



Full Length Research Article

GROWTH AND INSTABILITY IN AREA, YIELD AND PRODUCTION OF TOMATO IN ETHIOPIA

***Eyob Bezabeh, Tesfaye Haregewoin and Dejene Hilegiorgis**

Ethiopian Institute of Agricultural Research, Po. Box. 2003, Ethiopia, Adiss Abeba

ARTICLE INFO

Article History:

Received 14th August, 2014
Received in revised form
16th September, 2014
Accepted 30th October, 2014
Published online 18th November, 2014

Key words:

Tomato and Ethiopia

ABSTRACT

The study measured the growth and instability in area, production, and yield of the vegetable crop tomato in Ethiopia based on secondary data during 1991/92-2013/14 using different statistical techniques. Compound growth rates of area, production and yield were estimated by fitting semi-log trend equation. The study analyzed that, a negative annual percentage change was experienced in yield and a positive annual percentage change was observed in area and production over the study period. Analysis of annual compound growth rate in area showed a positive growth rate per annum that is greater than the growth rate in yield and production shows a positive non significant growth rate. The compound annual growth rate of yield was negative. The coefficient of variation of area and yield of tomato were 15.57 and 18.82 percent respectively. Even though both of area and yield of tomato are unstable, yield showed higher instability than area. Further, the study fitted the linear regression to test the dependency of production of tomato on its respective area. And the result showed that, the relationship between area and production was no significant and weak. Therefore to meet the increasing demand of the private investors, commercial farms as well as the households, The Ethiopian National Agricultural Research System need to release productive tomato varieties.

Copyright © 2014 Eyob Bezabeh et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Tomato is a seasonal climbing plant of the family *solanaceae* which is one of economically important and widely grown vegetable crop as annual both in the rainy and dry seasons for their fruits by smallholder farmers and commercial state and private farms in Ethiopia (MoA, 2013; AVRDC, 2014; Ambecha O. Gemechis *et al.*, 2012). It is also a source of basic raw material required for fresh consumption and local processing industry for the production of processed tomato like tomato paste, tomato juice and etc (EIA, 2008). Tomato has very wide importance both as a source of food and health care i.e it constitutes vitamins like vitamin A and C which play an important role in human health and is widely consumed in every household in different modes including raw, as an ingredient in many dishes, sauces, salads, and drinks (Tibebu tesfaye *et al.*, 2011; Fekadu Mariame and Dandena Gelmesa, 2006). Studies revealed that, Fresh tomato and tomato products are giving economic importance as a source of cash income for the households as well as in creating employment opportunity and access to smallholder farmers to participate in

the market (EIA, 2012; Lemma *et al.*, 1992; MoA, 2010). According to (CSA, 2013/14), Ethiopia devoted 7,257.45 ha to produce 393,730.22 tons of tomatoes. In 2012 Ethiopia was rated as the 84th producer of tomato in the world and ranked 58th in area coverage (Fact fish, 2013). Recently due to expansion of state farms and private investment which are basically concentrated in the rift valley areas of Ethiopia, commercial production of vegetables like tomato has been increasing. However still it is the smallholder farmers that contribute most of the tomato production produced in the country. The smallholder farmers are interested in tomato production more than any other vegetables for its multiple harvests potential and for its high profit per unit area (AVRDC, 2014).

Objectives

- To study the trend and growth of area, production and yield of tomato in Ethiopia
- To measure the instability in area, production and yield of tomato

MATERIALS AND METHODS

The study uses the time series data on area, production, and yields of tomato for 23years from 1991/92 to 2012/13 were

***Corresponding author: Eyob Bezabeh**

Ethiopian Institute of Agricultural Research, Po. Box. 2003, Ethiopia, Adiss Abeba

collected from different issues of CSA, Faostat and MoA plant variety release, protection and seed quality control directorate. Semi-log trend function was fitted to the data following the procedure adopted by Lokesh (2014), Sita rambabu *et al.* (2014) and Eyob Bezabeh *et al.* (2014) to find out the trend and estimate the growth rate of area, production and yield of tomato of Ethiopia.

$$\ln y_t = a + b_t + e$$

Where y = dependent variable (area, yield and production); t = trend over specific period, b = 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:

$$\text{CAGR} = \exp(b) - 1$$

And coefficient of variation (CV_t) around a line following the procedure as adopted by Hasan *et al.* (2008) was used as a measure of instability of area, Production and yield of tomato in Ethiopia, Simple linear regression were also fitted to the data for measuring the response of production of tomato to its respective area.

RESULTS AND DISCUSSION

Trends in Area, Production and yield of tomato over the period from 1991/92-2013/14

It can be revealed from the figure that the total area under production reaches 7,258 ha in 2013/14 from 4,000 ha during 1991/92. If we take a look at the production of tomato it shows a decline from 50,000 tons in 1991/92 to 39,375 tons in 2013. Similarly the productivity of tomato in 1991/92 was 12.5 t/ha and decreased to 5.4 t/ha in 2013/14.

In 2013/14, tomato ranks third and fifth in acreage coverage and production of vegetable crops respectively in the study country. The production of the vegetable crop tomato reaches its climax during 2011/12 as the production was about 81,738 tons. A negative annual percentage change has been in yield of tomato over the study period except in 1993/94, 1998/99, 2000/01, 2003/04 and 2008/9 to 2011/12. And a positive annual percentage change has been registered in area and production of tomato over the study period.

Regression analysis

The simple linear regression functions were fitted for estimating the response of production of tomato due to the change of its respective area. And productions of tomato were not significantly increased. The coefficient of production on area was 1.541 (table 1). But, if we consider the period from 1991/92 to 1999/2000 production of tomato was significantly increased by 5.596 times by unit change in area.

Table 1. Regression analysis: to test the dependency of production on area of tomato for the period 1991/92 to 2013/14

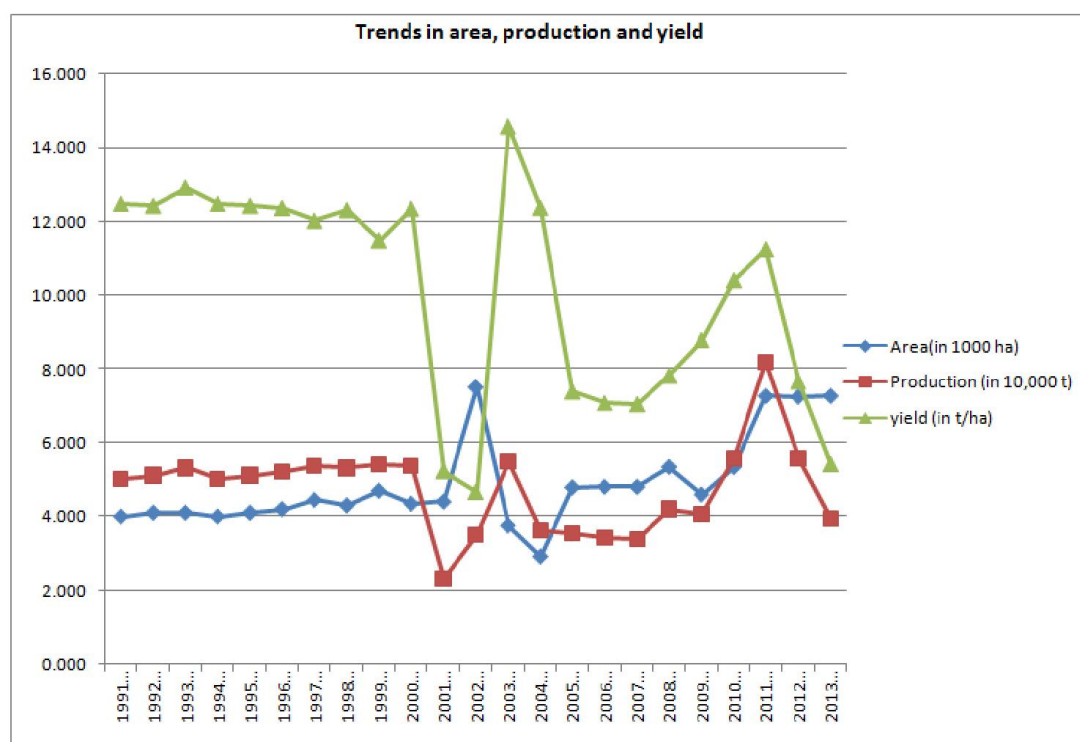
Constant value	Regression coefficient	t-value	P(T<=t) two tail
39786.34	1.541	0.748	0.463

Growth rate

Table 2 shows that the area of tomato has a significant (significant at 5%) positive trends of 2.2 percent per annum over the study period, while yield shows a significant negative trends of 2.7 percent. On the other hand, production does not show a significant growth rate.

Table 2. Growth rate in area, production and yield of tomato for the period 1991/92 to 2013/14

	Area	Production	Yield
CAGR Value	2.2	-0.5	-2.7



Source: FAOSTAT

Instability in area, production and yield of tomato

A linear trend equation $y = c + dt + e$ was fitted to the data (area, production and yield) for the period 1991/92 to 2013/14. Where, y is the dependent variable (area, production or yield), c is a constant, d is the trend coefficient and e is the error term. So, the regression result is

Area

$$y(\text{area}) = 3492.194 + 115.785t$$

$$t = (8.164) \quad (3.711)$$

$$p = (0.000) \quad (0.010)$$

Production

$$y(\text{production}) = 48931.451 - 135.277t$$

$$t = (9.316) \quad (-0.353)$$

$$p = (0.000) \quad (0.728)$$

Yield

$$y(\text{yield}) = 13.192 - 0.255t$$

$$t = (12.485) \quad (-3.306)$$

$$p = (0.000) \quad (0.030)$$

Since the trend term for the area and yield is significant we can compute for the CV_t following the procedure adopted by M.N. Hasan *et al.* (2008).

i.e Coefficient of variation around a line (CV_t) = coefficient of variation around the mean (CV) * SQRT(1-R²)

Area and yield of tomato show 15.52 and 18.82 respectively with 5% significance. The higher CV_t was noticed in yield of tomato over the study period (Table 3).

Table 3. Statistical tools of area, production and yield of tomato over the period from 1991/92 to 2013/14

Statistical tools	Area	production	yield
CV	25.56	25.24	29.14
R ²	0.609	0.077	0.583
CV _t	15.57	-	18.82

Variety Release

According to (MoA, 2013) Ethiopia's National Agricultural Research System (NARS) has released about 25 tomato varieties till 2013. From these varieties 11 were released by Ethiopian Institute of Agricultural research (10 of them are under production and 1 is released in 2013/14 which is expected to be multiplied and scaled up during the next Ethiopian fiscal year), 4 by Regional Agricultural Research institutes (4 of them are under production) and 10 by private companies (10 of them are under production). But, Melka salsa (Serio) and Melka Shola (Red Pear) which were released by Ethiopian Institute of Agricultural research (Melkasa Agricultural research center) in 1997/98 are the oldest varieties which are on production still now. They are disease tolerant tomato varieties.

Conclusion

A negative annual percentage change was experienced in yield and a positive annual percentage change was observed in area and production over the study period. Examination of

regression analysis during the study period shows that, the production is not strongly affected by the increment in area. i.e the relationship between the area and the production is very weak. Analysis of annual compound growth rate in area showed a positive growth rate per annum that is greater than the growth rate in yield. The compound annual growth rate of yield was negative, while the growth rate in production was not significant. Yield exhibited the higher degree of instability as the coefficient of variation around a line was 18.82 percent which is significant at 5%. Varieties released by Ethiopian NARS were registered to be 25 in number. From these 44%, 16% and 40% of them were released by Ethiopian Institute of Agricultural research, Regional Agricultural research Institutes and Private companies respectively. And Melka salsa (Serio) and Melka Shola (Red Pear) were the only two varieties which are still under production since 1998/99. These two varieties were released by Ethiopian Institute of Agricultural Research (Melkasa Agricultural Research center during 1997/98). Therefore to satisfy the increasing demand for tomato both from state farms, private investments and the house hold, it is better to generate or adapt high yielding and disease tolerant varieties frequently.

REFERENCES

- Ambecha O. Gemechis *et al.* 2012. Tomato production in Ethiopia: constraints and opportunities.
- AVRDC, Asian Vegetable Research and Development Center, 2014. Scoping study on vegetables seed systems and Policy in Ethiopia, report.
- CSA, Central Statistics Agency. 2013. Agricultural Sample Survey 2012/2013 (2005 E.C.). Volume I. Report on Area and Production of Major Crops (Private Peasant Holdings, Meher Season). Statistical Bulletin 532, Addis Ababa
- EIA, Ethiopian Investment Agency 2008. Investment opportunity profile for tomato processing in Ethiopia.
- EIA, Ethiopian Investment Agency 2012. Investment opportunity profile for production of fruits and vegetables in Ethiopia.
- Eyob bezabeh *et al.* 2014. Change and growth rate analysis in area, production and yield of wheat in Ethiopia. *International Journal of Development Research*, 4(10):
- Factfish data base (Fact fish, 2014), available at <http://factfish.com>
- Food and Agriculture Organization of the United Nations, FAOSTAT database (FAOSTAT, 2014), available at <http://faostat.fao.org/>
- Fekadu, M and Dandena, G. 2006. Review of the status of vegetable crops production and marketing in Ethiopia. *Uganda Journal of Agricultural Sciences*, 12(2): 26-30.
- Lokesh, 2014. Agricultural development and sources of growth of output in Himachal Pradesh. *International Journal of Development Research*, 4(4): 852-857.
- Lemma *et al.* 1992. Varietal development on vegetables, Proceedings of the second national horticultural workshop of Ethiopia: p89-99.
- M.N. Hasan *et al.* 2008. Change and instability in area and production of wheat and maize in Bangladesh. *Bangladesh J. Agril. Res.* 33(3): 409-417.
- MoA, Ministry of Agriculture 2013. *Crop Variety Register* Issue No. 16. Addis Ababa Ethiopia.
- MoA, Ministry of Agriculture 2012. *Crop Variety Register* Issue No. 15. Addis Ababa Ethiopia.

MoA, Ministry of Agriculture 2010. *Crop Variety Register*
Issue No. 13. Addis Ababa Ethiopia.

Sita rambabu *et al.* 2014. Estimating growth rates,
decomposition analysis and instability of groundnut crop
production in Andhra Pradesh. *International Journal of
Development Research*, 4(1): 085-087

Tibebu tesfaye et. al., 2011. Clay plot irrigation for tomato
production in the north east semi arid region of Ethiopia.
*Journal of Agriculture and rural development in the
tropics and sub tropics*, 112(1): 11-18.
