Report 2021). National research extension supports, improved local varieties, and better yields contributed to the production increment (Ethiopian Annual Oilseeds Report 2021). However, from soyabean produced by the primary producers on average only 59% was brought to the market in the study periods. The remaining 41% were used for consumption; preserved as seed for next year farming, pay for wage, used as animal feed and others (CSA, 2020). It is important to recognize that producers may bring additional soyabean to the market from their consumption when they were in need of money.

Soybeans contribute nearly about 15.4 percent (Table1) to the country's total oilseed production. Soybean demand is expected to continue its rising as consumers demand more soy-based edible oil and as the poultry sector demands more soybean meal. Expansion of integrated agro-processing industrial parks and the launch of new edible oil manufacturing plants will also expand soybean demand. In addition to oil, soybeans are used to

make a variety of local foods, as well as corn-soy blend. Besides, the big feed industries in Ethiopia are mainly producing poultry feed in which soya bean and maize are the major ingredients.

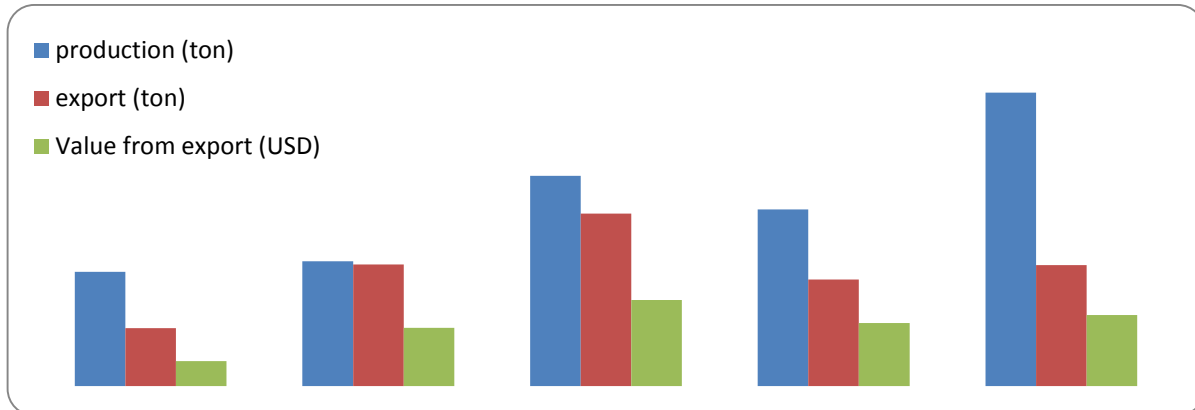


Fig. 1. Soya bean production, export volume and value.

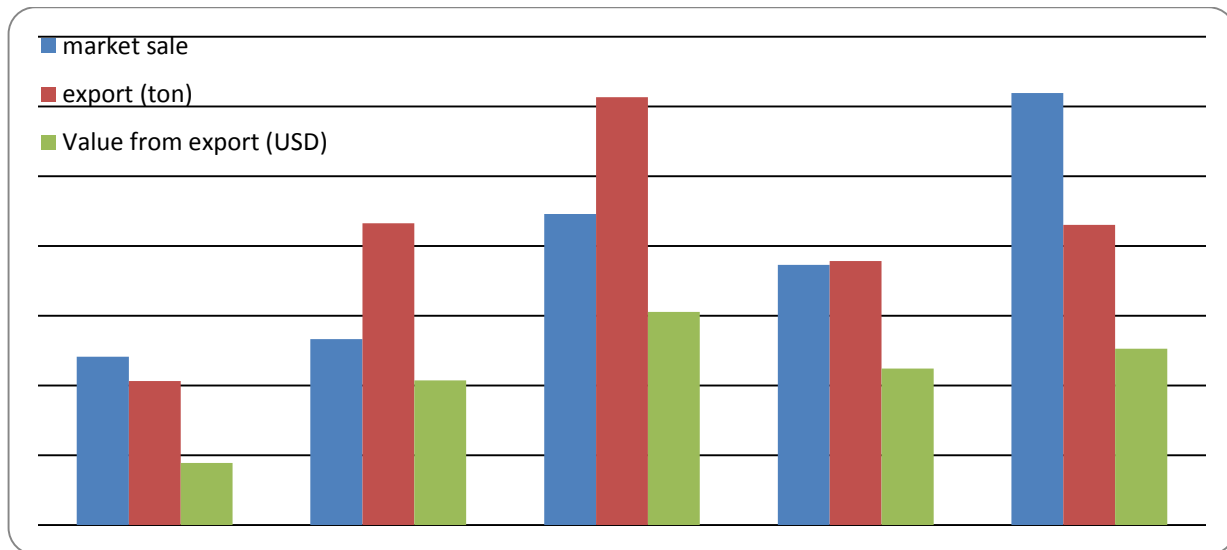


Fig. 2. Soya bean market sale, export volume and value.

Table 4

Soya bean seed production, market sale and export volume and value.

Year	Production (Ton)	Market Sale (ton)	Export (ton)	Value from export (USD)
2016/17	81,235	48204.8 (59.33%)	41,234	17,750
2017/18	88,803	53246.3(58.96%)	86,468	41,477
2018/19	149,455	89157.4(59.65%)	122,642	61,101
2019/20	125,623	74557.3(59.35%)	75,670	44,881
2020/21	208676	123849(59.34%)	86,000	50,551

Sources: Trade Data Monitor and FAS Addis Ababa 2020/21, (CSA, 2016-20).

3.3.2. Market supply and export trend of Soyabean

Soya bean production was in an increasing trend (except 2019 which was decrease by -15% from the previous year) and from the produced soyabean on average only 59% were brought to the market for the past five years. However, from the soyabean brought to the market 85% of them were exported in 2016/17. Similarly, the exported soyabean was 62.4, 37.6, and 1.5% higher than the soyabean brought to the market in the years of 2017,

2018 and 2019 respectively (Table 5 and Figure 2). Only in 2020/21 69% of soyabean brought to the market was exported. This result shows that the exported soya beans were largely beyond its market supply in each year except 2016/17 and 2020/21 and it implies the scarcity of this seed for local oil and feed industries. The difference of market supply and export could be brought from the farmers kept for consumption and others. The deficit of market supply to export could bring its scarcity in the local market and the lower supply than demand would result for increasing of its price.

As this study indicated most of the oil seeds productions were lower in Ethiopia and the same is true for global oil seed production and explained by Food outlook (2020) as falling short of the record-high output recorded in 2018/19, global oilseed production in 2019/20 is estimated at 584.3 million tones. The drop primarily reflects reduced yields as well as smaller harvested areas in several key producing countries following unfavorable weather conditions.

Exports are projected to grow but could face scarcity in the local market, which has witnessed a rising demand for soya beans. Due to a rise in demand, local prices are expected to continue an ascending owing to strong demand for the beans in domestic and overseas markets. The livestock industry is sensitive to changes in price of raw materials to compound feeds. With short market supply and competing export markets for soya bean affect the growth of animal feed industry negatively in short term. It is thus important to improve production, market supply and price competitiveness of raw materials produced. There is comparative advantage in production of oil seeds and processing as its use as by-products for production of animal feeds in long term. The high cost of oil-seed cakes and other ingredients would affect quality and quantity of production of animal feeds which has wider implication on the quality of animal source foods and public health.

3.3.3. Sesame Seed market supply and export trend

Sesame seed production was declined over the previous 3 years from 2016, 17, 18 (Figure 3) and its export was higher than market supply in the study periods (Table 5). Even though, Ethiopia is one of the major global producers and exporters of sesame seed, the country faces increasing challenges related to both supply and demand side constraints. Some of the major supply side constraints are diminishing productivity levels, pests and diseases, and poor access to modern technology. On the demand side, defiantly higher domestic price, easy entry of an experienced traders and market distortion, and contractual non-performance of export sales are the major constraints. Other demand side constraints include international price instability, extremely concentrated export market, and strong competition in the international market. These constraints are posing serious treats to Ethiopia's sesame seed growth potential (Ethiopia Oilseeds Report Annual, 2020). In addition, domestic demand for sesame for local food processing industry is growing due to new edible oil industrial facilities are opening and this in turn amplify scarcity and price instable or increment.

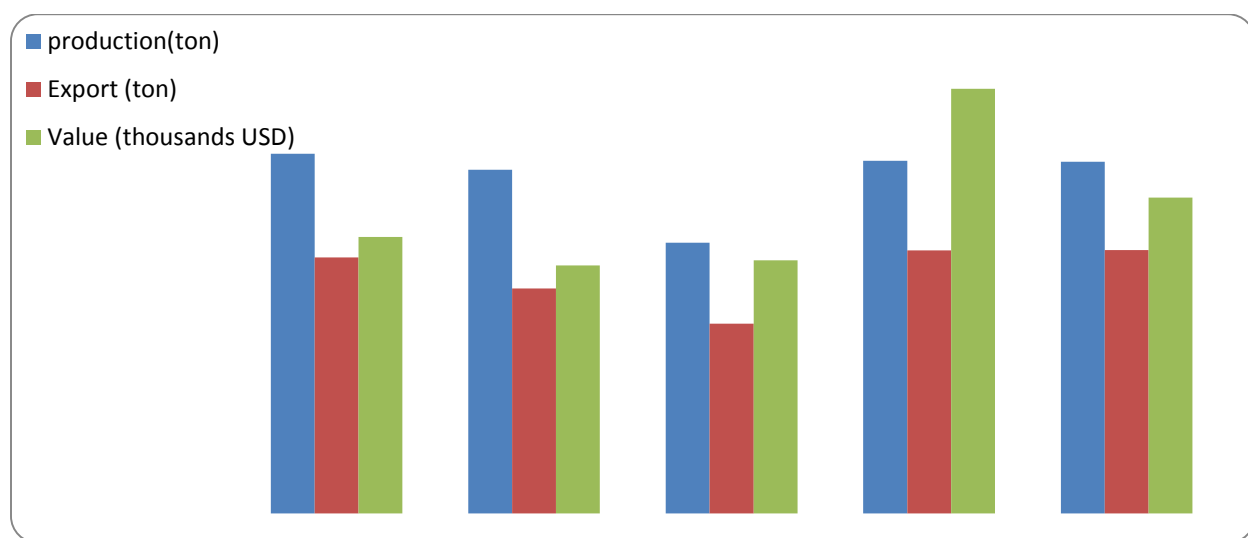


Fig. 3. Sesame seed production, export volume and value in USD.

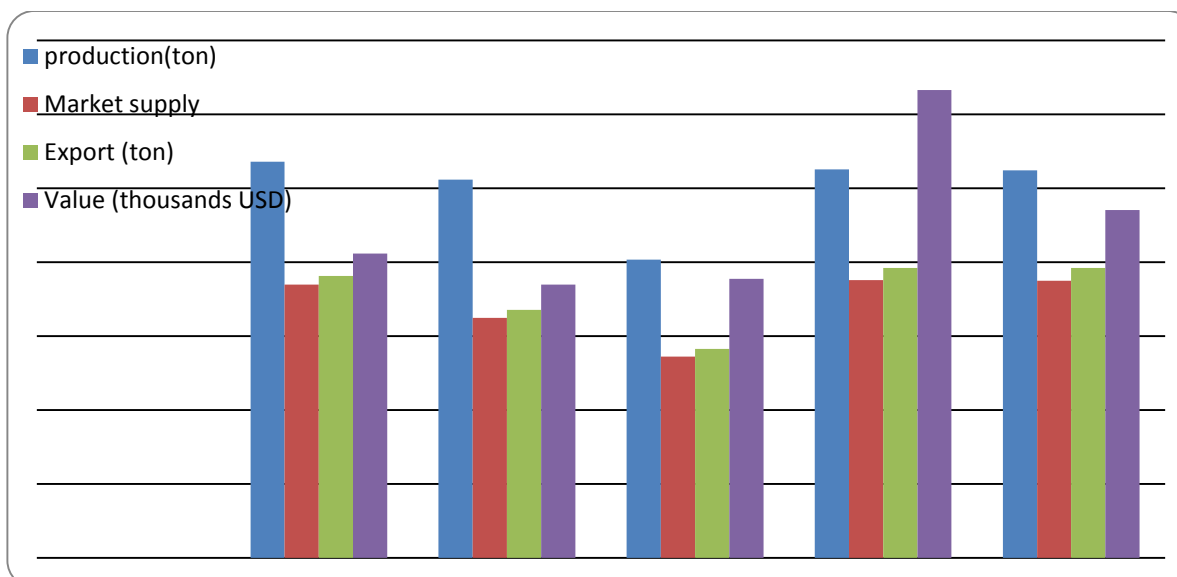


Fig. 4. Sesame seed production, market supply, export volume and value in USD.

Table 5

Sesame seed production, export volume and value.

Year	Production (ton)	Market supply (Sale)	Export (ton)	Value (thousands USD)
2016/17	267,867	184,882	190,721	205,883
2017/18	255,903	162,422	167,719	184,879
2018/19	201,665	136,144	141,357	188,669
2019/20	262,654	187,929	196,071	316,399
2020/21	262,058	187,502	196,098	235,168

Sources: Trade Data Monitor and FAS Addis Ababa and MOA 2020

Generally, the expansion of local edible oil industries and livestock feed industries in the country is anticipated to stimulate the rapidly growing local demand for oils seeds as well as its byproducts. When the new large-scale oil factories are to be operational in a few years, the country are likely to increase production of oilseeds locally to meet the demand in the long-term. In the short-term, however, low local production and market supply of oilseeds cannot meet local raw materials demand. As indicated in Appendix 1 Table 6, both the designed capacity and current performance of oil industries were grown in absolute terms in the last five years (2016/17-2020/21). However, huge gap has been observed between the design and current performance (Table 6). In 2020/21 edible oil industries had a design capacity of 1.75 million ton with current performance of 786,736 ton and this revealed a gap of 967,603 tons per annum which was the highest from the previous four years (Table 6 and Annex1). From feed perspective the shortage of raw material production has direct effect on the feed ingredient supply from edible oil industries.

Table 6

Gap in design and current performance of oil industries (tone).

Year	2016/17	2017/18	2018/19	2019/20	2020/21(Gap)
Niger seed	120,000	150,000	172,200	210,000	240,000.00
Ground nut	45,000	55,000	70,000	75,000	100,000.00
Linseed seed	80,000	95,000	75,000	100,000	155,000.00
Sunflower	150,000	175,000	175,000	210,000	230,000.00
Soya bean	127,997	136,997	145,997	159,497	242,603.40
Total	522,997	611,997	638,197	754,497	967,603.4

3.4. Trend of cereal crop production and market supply from 2016-2020

3.4.1. Maize production and utilization

Trends of cereal production and utilization from 2016-2020 is indicated in Table 7. As observed in the data maize production was increased from around 7.8 million tons in 2016/17 to 10.2 million tons in 2020/21. Maize consumption was increased from 5.8 million ton in 2016/17 in to 7.6 million ton in 2020(CSA, 2021). The data indicate that from the produced maize in each year on average 74-75% were consumed. The study OECD-FAO (2016) indicated that maize consumption in 2021/22 is projected at 8.65 million metric tons due to growing demand for food and feed.

In the study periods the lowest annual growth rate of maize supplied to the market was observed in 2019 followed by 2017 with 5.4 and 6.9% respectively (Table 8) whereas, the highest was in 2020 with 32.4%. As observed in Table 5, large volume of maize was supplied to the market each year which was beyond the designed capacity of flour industries. However, due to absence of maize for the industries, those flour industries were performed 30% (Table) of their capacity on average for the last five years. The absence of maize for the industries may be due to unidentified reasons.

3.4.2. Wheat production and utilization

Most of the animal feed processing ingredients in the flour mill industries are produced from wheat. As a result and due to high demand, the average growth rate of wheat production for the past five years (2016/17-2020/21) was 1173.8% (from 453,739.85 to 5,780,130.6 tone) and average growth rate for market supply of wheat in the same years was 1327.8% (Table 7 and 8). From the average growth rate, the highest annual wheat growth was obtained in the production year of 2016/17. However, the annual growth rate of wheat market supply was lower at 7.5% in 2018 and the highest was 21% in 2020/21. Even though, there were increments of annual growth rate of market supply for wheat in the study periods, the maximum market supply of wheat was 1.4 million tons in 2020.

Table 7

Production and utilization of cereal crops in Ethiopia (2016-2020) (tone).

Cereal crops	Year	Production	Consu	Supplied for market (Sale)	Wage	AnFe	Other	Seed
Maize	2016	7847174.60	5868901.88	970695.498	54145.50474	138894.99	188332.19	626204.5331
Maize	2017	8395887.20	6407741.11	1038571.25	46177.3796	90675.582	169596.921	643124.9595
Maize	2018	9492770.80	7153752.07	1218871.77	56481.98626	139069.09	206467.765	718128.111
Maize	2019	9304824.49	6839970.32	1281531.60	61621.35424	178124.23	224340.243	719236.744
Maize	2020	10556037.88	7608497.35	1699692.07	77066.78321	218531.84	261815.921	690433.9208
Wheat	2016	453739.85	258430.68	98652.909	4174.824116	816.81341	14611.8844	77052.73205
Wheat	2017	4642965.70	2720313.60	955058.044	46429.657	4178.6691	143003.344	773982.3822
Wheat	2018	4809045.55	2808743.86	1026881.21	19352.296	10159.955	149738.39	794169.8471
Wheat	2019	5582657.94	3324731.12	1162981.14	37206.8921	17540.392	165304.906	874893.4914
Wheat	2020	5780130.60	3231671.01	1408617.83	39882.90114	26588.601	156063.526	917306.7262

Source: CSA. Consu; consumption, AnFe; animal feed.

Table 8

Annual growth rate of cereal production and sale.

Cereal crops	Annual growth Rate of production (%) (2016/17-2017/18)	Rate of Sale growth (%) (2016/17-2018/19)	Annual growth Rate of production (%) (2017/18-2018/19)	Sale change (%) (2017/18-2018/19)	Annual growth Rate of production (%) (2018/19-2019/20)	Sale change (%) (2018/19-2019/20)	Annual growth Rate of production (%) (2019/20-2020/21)	Sale change (%) (2019/20-2020/21)	Five years rate of production growth (2016-2020)	Five years growth rate for sale (2016-2020)
Maize	7.00	6.90	13.06	17.36	-1.97	5.14	13.45	32.63	34.52	75.10
Wheat	923.26	868.09	3.58	7.52	16.09	13.25	3.53	21.12	1173.8	1327.8

Table 9

Gap in current performance of flour industries (tone).

Year	2016/17	2017/18	2018/19	2019/20	2020/21(Gap)
Wheat	500,000	875,000	1,040,000	1,500,000	2,100,000.00
Maize	158,550	206,115	236,640	251,640	280,620.00

As the market supply of wheat was compared with the design capacity and current performance of all flour industries in the country, there was an average deficit of 1,500,000 tons of wheat from 2017-2020 with a minimum and maximum of 500,000 and 2,100,000 tons in 2016/17 and 2020/21 respectively (Table 9). This implies that there was shortage of wheat market supply in the country. In this regard, Grain and Feed Annual report (2021) explained that there are about 600 small and large flour mills in Ethiopia, with a total wheat utilization capacity of 2 million in 2016 and increase to 3.5 million tons in 2020. However, due to wheat shortages the mills work below 50 percent of their capacity. The major reason for the deficit of cereals is population growth and increment of urbanization in the country. In this regard, earlier study FAO (2010) mentioned that rapid population growth could continue to be an important impediment to achieving improvements in food security in some countries.

The lower wheat market supply in Ethiopia is supported by the study Grain and Feed Annual report (2021) and stated that wheat import has grown significantly over the past decade and Ethiopia remains a net importer of wheat, satisfying around 25 percent of the local demand with wheat imports. Wheat import increased by an average of 6.6 percent over the past decade. FAS/Addis Ababa forecasts that wheat consumption in 2021/22 will reach around 6.7 million MT. In Ethiopia demand for wheat is growing, reflecting population growth, and shifting dietary patterns linked to urbanization. The study (OECD-FAO, 2015) explained that population growth is still driven by developing countries, particularly Africa which is expected to exhibit the fastest growth rate at 2.5%-3.5% and this will be related with consumption growth which leads to deficit in the market.

3.4.3. Mean comparison of cereals production and utilization in the study periods

Least square mean and mean comparison of the two cereal crops are indicated in Table 10. The data shows that production and consumption of both maize and wheat were non significantly ($P>0.05$) different among the five years. It implies that productions were similar or there is no difference in production among the five years. But market supply have statistical difference among the five years and high supply was observed in 2020 than 2016 production years, otherwise similar volume of market supply was observed from 2016-2019 and from 2017-2020 in both maize and cereal crops. On the other side, the production and consumption volume of maize and wheat was significantly difference for the five aggregate years and more maize was produced and consumed than wheat. However, similar maize and wheat were supplied to the market in the five years of study periods. This indicates that, even though demand of flour industries was increased for the past five years, market supply of maize and wheat were stagnant in the country.

Table 10

Least square means (SLM) and Mean comparison for cereals production and utilization in the study periods.

Overall Mean	Variables						
	Cereals	Years	Production (ton)	Consumption(ton)	Market	Wage	Seed
			LSM	LSM	supply (ton)	(ton)	(ton)
	Maize		9119338.99	6775772.55	1241872.44	59098.60	679425.654
	Wheat		4253707.93	2468778.06	930438.23	29409.31	687481.036
Mean comparison for cereals production and utilization among the study periods							
		2016	4150457.23a	3063666.29a	534674.20b	29160.16a	351629.63a
		2017	6519426.45a	4564027.36a	996815.65ab	46304.51a	708554.67a
		2018	7150908.18a	4981248.97a	1122876.49ab	37917.14a	756149.97a
		2019	7443741.22a	5082351.72a	1222256.37ab	49414.12a	797065.11a
		2020	8168084.24a	5420084.18a	1554155.95a	58475.84a	803870.32a
			NS	NS		NS	NS
Mean comparison for average cereals production and utilization in the five years							
	Maize	2016-2020	9,119,339 ^a	6,775,773 ^a	1,241,872 ^a	59099 ^a	687,481a
	Wheat	2016-2020	4,253,708 ^b	2,468,778 ^b	930,438 ^a	29409 ^b	679,426a
					NS		NS

P value: $P<0.05$ NS: Non significant

3.5. Feed ingredients demand and supply dynamics

The major ingredients used to formulate compound feed include maize, sorghum, flour processing by-products (wheat bran, wheat short, rice bran), different kind of oil seed cakes (soyabean meal, Nuog seed cake, linseed cake, groundnut cake, cotton seed cake, sesame seed cake, and others), molasses, and ingredients that are added in tiny quantities to boost production (vitamins, minerals, amino acids and premixes). A list of the ingredients demanded by feed industry in 2020/21 is presented in Table 11. As indicated the highest amount of ingredient required by feed industries is wheat followed by maize and soyabean. This is because compound feed for ruminant required more volume of maize and wheat by products (wheat bran and wheat middling) and soyabean is mainly required for poultry. Generally, demands for feed ingredients by feed processing industries were increased from 120,897 to 574,734 tons between the study periods. However, the supply of feed ingredients for feed industries was only around 50% (Table 12 and Figure 5).

As Figure 5 shows demand of feed industries was increased at a faster rate than supply in the study periods. With this deficit, the feed industries had performed below their capacity. The deficit in feed industries is related with low market supply of wheat for flour industries to produce wheat bran and wheat middling, absence of the produced maize for the industries and the lower local market supply of oil seeds. This shows that as livestock sectors intensifies protein meal and cereal use would expand. This expansion should be supported by increasing oil seeds and cereal production and supply to the market. However, as observed in Table 1 market supply (sale to the market) for oil seeds and cereals were lower than the demand. The study OECD-FAO (2016) indicated that as livestock production intensifies in the coming years, protein meal use expands across most of SSA, with the fastest growth recorded in Western Africa (43%) and Eastern Africa (32%). This implies that the demand for oil seed and oil seed cake would be increased and it could be a good opportunity to produce more oil seed to utilize locally and to export.

The production of cereal grain crops in Ethiopia is destined for human consumption. Consequently, only the milling by-products such as maize bran and wheat bran are available for livestock feed production. Maize bran and wheat bran are the most commonly used cereals. The most widely available oilseed cakes are Noug and sunflower. All the feed premixes are imported. The raw materials available to the animal feed industry are generally those that are produced within the country. These include oilseeds (soya, cotton and sunflower seeds maize, maize bran, wheat bran, soya cake and cotton cake.). The livestock industry is a driving demand for animal feeds especially for poultry, and poultry feed accounts over 60-96% of the compound feed. The high demand for poultry feed is driven by increasing demand for poultry products especially due to population increase that is becoming urbanized, and higher levels of disposable income.

The highest demand for livestock products would appear that growth in the animal feeds industry will be driven by growing demand for livestock products. However, this growth has been slow owing to limited production of the major ingredients. The projected increase in demand for animal feed will put pressure on the availability of raw materials. It follows then that to meet this demand, there needs to be a corresponding increase in production of raw materials such as maize, wheat and oil seeds and as a result their by-products would be available for feed processing industries.

Table 11
Feed processing ingredient quantity demand by types in 2020/2021 EC.

Ingredient type	Amount(tons)
Noug seed cake	45,656.5
Ground nut cake	45,686.6
soya bean cake	74,480.4
linseed cake	21,544.5
Sunflower	46,264.8
Wheat bran	67,816.5
Wheat middling	47,283.5
Cotton seed cake	23,978.5
Maize	141,973.3
Total	514,684.60

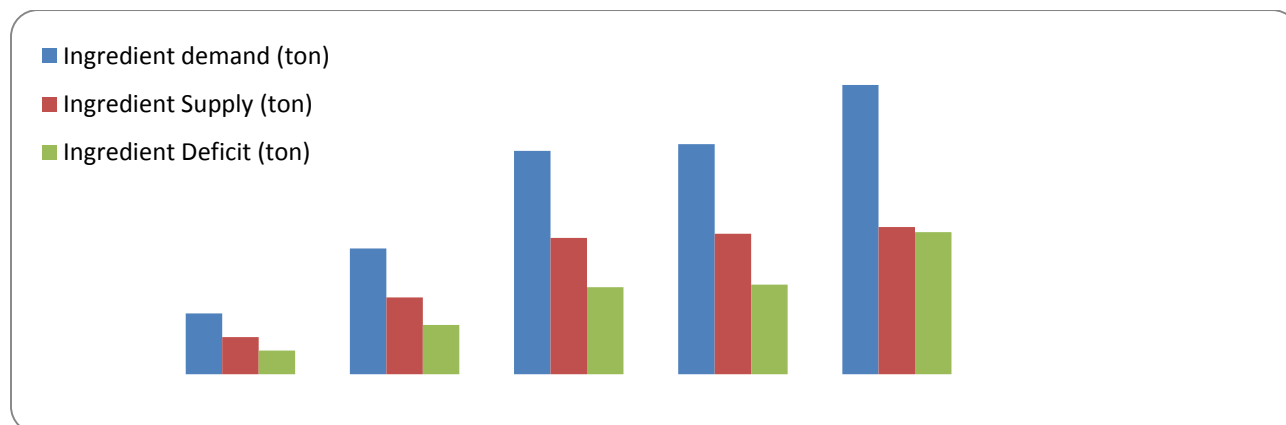
Source: Calculated from design capacity of feed companies

Table 12

Total feed ingredient demand, supplied and deficit quantity.

Year	Ingredient demand (ton)	Ingredient Supply (ton)	Ingredient Deficit (ton)
2016/17	120897	73,747.20	47,149.80
2017/18	250043.2	152,526.40	97,516.80
2018/19	443699.6	270,656.80	173,042.80
2019/20	457083.7	278,821.10	178,262.60
2020/21	574734.5	292,761.90	281,972.60

Source: calculated from the Feed company design capacity.

**Fig. 5.** Total feed ingredient demand, supply and deficit.

4. Conclusion

Even though there was an increasing demand for cereals and oil seed by the industries, there was no significant increment of cereals and oil crops production and supply to the market from production year of 2017-2020/21. There was scarcity of wheat production in the country and as a result low volume of wheat was supplied to the market which cannot meet up the demand of the industries. In the contrary, maize was produced and supplied to the market in large quantity in comparison to the demand of flour and feed industries. However, the industries did not get maize for their utilization. Export of soyabean and sesame seed were larger than supplied to the market in all the study periods except 2020/21.

The highest gap between demand and supply was recorded for dairy compound feed followed by beef and poultry. Inflation rate of feed ingredients and livestock products (the product of feed ingredients) were higher as compared to inflation rate of food items. Main reasons for the high prices of feed ingredients are VAT and other taxes imposed on the feed ingredients, export of feed ingredients, oil seeds and oil factory by products. Multiple taxes due to unnecessary long supply chain adds the VAT imposed on feed ingredients up to 60% or more.

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How to cite this article: Negash, D., Teshome, T., Temesgen, D., 2022. Study on the current status of feed ingredient production, supply and marketing in Ethiopia. Scientific Journal of Animal Science, 10(2), 726-739.

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