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Trends of Oat Production area, Productivity and Utilization in Ethiopia

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Abstract

Oat is an important multi-purpose cereal crops cultivated for grain, feed and straw used for human consumption and livestock feed. Oat is ranked as sixth in the world's cereal production following wheat, maize, rice, barley and sorghum. Therefore, this study is initiated to analyze the trends of; oats production area, productivity and utilization in Ethiopia. Data of meher season oats area of production (ha), productivity (qt/ha) and utilization (%) were collected from Central statistical Agency (CSA) of Ethiopia. Trend test was carried out using the non-parametric Mann-Kendall's trend test packaged in XLstat. The result of this study indicated that the production of oat showed non-significant increasing trend. Additionally oats yield qt/ha showed that significant increasing trend. Oat production area showed significant decreasing despite used as Household Consumption and animal feed showed non-significant decreasing trend.

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Keywords

Oat, animal feed, household consumption, trend analysis, area of production

Introduction

Oat (*Avena sativa L.*) is one of the well-adapted and important fodder crops grown in the highlands of Ethiopia, mainly under rain-fed conditions (Amanuel *et al.*, 2019) and in Ethiopia used for human consumption and livestock feed. Oat is an important multi-purpose cereal crops cultivated for grain, feed and straw over more than 9 million hectares globally (FAO, 2011). Gebremedhin *et al.*, (2015) reported that oats grain is the staple diet of human beings in some parts of the central high lands of Ethiopia. Lulseged (1987) also stated that oat is a dual purpose forage crop which can also be used as human food in many parts of the world. According to the Ethiopia Ministry of agriculture and rural development, oats was registered as grass and used as forages (Getnet, 2012). Oats (*Avena sativa*) is abundantly grown in the central highlands of Selale and some parts of west Shewa like Meta-Robi and Galessa areas of Dendiworeda, Arsi, Bale and Gojjam. Oat is ranked as sixth in the world's cereal production following wheat, maize, rice, barley and sorghum. The initial aim of oats introduce to the smallholders was for feed production (Fekadu *et al.*, 2018).

Oats are forage crop grown at medium to high altitudes (1600-3000m) on heavy soils (vertisols) where temperate grasses and other improved forages are difficult to establish (Negash *et al.*, 2017). Oat (*Avena sativa)* was early maturing, palatable, succulent and energy-rich crop and mostly used as silage and is preferred by animals due to its high palatability and softness. Its grain is also a valuable feed for dairy cows, horses, young breeding animals and poultry. Many cultivars of oat have high feed value if cut at its 50 percent flowering stage which is the best time for the crop harvest for better yield and

can meet the demand of the rapidly growing livestock industry of Ethiopia (Gebremedhin *et al.*, 2015).

Ethiopia is endowed with diverse agro-ecologies suitable for cereal production. Cereals crop like Oats productions in Ethiopia were under rain fed production system. However, the success of this production system relies more on climate condition. The facts about land use, utilization and number of householder at the national level have potentially imposed limits on the areas sown as a major source of increase in production. This causes inverse relationship between area and production because expansion area which is unsuitable for agriculture and uses.

The interconnection of oat production area, productivity and utilization change with areas cover on trends of oat is less understood. The current trends of oat production areas, productivity and utilization have not yet investigated in Ethiopia. Therefore, the objective the study was designed to analysis trend of oat production areas, utilization in Ethiopia.

Materials and Methods

Data of maher season for oat production area, productivity, utilization of oat for the period of 2008 to 2022/2021 were collected from Central Statistical Agency (CSA).Trend test were carried out using the non-parametric Mann-Kendall's trend test which is less sensitive to outliers and test for a trend in a time series without specifying whether the trend is linear or non-linear (Partal and Kahya, 2006; Yenigun *et al.*, 2008; Hadgu *et al.*, 2013).The Mann-Kendall's test statistic is given as:

$$S = \sum_{i=1}^{N-1} * \sum_{j=i+1}^{N} sgn\left(x_j - x_i\right) \text{equation} \quad \ldots(5)$$

Where S is the Mann-Kendal's test statistics; x_i and x_j are the sequential data values of the time series in the years *i* and *j* (*j* >*i*) and *N* is the length of the time series. A positive *S* value indicates an increasing trend and a negative value indicates a decreasing trend in the data series. The sign function is given as

$$sgn\left(x_j - x_x\right) = \begin{Bmatrix} +1 \; if & \left(x_j - x_i\right) & > 0 \\ 0 \; if & \left(x_j - x_i\right) & = 0 \\ -1 \; if & \left(x_j - x_i\right) & < 1 \end{Bmatrix} \text{equation} \quad \ldots(6)$$

The variance of *S*, for the situation where there may be ties (i.e., equal values) in the *x* values:

$$var(S) = \frac{1}{18}\left[N(N-1)(2n+5) - \sum_{i=1}^{m} t_i(t_i-1)(2t_i+5)\right] \text{equation} \quad \ldots(7)$$

Where, *m* is the number of tied groups in the data set and t_i is the number of data points in the i^{th} tied group. For n larger than 10, Z_{MK} approximates the standard normal distribution (Partal and Kahya, 2006; Yenigun *et al.*, 2008) and computed as follows

$$Z_{MK} = \begin{Bmatrix} \frac{S-1}{\sqrt{var(S)}} & if & S > 0 \\ 0 & if & S = 0 \\ \frac{S+1}{\sqrt{var(S)}} & if & S < 0 \end{Bmatrix} \text{equation} \quad \ldots(8)$$

The presence of significant trend is evaluated using the Z_{MK} value. In a two-sided test for trend, the null hypothesis *Ho* should be accepted if $Z_{MK} < Z_{1-\alpha/2}$ at a given level of significance. $Z_{1-\alpha/2}$ is the critical value of Z_{MK} from the standard normal table.

Results and Discussion

Sen's slope value in Tables 1 to 3 indicated that the country level production of Oat (Qt/yrs) showed non-significant (p=0.879) increasing trend by factors of 3313qt for 2008-2020 production years. In the country Yield of Oat qt/ha showed significant (P=0.000) increasing trend by factor of 0.823 (qt/ha)/years.

However, Oat production area showed significant (P=0.041) decreasing trend by factor of -778.695 ha/year. In agreement with this result, (Wasihun and Desu, 2020) indicated that in Ethiopia area of oat production is decease despite yield qt/ha is increase.

Household Consumption showed non- significant (P=0.087) decreasing trend by factor of- 0.186 percent/years. Oat used as animal feed showed non-significant (P=0.542) decreasing trend by factor of -0.027 percent/years.

As CSA show that oat production is distributed only in Oromia, Amhara and SNNP. From One decade ago Oat is abundantly grown in the central highlands of Selale and some parts of west Shewa like Meta-Robi and Galessa areas of Dendiworeda, Arsi, Bale and Gojjam.

Table.1 Oat production (qt), area of production (ha) and yield (qt/ha) in Ethiopia from 2004-2020

Years	Production in (qt)	Area of production (ha)	Yield (qt / ha)
2004	566,754.00	45,131.00	12.56
2005	401,634.00	44,401.00	9.05
2007	365,857.00	30,556.00	11.97
2008	427,729.00	30605.00	13.98
2009	330,191.00	24,017.00	13.75
2010	475,650.57	30,858.76	15.41
2011	494,749.24	30,568.39	16.18
2012	436,337.83	26514.10	16.46
2013	616,502.59	35,617.76	17.31
2014	508,059.26	27,899.64	18.21
2015	402,689.43	22,105.72	18.22
2016	491,796.43	24,040.94	20.46
2017	526,318.93	25,896.22	20.32
2018	301,439.40	14,843.08	20.31
2019	457,543.61	21,281.80	21.5
2020	381,530.36	21,882.01	19.7

Source CSA, 2004-2020

Table.2 Oat utilization in Ethiopia from 2008-2020

Years	Household Consumption %	Oat used for Animal feed %
2008	65.39	1.37
2009	67.62	0.28
2011	59.39	0.85
2012	62.32	0.95
2013	60.67	1.05
2014	67.02	1.17
2015	64.19	0.69
2016	60.99	0.86
2017	58.86	0.58
2019	61.11	0.67
2020	52.73	0.89

Source, CSA, 2008-2020

Table.3 Mann-Kendall Trend statistics for Production, area of production, yield, and household consumption, animal feed for 2008-2020.

Oats	Zmk	MK Statistics	p-value	alpha	Sen's slope:
Production area (ha)	-0.491	-27.000	0.041	0.05	-778.695
Production (qt)	0.055	3.000	0.879	0.05	3313
Yield (qt/ha)	0.818	45.000	0.000	0.05	0.823
Household consumption (%)	-0.418	-23.000	0.087	0.05	-0.816
Animal feed (%)	-0.164	-9.000	0.542	0.05	-0.027

Fig.1 Production of oats in Ethiopia from 2003-2020

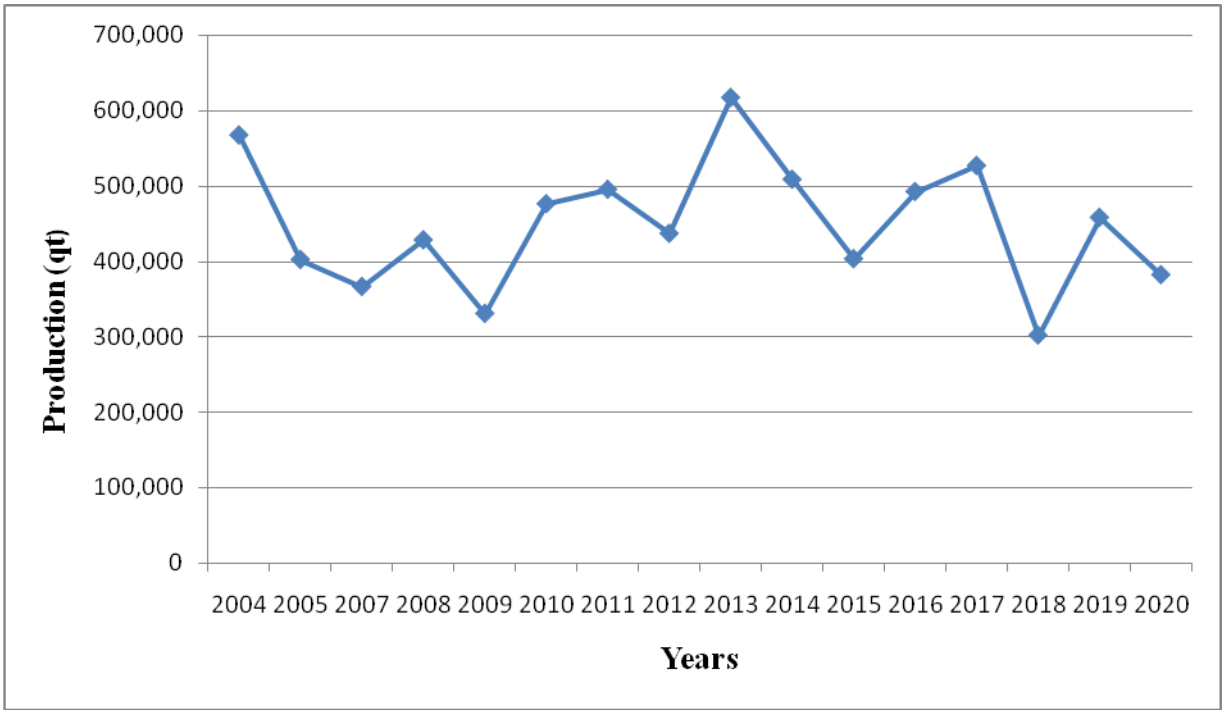


Fig.2 Production area of Oat in Ethiopia from 2004-2020

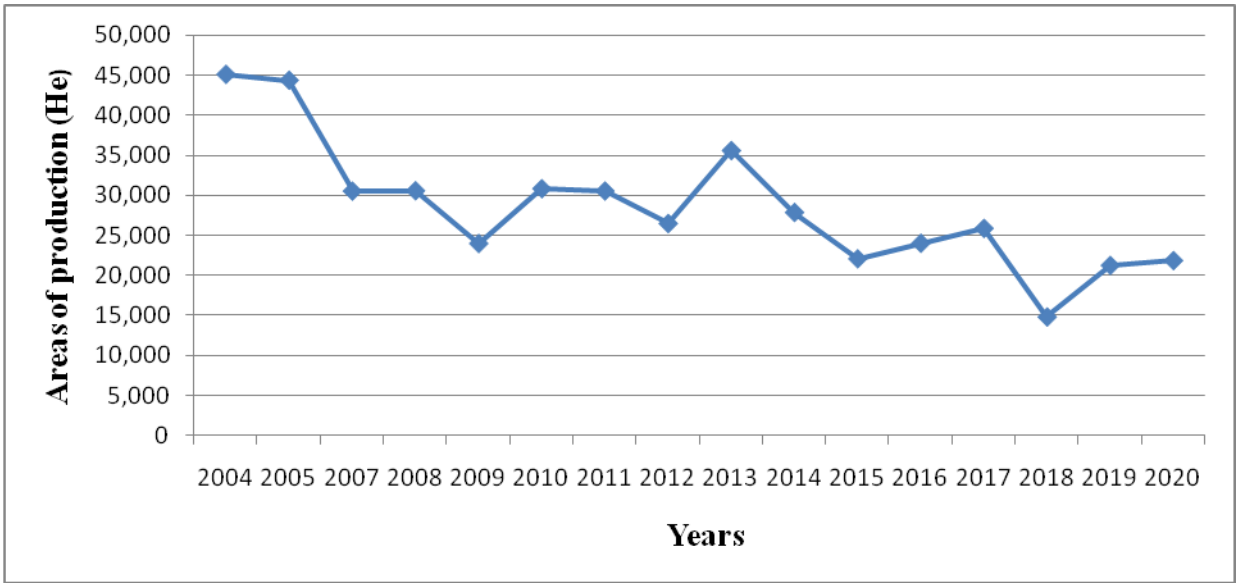


Fig.3 Productivity (yield qt/ha) of oat in Ethiopia from 2004-2020

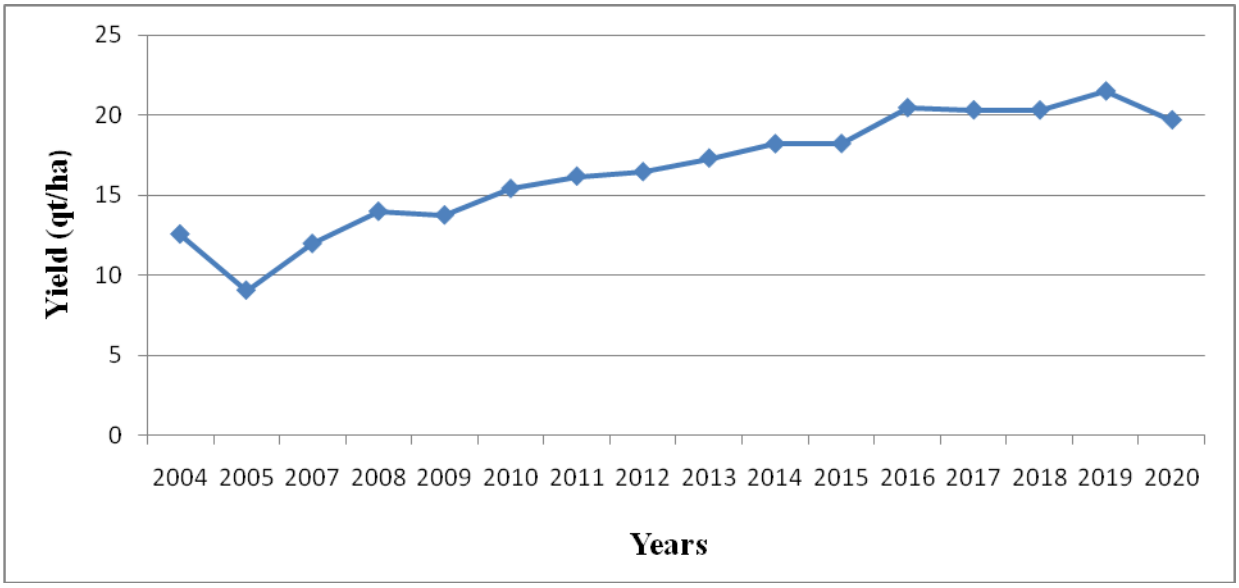


Fig.4 Oat used as Household Consumption in Ethiopia from 2008-2020

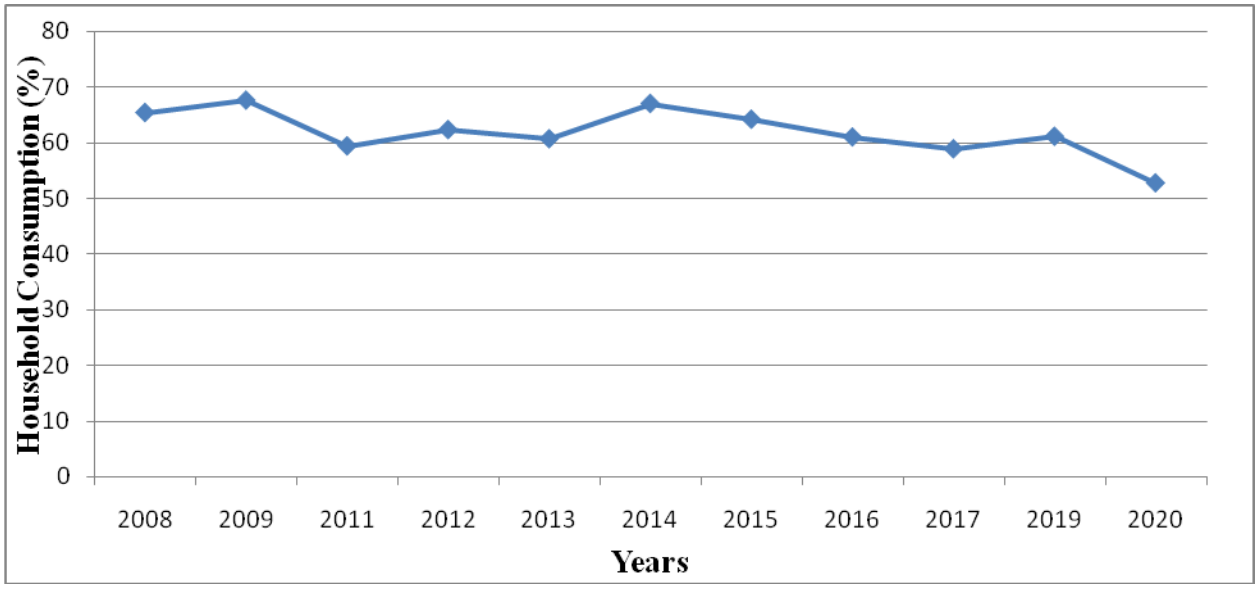
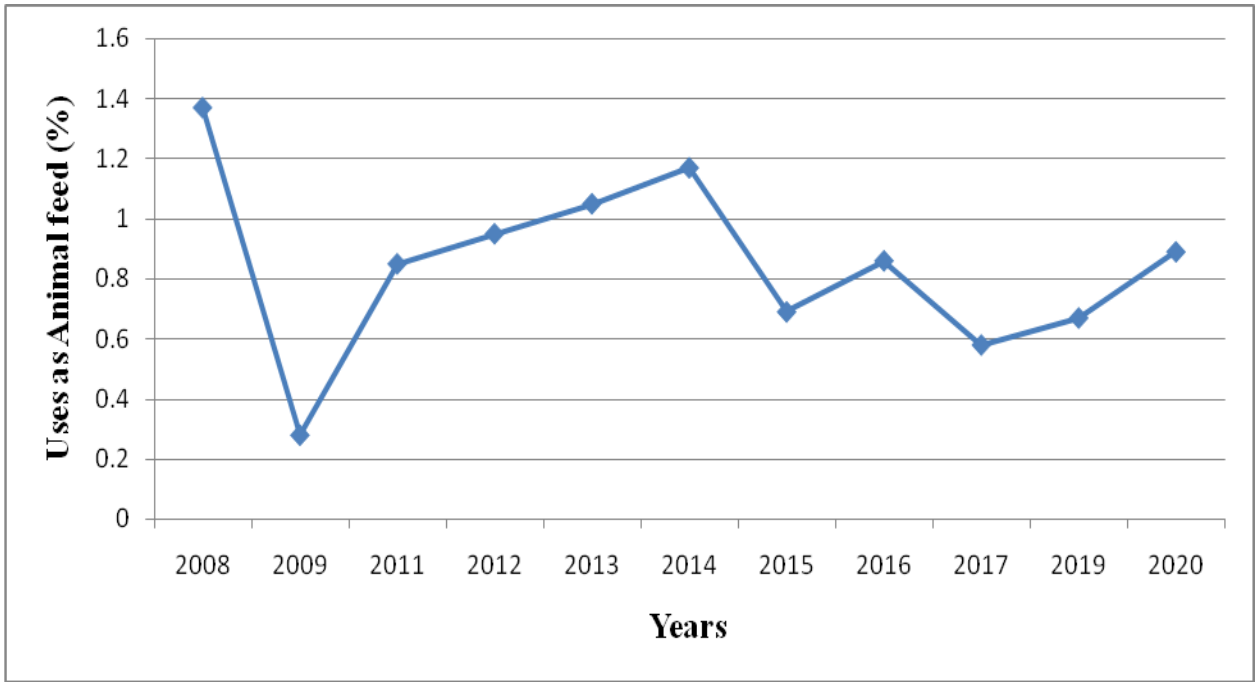


Fig.5 Oats used as Animal feed (%) in Ethiopia from 2008-2020



However, recently due to expansion of crop cultivation, the area of oat production is decrease and oat used as household consumption and animal feed is decrease while cereal and pulse crop production area is increase and household consumption is more shifted to cereal and pulse crops.

But production of oat (qt/yrs) and yield (qt/ha) of oats are increase, this is due to various research result which is related to oat variety development, agronomy and adaption with modern inputs.

Generally in Ethiopia due to shortage of land, the attentions of small householders are on cash crops and human feed crops rather than animal feed.

Oat is an important multi-purpose cereal crops cultivated for grain, feed and straw used for human consumption and livestock feed. Sen's slope value in Tables 1 to 3 indicated that the country level production of Oat (Qt/yrs) showed non-significant (p=0.879) increasing trend by factors of 3313qt for 2008-2020 production years. In the country Yield of Oat qt/ha showed significant (P=0.000) increasing trend by factor of 0.823 (qt/ha)/years.

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