Change and growth rate analysis in area, yield and production of wheat in Ethiopia

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The study measured the change and growth rate in area, production, and yield of wheat in Ethiopia based on secondary data during 1991/92-2012/13. Paired t-test was used to identify the significant change in area, production and yield of wheat between the periods 1991/92-2001/02 and 2002/03-2012/13. And semi-log model was applied to measure the compound annual growth rate of wheat for period I (1991/92 to 2001/02), period II (2002/03 to 2012/13) and the whole period (1991/92 to 2012/13). The results revealed that, yield and production of wheat increased satisfactorily from period I to period II. But area was not increased significantly. The compound growth rate in yield of wheat improved rapidly in period-II, whereas the growth rate in area and production decreased slightly. This shows us that increasing production through increasing the area may not be feasible without reducing the area share of other crops. Therefore to meet the growing demand of manufacturing industries, increasing the yield potential would be the solution in the long-run.

Key words: Wheat, Ethiopia, paired t-test and semi-log equation.

INTRODUCTION

Wheat is one of the major staple and strategic food security crop in Ethiopia. It is cultivated on 1,627,647.16 hectares of land and has the production of 34,347,061.22 quintals with productivity of 21.10 kg/ha in Ethiopia (CSA, 2013). Ethiopia is the second largest wheat producing country in Africa next to South Africa. Studies revealed that, currently bread wheat covers about 60% of the total wheat area from a15% in 1967 and a 40% in 1991, while durum wheat covers about 40% from an 85% in 1967 and a 60% in 1991 (Hailu et al., 1991 and Alemayehu et al., 2011). At present, it is the smallholder farmers (4.5 million holders on 1,426,000 ha) that produce most of the wheat production in Ethiopia comparing to the 8% contribution of the large state-owned farmers (124,000 ha of land). The production of wheat in the country is very insufficient to meet the increasing demand for food for the ever-increasing population that is Ethiopia's wheat production self sufficiency is only 75 percent and the remaining 25 percent wheat is imported commercially and through food aid (GAIN, 2014). According to USAID country report, wheat is mainly grown in the central and southeastern highlands (Arsi, Bale and parts of Shoa are considered the wheat growing belt) during the main (Meher) rainy season (June to September) and harvested in October-November.

Wheat is the second most consumed cereal in Ethiopia next to corn. It accounts for approximately 11 percent of the national calorie intake in the country (200kcal/day in urban areas / 310kcal/day in rural areas). It has versatile uses in making various human foods, such as bread, biscuits, cakes, sandwich, etc. Additionally, wheat straw is commonly used as a roof thatching material and as animal feed (GAIN, 2014).

Objectives

(i) To determine the growth rate of area, production, and

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Table 1. Growth in area, yield and production in percent.

<table>
<thead>
<tr>
<th>Area</th>
<th>Production</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period I</td>
<td>11**</td>
<td>9.5**</td>
</tr>
<tr>
<td>Period II</td>
<td>3.7*</td>
<td>9.3**</td>
</tr>
<tr>
<td>Overall</td>
<td>2.8*</td>
<td>6.3**</td>
</tr>
</tbody>
</table>

* = significant at 5% and ** = significant at 1%

Table 2. Change in area, production and yield of wheat.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Mean</th>
<th>t-value</th>
<th>P(T&lt;t) two-tail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area (1000ha)</td>
<td>Period I 7.081</td>
<td>Period II 7.240</td>
<td>-1.791</td>
</tr>
<tr>
<td>Production (1000mt)</td>
<td>7.193</td>
<td>7.756**</td>
<td>-7.104</td>
</tr>
<tr>
<td>Yield (mt/ha)</td>
<td>.113</td>
<td>.5172*</td>
<td>-4.970</td>
</tr>
</tbody>
</table>

Source: Authors estimation

Table 1 show that the area under wheat in Ethiopia recorded annual growth rate of 11% during period I, when production increased at a rate of 9.5% and yield witnessed a negative growth rate during the same period. During the period II, the area under wheat increased at a rate of 3.7%, while yield and production increased at a rate of 5.4% and 9.3% respectively. The yield of wheat increased at a rate of 3.3%, whereas production and the area recorded the growth rate of 6.3% and 2.8% respectively during the overall period.

**MATERIALS AND METHODS**

The study was based on yearly time series secondary data on area, production and yield of wheat in Ethiopia. The secondary data were collected from published records and reports of the CSA, FAOSTAT and USAD. The study period was analyzed as a whole as well as by dividing it into period I (1991/92 to 2001/02) and period II (2002/03 to 2012/13). And the following semi-log trend function was used to find out the trend and estimate the growth rate of area, production and yield of wheat of Ethiopia.

\[ \ln y_t = a + bt + e \]

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: \( \text{CAGR} = \exp (b) - 1 \) On the other hand to identify the significant change in area, production, and yield between two periods, the paired t-test was used.

\[ t = \frac{(\bar{A}_2 - \bar{A}_1) - 0}{\sqrt{\frac{S_f}{n_1} + \frac{S_f}{n_2}}} \]

Where, \( \bar{A}_1 \) = mean value of period 1 and \( \bar{A}_2 \) = mean value of period 2
\( A \) is the mean of the difference between the two paired observations
\( S_f \) is sample variance and \( n \) is sample size.

**RESULTS AND DISCUSSION**

Table 1 show that the area under wheat in Ethiopia recorded annual growth rate of 11% during period I, when production increased at a rate of 9.5% and yield witnessed a negative growth rate during the same period. During the period II, the area under wheat increased at a rate of 3.7%, while yield and production increased at a rate of 5.4% and 9.3% respectively. The yield of wheat increased at a rate of 3.3%, whereas production and the area recorded the growth rate of 6.3% and 2.8% respectively during the overall period.

**Change in area, production and yield of wheat over the periods:**

Wheat production and yield increased from period-I to period-II significantly at 1% and 5% level of significance respectively. The increase in area from period-I to period-II was not significant (Table 2). So the area of wheat is not increased from period-I to period-II satisfactorily.

**Conclusion**

The compound growth rate analysis indicated that the area under wheat crop has decreased over the time. But, the production of wheat during period II was increased.
due to the corresponding increase in per hectare yield of wheat crop. Increasing production through increasing the area may not be feasible without reducing the acreage under other crops. Therefore to meet the growing demand of manufacturing industries, increasing the yield potential would be the solution in the long-run.

**REFERENCES**


