Trends, Growth and Instability of Teff Production in Ethiopia

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Abstract: The present study is related to the trends, growth and instability of area, production and productivity of Teff in Ethiopia. The study is based on secondary data of Teff production, area and yield for the period of 2000/01 to 2014/15 using the compounded annual growth rate, cuddy Della Vally Index and Decomposition analysis. The study analyzed that, a positive annual percentage change was experienced in yield production and area over the study period. Analysis of annual compound growth rate in production showed a positive growth rate per annum that is greater than the growth rate in yield and area. The growth rate in area, production and yield was statistically significant at 1% significance level. Further, the study fitted the linear regression to test the dependency of production of Teff on its respective area. And the result showed that, the relationship between area and production was significant. And instability index of Teff during the study period are also low. The increase in production is due to increase in yield.

Keywords: Ethiopia, Instability and Decomposition analysis.

1. INTRODUCTION

Tef (*Eragrostis tef*), is an important and major staple cereal crop, which have pivotal role in the country's food security and farmers' lively hood in Ethiopia. It is extensively cultivated in many parts of Ethiopia (Fufa, B., B. Behute, R. Simons, and T. Berhe. 2011). Since teff is an excellently adapted crop to the changing environments in the country, farmers face low risk. The nutritional status of tef grains is comparable to that of the other major world cereals. The grain of Teff is used as whole flour mostly for processing injera (or *caabitaa, budeena, tayeta*), a staple food for the majority of Ethiopians. In addition to traditional foods and beverages, tef grain is processed for gluten free markets, in infant foods and various snack bars as whole grain supplement to the diet. On the other hand, both the grains and straw fetch relatively high market prices in comparison to other cereal crops (Assefa, K., S. Chanyalew and Z. Tadele. 2013). Tef straw (*chid*) is the main source of feed for ruminants in various agro-ecologies of the country. According to the agricultural sample survey 2014/15 provided by central statistical agency of Ethiopia, at the national level, about 6536,605 private peasant holders have grown Teff on about 3,016,053.75 hectares (24.02% of the total cereal crops area), while maize, sorghum and wheat took up, 16.80% (about 2,110,209.61hectares), 14.58% (1,831,600.45hectares) and 13.25% (1,663,837.58hectares) respectively. As to production, Teff made up 17.57% (47,506,572.79 quintals) second to maize 26.76% (72,349,551.02 quintals) of the total cereal production during 2014/15 meher session.

With this backdrop the present study aimed at assessing the trends, growth and instability of Teff production in Ethiopia.

2. METHODOLOGY

The study was based on secondary data from CSA. Compounded Annual Growth Rate (CAGR), Decomposition Analysis and Cuddy Della Valle Index (CDVI) were used. The growth rates (r) of area, production and yield of Teff were estimated using Semi-log trend function/formula:

$\ln y_t = a + bt + \varepsilon$

Where y = dependent variable (area, yield and production); t = trend over specific period, b is coefficient of trend; ln = natural logarithm; and e = error term. Here, the coefficient of trend (b) measures the constant proportional or relative change in y for a given absolute change in the value of time t. Therefore the compound annual growth rate (CAGR) can be taken as:

CAGR = exp (b) -1

Any change in the output of a crop in physical term depends fundamentally on the changes in the area under the crop and its average yield. To determine the source of production growth and to measure the effect of area, productivity and their interaction in increasing crop output, differential equation given by Rakesh Sihmar (2014) was used:

$\Delta P = A\Delta Y + Y\Delta A + \Delta A\Delta Y$

The first term on the right hand side is considered as yield effect, second term as the area effect and the third as the interaction effect. Thus, total change in output can be decomposed into three effects; yield effect, area effect, and interaction effect due to change in yield and area.

Instability in area, production and yield can be measured by different methods, such as the coefficient of variation (CV), dispersion, Cuddy Della Valle Index (CDI), etc. The present study applies the Cuddy Della Valle Index for measuring the instability. This Index first de-trends the given series and gives a clear direction about the instability. The use of coefficient of variation as a measure to show the instability in any time series data has some limitation. If the time series data exhibit any trend the variation measured by CV can be over-estimated. As against that Cuddy-Della Valle index attempts detrend the CV by using coefficient of determination (R^2). Thus it is a better measure to capture instability in agricultural production. A low value of this index indicates the low instability.

In this study, the instability in area, production and yield was estimated using Cuddy-Della Valle index (CDVI).

The estimable form of the equation is as follows:

$I = CV*SQRT(1- R^2)$

Where: I is the instability index in percent, CV is the coefficient of variation in percent,

R^2 is the coefficient of determination from time trend regression adjusted by the number of degree of freedom

3. RESULTS AND DISCUSSION

Growth rate and sources of growth in area, production and yield of Teff:

To understand the growth performance and relative contribution of basic components of Teff production in Ethiopia during the period 200/01 to 2014/15 time series data on area, production and yield was analyzed. During the period, area, production and yield have showed significant at 1% level of significance respectively growth rate in production (8.8%), area (3.5)% and yield (5.1%) (Table 1). With the help of additive decomposition model the percentage contribution of area, productivity and their interaction on Teff production in Ethiopia has been estimated and presented in Table 2. As indicated, Teff production has increased by more than 30 million tones and percentage contribution of yield (56 percent) was more as compared to area (22 percent) and their interaction (22 percent). Yield increase of Teff in the country during the last 15 years might be due to the release of improved Teff varieties such as Quncho which was released in 2006.

Instability in area, production and yield of Teff in Ethiopia:

In order to assess the consistency of growth performance, it becomes imperative to study the instability index for different variables during the study period. Table 3 indicated index of instability of area, production and productivity of Teff in Ethiopia during the period 200/01 to 2014/15. During the period Teff recorded instability in area, production and yield as 0.4, 0.50 and 2.5 respectively. Thus yield variability has more influence on production fluctuation in the crop Teff.

Trends in Area, Production and yield of Teff over the period from 2000/01 to 2014/15:

It can be revealed from the figure that the total area under production reaches above 3 million ha in 2014/15 from around 2.2 million ha during 2000/01, while the production of teff increased from 17 million tons in 2000/01 to 48 million tons during the 2014/15 meher sesion. Similarly the productivity of teff in 2000/01 was 8 t/ha and increased to 16 t/ha in

2014/15. The production of the crop Teff reaches its minimum during 2001/02 as the production was about 17 million tons. A positive annual percentage change has been in production of Teff over the study period except in 2001/02 and 2002/03. And a positive annual percentage change has been registered in productivity of Teff over the study period except during the 2002/03 meher sesion. In 2001/02, 2008/09, 2011/12, 2012/13 and 2014/15 the area coverage of teff shows a negative percentage change.

Regression analysis:

The simple linear regression functions were fitted for estimating the response of production of Teff due to the change of its respective area. And productions of Teff were significantly increased. The coefficient of production on area was 26.9 (Table 4).
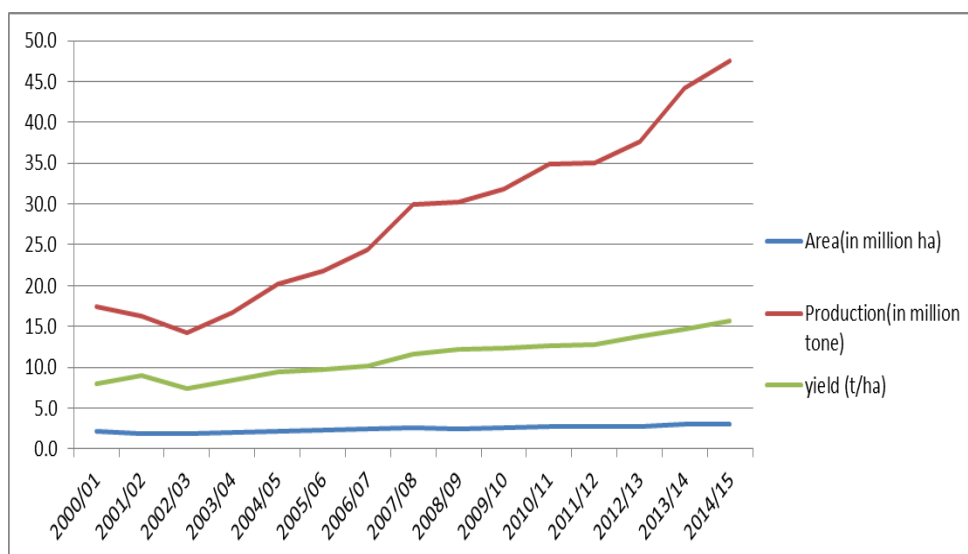

Fig. 1 Trends in area, production and yield Of Teff in Ethiopia (2000/01 to 2014/15)

Table 1. Compounded growth rate of area, production and yield of Teff in Ethiopia

Compounded annual growth rate from 2000/01 to 2014/15 in (%)	
Area	3.5
Production	8.8
Yield	5.1

Table 2. Sources of growth of Teff production in Ethiopia

Change in production	Area effect	Yield effect	Interaction effect
30,137,333	6634849	17004605	6494180

Table 3. Instability in area, production and yield of Teff in Ethiopia

	Mean	Standard deviation	CV	I
Area	0.159264	14.69586	1.083734	0.378532
Production	0.385038	17.08549	2.253596	0.538039
Yield	0.232208	2.38987	9.716344	2.533713

Table 4. Regression analysis: to test the dependency of production on area of Teff for the period 2000/01 to 2014/15

Constant value	Regression coefficient	t-value	P(T<=t) two tail
-37371731	26.9	15.90	0.00

4. CONCLUSION

A positive annual percentage change was experienced in yield, area and production of Teff in Ethiopia over the study period. Examination of regression analysis during the study period shows that, the production is strongly affected by the increment in area. i.e the relationship between the area and the production is strong enough. Analysis of annual compound growth rate of area, production and yield for Teff in Ethiopia registered positive and statistically significant. Yield exhibited relatively higher degree of instability as the coefficient of variation index was 3 percent which is significant at 1%. During the study period, yield effect was found higher than the area and interaction effect. i.e the contribution of yield component dominated over area component towards production of Teff in Ethiopia.

REFERENCES

[1] Assefa, K., S. Chanyalew and Z. Tadele. 2013. "Achievements and Prospects of Tef Improvement" Proceedings of the Second International Workshop, November 7-9, 2011, Debre Zeit, Ethiopia.

[2] CSA (Central Statistical Agency). 2000/01. *Agricultural Sample Survey 2013/2014: Report on area and production of major crops.* Central Statistical Agency, Addis Ababa.

[3] CSA (Central Statistical Agency). 2001/02. *Agricultural Sample Survey 2013/2014: Report on area and production of major crops.* Central Statistical Agency, Addis Ababa.

[4] CSA (Central Statistical Agency). 2002/03. *Agricultural Sample Survey 2013/2014: Report on area and production of major crops.* Central Statistical Agency, Addis Ababa.

[5] CSA (Central Statistical Agency). 2003/04. *Agricultural Sample Survey 2013/2014: Report on area and production of major crops.* Central Statistical Agency, Addis Ababa.

[6] 2014. *Agricultural Sample Survey 2004/2005: Report on area and production of major crops.* Central Statistical Agency, Addis Ababa.

[7] CSA (Central Statistical Agency). 2005/06. *Agricultural Sample Survey 2013/2014: Report on area and production of major crops.* Central Statistical Agency, Addis Ababa.

[8] CSA (Central Statistical Agency). 2006/07. *Agricultural Sample Survey 2005/2006: Report on area and production of major crops.* Central Statistical Agency, Addis Ababa.

[9] CSA (Central Statistical Agency). 2007/08. *Agricultural Sample Survey 2006/2007: Report on area and production of major crops.* Central Statistical Agency, Addis Ababa.

[10] CSA (Central Statistical Agency). 2008/09. *Agricultural Sample Survey 2007/2008: Report on area and production of major crops.* Central Statistical Agency, Addis Ababa.

[11] CSA (Central Statistical Agency). 2009/10. *Agricultural Sample Survey 2008/2009: Report on area and production of major crops.* Central Statistical Agency, Addis Ababa.

[12] CSA (Central Statistical Agency). 2010/11. *Agricultural Sample Survey 2009/2010: Report on area and production of major crops.* Central Statistical Agency, Addis Ababa.

[13] CSA (Central Statistical Agency). 2011/12. Agricultural Sample Survey 2010 / 2011 (2005 E.C.) Volume I *Report on area and production of major crops.* Central Statistical Agency, Addis Ababa.

[14] CSA (Central Statistical Agency). 2012/13. *Agricultural Sample Survey 2011/2012: Report on area and production of major crops.* Central Statistical Agency, Addis Ababa.

[15] CSA (Central Statistical Agency). 2013/14. *Agricultural Sample Survey 2012/2013: Report on area and production of major crops.* Central Statistical Agency, Addis Ababa.

[16] CSA (Central Statistical Agency). 2014/15. *Agricultural Sample Survey 2013/2014: Report on area and production of major crops.* Central Statistical Agency, Addis Ababa.

[17] Fufa, B., B. Behute, R. Simons, and T. Berhe. 2011. "Strengthening the tef value chain in Ethiopia." Mimeo, Agricultural Transformation Agency (ATA), Addis Ababa.

[18] Rakesh Sihmar. 2014. " Growth and Instability in Agricultural Production in Haryana: A District level Analysis", International Journal of Scientific and Research Publications, Volume 4, Issue 7, July 2014