Content list available at http://epubs.icar.org.in, www.kiran.nic.in; ISSN: 0970-6429

Indian Journal of Hill Farming

December 2015, Volume 28, Issue 2, Page 96-101

Estimation of Growth Rate and Decomposition of Output Components of Oilseed: A Comparative Study among the States of North East

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ARTICLE INFO

Article history:
Received 29 July 2015
Revision Received 17 October 2015
Accepted 18 October 2015

Key words:
oilseed, growth rate, decomposition

ABSTRACT

This paper investigates the trends in area, production and yield of oilseed in the states of north east India by using component analysis model. The study period was from 1982-83 to 2011-12 and it had been divided into three periods: 1982-83 to 1991-92, 1992-93 to 2001-02, 2002-03 to 2011-12 to have an understanding of decadal performance. The results clearly showed that the growth rate performance of area, production and yield of oilseed in the region declined sharply from period 1 to 3. The study witnessed that more than half of the area under the crop in the region suffered from low growth rate in production. The comparison of production growth rates in all the periods revealed that Nagaland show better performance followed by Arunachal Pradesh, Meghalaya, Mizoram and Sikkim while Assam, Manipur and Tripura are running behind. Performance of Nagaland was even better than the north east total and national level. Area growth was also best achieved by Nagaland followed by Arunachal Pradesh, Meghalaya and Sikkim. The decomposition analysis of growth suggests that sources of output growth in north east were the same in all the three periods as the major contribution was yield effect followed by area effect. In all the eight states for all the period the relative contribution to the change of output was either yield effect or area effect except in few cases.

1. Introduction

The 'yellow revolution' in India owes its earlier success to a spectacular increase in output to 24.75 million tonnes in 1998-99 from 10.83 million tonnes in 1985-86. But thereafter, we have not been able to achieve self-sufficiency in oilseeds. Current production is not enough to meet the needs of cooking oils of our growing population. The annual demand as per 2011 population has risen to 44172 thousand tonnes whereas production is hardly around 29000 thousand tonnes in 2011. The shortage is met by imports every year from Argentina, Brazil, Malaysia and Indonesia. The situation of oilseed production is even worst in states of north eastern India. On the oilseeds map of India, North east occupies only 1.00% in area and 1.62% in production and in the region this sector produced a total of 427 thousand tonnes from an area of 298 thousand hectares during 2011-12 (GOI, 2012). Thus, the average productivity of the region during the above period has been around 699 kg/ha, which is much below the national average of 1132 kg/ha. The region faces a deficit of 1372 thousand tonnes of oilseed as per 2011 populations, which is met by imports from other countries. Though India used to be self-sufficient of edible oil until 1990s all the states of north east have been being deficit since 1960s till date. Hence, a study to analyze the growth of oilseed crops in north east India was found necessary so as to suggest suitable strategies to increase the production of oilseeds in the region and simultaneously working out measures for taking advantage of trade openness in a dynamic setting without affecting the basic objective of domestic food and nutritional security.

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With the above background and with broad objective of analyzing the growth rates of domestic oilseeds production, the present study was taken up with the specific objective to analyze the temporal growth in area, production and productivity of oilseed in the region.

Data and Methodology

Secondary data on area, production and productivity from department of economics and statistics, Ministry of agriculture were compiled. According to the availability of data the study was made from 1982-83 to 2011-12 and in turn the entire period was decomposed into three periods viz 1982-83 to 1991-92, 1992-93 to 2001-02 and 2002-03 to 2011-12 to have an understanding of decadal performance.
The methods used for estimating growth rate with its test of significance, decomposition of growth components, confirmation of existence of acceleration, deceleration or stagnation of growth and instability analysis are described below:

Growth rate Estimation

The growth rate was measured following the popular procedure adopted by various authors, Mohamed Elamin Abd Ellatif Mahir et al (2010), J. S. Sonnad et al (2011), Abhey Singh Godara et al (2013), Edwin Kenamu et al (2014), and many others and the steps followed are presented below.By taking time as the independent variable and the area, production and productivity of the concerned oilseed crops as the dependent variable, the compound growth rates were estimated by using the formula:

$Y = A (1 + r) t$
Where,
Y = Dependent variables like area, production and productivity in the year‘t’ for which growth rate is estimated
A = Constant
r = Rate of annual increment

The significance of growth rate was tested by applying student‘t’ test statistic.

Decomposition of Growth Components

To measure the relative contribution of area and yield towards the total production change with respect of individual crop, the technique of decomposition has been adopted. The change in the production of crop between any time periods can be expressed as

Change in production = Yield effect + Area effect + Interaction effect

Thus, the total change in production is attributed due to area and yield that can be decomposed into three effects viz; yield, area and interaction effects.

2. Result and discussion

Growth rates of area, production and productivity

To estimate the growth performance of area, production and yield of oilseeds in state wise comparative mode during the period1982-83 to 2011-12 time series data on area, production and productivity was analyzed. The whole period was divided into three decades to understand the decadal performance. The periods 1982-83 to 1991-92, 1992-93 to 2001-02 and 2002-03 to 2011-12 have been referred to as period 1, period 2 and period 3 respectively from here onwards.

Period 1 (1982-83 to 1991-92**)**

In this period highest growth in area was observed in Nagaland (16.646%) followed by Tripura (10.972%), Arunachal Pradesh (9.279%) and Sikkim (4.825%) all positively significant. Highest significant production growth was observed in Mizoram (29.852%) followed by Nagaland (23.111%) and Tripura (15.043%), Arunachal Pradesh (12.782%) and Sikkim (8.892%) while only Tripura (3.669%) had shown significant positive growth in yield. Though Manipur showed negative growth in area, production and yield the growth rates are not statistically significant. When considered entire north east only growth rate of production was found statistically significant (4.749%) which was less than the national figure (7.058%). This period was comparatively better than the other two following periods in terms of growth rate of oilseed production of the region as four states namely Arunachal Pradesh, Mizoram, Nagaland, Sikkim, Tripura and total north east as well as total India were found positively significant growth. In this period, the first national programme on Oilseeds was launched in 1986 as Technology Mission on Oilseeds (TMO) where well known Yellow Revolution started in Indian agriculture.

Period 2 (1992-93 to 2001-02**)**

Nagaland registered the highest positive significant growth rate in area (14.531%) and production (16.347%) followed by area growth of Arunachal Pradesh (1.403%) and Meghalaya (0.704%) while

Table1. Compound growth rate of area, production and yield of major agriculture crops in the states of north eastern India during the decades 1982-83 to 1991-92, 1992-93 to 2001-02, 2002-03 to 2011-12 and overall period1982-83 to 2011-12

	Arunachal	Assam	Manipur	Meghalaya	Mizoram	Nagaland	Sikkim	Tripura	NE	India
1982-83 to 1991-92										
A	9.279** (0.015)	0.866 (0.613)	-5.658 (0.257)	2.334 (0.328)	14.642 (0.347)	16.646** (0.028)	4.825** (0.015)	10.972** (0.018)	1.992 (0.165)	4.093*** (0.007)
P	12.782** (0.017)	2.759 (0.221)	-7.077 (0.236)	3.327 (0.410)	29.852*** (0.007)	23.111* (0.079)	8.892* (0.081)	15.043** (0.011)	4.749** (0.017)	7.058* (0.076)
Y	3.206 (0.479)	1.876 (0.439)	-1.505 (0.541)	0.970 (0.607)	13.267 (0.248)	5.543 (0.434)	3.880 (0.350)	3.669*** (0.002)	2.703 (0.182)	2.848 (0.318)
1992-93 to 2001-02										
A	1.403* (0.067)	0.207 (0.720)	-10.869 (0.106)	0.704*** (0.009)	-0.298 (0.897)	14.531** (0.010)	3.214 (0.123)	-11.51*** (0.000)	0.964* (0.085)	-1.406 (0.249)
P	1.282 (0.389)	0.373 (0.798)	-11.327 (0.126)	3.009 (0.242)	-3.053 (0.659)	16.347** (0.012)	0.846 (0.820)	-12.05*** (0.001)	1.825** (0.039)	-0.441 (0.841)
Y	-0.120 (0.937)	0.165 (0.917)	-0.514 (0.738)	2.289 (0.347)	-2.763 (0.603)	1.586 (0.414)	-2.294 (0.457)	-0.608 (0.541)	0.853 (0.409)	0.979 (0.488)
2002-03 to 2011-12										
A	2.646* (0.057)	-0.985 (0.518)	49.873 (0.456)	0.329 (0.515)	-12.303*** (0.004)	1.772 (0.677)	-0.618 (0.585)	-2.995 (0.438)	0.448 (0.760)	1.517 (0.436)
P	1.895 (0.526)	0.265 (0.919)	50.381 (0.261)	1.593** (0.028)	-9.414 (0.475)	-0.207 (0.942)	1.527 (0.428)	-2.695 (0.528)	1.140 (0.643)	5.183 (0.264)
Y	-0.732 (0.746)	1.262 (0.357)	0.339 (0.991)	1.260 (0.118)	3.295 (0.805)	-1.944 (0.558)	2.159 (0.286)	0.356 (0.638)	0.690 (0.632)	3.612 (0.291)
1982-83 to 2011-12										
A	3.313*** (0.000)	-0.836** (0.011)	-3.082 (0.590)	0.888*** (0.002)	2.356 (0.444)	10.689*** (0.000)	-0.556 (0.429)	-3.307* (0.057)	0.304 (0.252)	1.187** (0.014)
P	3.845*** (0.002)	-0.349 (0.459)	-0.255 (0.957)	1.607*** (0.003)	3.436 (0.403)	12.655*** (0.000)	-1.003 (0.418)	-2.604 (0.21)	1.462*** (0.001)	3.196*** (0.001)
Y	0.515 (0.413)	0.49 (0.16)	2.917 (0.378)	0.713** (0.044)	1.055 (0.619)	1.776* (0.061)	-0.450 (0.562)	0.727* (0.065)	1.154*** (0.000)	1.985*** (0.000)

Figures in the parenthesis are p-values

*Significant at 10 per cent level **Significant at 5 per cent level ***Significant at 1 per cent level

Tripura showed significant negative growth rate of -11.51% in area and -12.05% in production. None of the growth entries of yield in this period were found significant. For north east total, growth in area (0.964%) and production (1.825%) registered significant while it was non-significant at national level. Production growth rate of the region declined from 4.749% in the previous decade to 1.825% in this decade where yellow revolution had been running hot in Indian agriculture. Among the three periods this period was running second in position in terms of growth performance of oilseed production in the region. However this period was found worst in case of national level where area and production showed negative growth though they are not statistically significant.

Period 3 (2002-03 to 2011-12**)**

In this period only three figures were found significant i.e. positive growth of area of Arunachal Pradesh (2.646%), negative growth of area of Mizoram (-12.303%) and positive production growth of Meghalaya (1.593%). Total north east and national level showed non-significant growth in area, production and yield. Hence for the region this period had been the worst among the three periods.

Entire period (1982-83 to 2011-12)

In the entire period, among the states Nagaland registered the highest significant growth in area

(10.689%), production (12.655%) and yield (1.776%). After Nagaland, area and production growth were followed by Arunachal Pradesh (3.313% in area, 3.845% in production) and Meghalaya (0.888% in area, 1.607% in production). Assam and Tripura showed significant negative growth rate of area. Total north east had significant figures of production (1.462%) and yield (1.154%) while national figures showed significant in area (1.187%), production (3.196%), and yield (1.985%)

Contribution of area, productivity and their interaction

The growth analysis (area, production and yield) of oilseed revealed the general pattern of growth and direction of changes in yield and area. But this analysis does not evaluate the contribution of area and yield towards the production growth. So, it is necessary to examine the sources of output growth. To appraise the sources of output growth, the change in production is divided in to three effects i.e., area effect, yield effect and interaction effect. With the help of this additive decomposition model the relative contribution of area, productivity and their interaction on oilseeds production in the states of north east for different periods (1982-83 to 1991-92, 1992-93 to 2001-02, 2002-03 to 2011-12 and overall period1982-83 to 2011-12) have been estimated and presented in table 2.

As Table 2 reveals during period 1 the major contribution in the change of oilseed production of Arunachal Pradesh, Meghalaya, Sikkim, Tripura and all India was area effect, all being more than 50%. Assam and north east total had yield effect (around 50%) as major contribution while Manipur, Mizoram and Nagaland had interaction effect as major contribution to the change of oilseed production in first decade. In the second decade, Assam, Meghalaya, North East and India had yield effect as major contribution. Arunachal Pradesh, Mizoram Nagaland Sikkim showed area effect as major contribution while Manipur and Tripura had interaction effect as major contribution to the change of oilseed production in second decade. In the third decade, Assam, Meghalaya, Mizoram, Sikkim, Tripura, North East and India had yield effect as major contribution while Arunachal Pradesh, Manipur and Nagaland had area effect as major contribution. The overall period analysis is somewhat similar to that of third decade. Assam, Meghalaya, Mizoram, Sikkim, Tripura, North East and India had yield effect as major contribution while Arunachal Pradesh and Manipur had area effect as major contribution and Nagaland had an interaction effect on the output change.

When total north east was considered, yield effect had been the major contribution followed by area effect in all the three periods.

Conclusions

The results clearly show that the growth rate performance of area, production and yield of oilseed in the region declined sharply from period 1 to 3. By inspection table 1, it is vivid that around 20 % of the figures are statistically and positively significant other figures are either negative or non-significant. It implies that more than half of the area under the crop in the region suffered from low growth rate in production The comparison of growth rates of area, production and yield in all the periods among the states revealed that Nagaland show better performance in production growth followed by Arunachal Pradesh, Meghalaya, Mizoram and Sikkim while Assam, Manipur and Tripura are running behind. Production growth of Nagaland was even better than the north east total and national level. Area growth was also best achieved by Nagaland followed by Arunachal Pradesh, Meghalaya and Sikkim.

The results of decomposition analysis for examining the sources of output growth show that sources of output growth were almost same in all the periods. In all the eight states for all the period the relative contribution to the change of output was either area effect or yield effect except in few cases. For north east total, yield effect was the major contribution followed by area effect in all the three periods. The results of decomposition analysis have important policy implications because each growth component alone has a limited scope to expand overtime. For example, land's growth potential (the acreage effect) is limited due to the scarce supply of water resources. If the current yield trends continue, the growth in crops production will decline overtime because of the limitations on land growth potential. In addition, some arable land would likely be reduced to accommodate the residential land needs of a growing population, which would likely have a negative effect on per capita production.

Policy Implications

The first national programme on Oilseeds was launched in 1986 as Technology Mission on Oilseeds (TMO). When the TMO was later restructured in 2004 as Integrated Scheme of OilSeeds, Pulses,Oilpalm and Maize (ISOPOM) the north eastern states except Assam and Tripura are not included as they are not major producer of oilseed.

Table 2. Contribution of Area, Productivity (Yield) and their Interaction in the production of oilseed during the decades 1982-83 to 1991-92, 1992-93 to 2001-02, 2002-03 to 2011-12 and overall period1982-83 to 2011-12

	Arunachal	Assam	Manipur	Meghalaya	Mizoram	Nagaland	Sikkim	Tripura	NE	India
1982-83 to 1991-92										
ΔP	12700 (100)	54300 (100)	-900 (-100)	1400 (100)	6100 (100)	12400 (100)	5100 (100)	6700 (100)	97800 (100)	8604430 (100)
$Y_0\Delta A$	7619.42 (60)	18199.07 (33.52)	-717.07 (-79.67)	728 (52)	1666.67 (27.32)	5111.9 (41.23)	3168.54 (62.13)	4302.94 (64.22)	37951.44 (38.81)	4578102.79 (53.21)
$A_0\Delta Y$	2468.4 (19.44)	31820.76 (58.6)	-277.78 (-30.86)	572.73 (40.91)	1173.53 (19.24)	1974.84 (15.93)	1263.97 (24.78)	1124.14 (16.78)	48437.74 (49.53)	2761501.58 (32.09)
$\Delta A\Delta Y$	2612.19 (20.57)	4280.18 (7.88)	94.85 (10.54)	99.27 (7.09)	3259.8 (53.44)	5313.26 (42.85)	667.49 (13.09)	1272.92 (19)	11410.81 (11.67)	1264825.63 (14.7)
1992-93 to 2001-02										
ΔP	4400 (100)	6300 (100)	-1500 (-100)	2200 (100)	-1800 (-100)	38100 (100)	1200 (100)	-7000 (-100)	41900 (100)	555800 (100)
$Y_0\Delta A$	4037.5 (91.76)	-3187.13 (-50.59)	-1447.62 (-96.51)	334.09 (15.19)	575 (31.94)	28356.4 (74.43)	2560.87 (213.41)	-6932.43 (-99.03)	11615.12 (27.72)	-2071067.42 (-372.63)
$A_0\Delta Y$	309.92 (7.04)	9693.51 (153.87)	-220 (-14.67)	1728.42 (78.56)	-2192.31 (-121.79)	3385.66 (8.89)	-939 (-78.25)	-188.68 (-2.7)	28753.58 (68.62)	2928519.16 (526.9)
$\Delta A\Delta Y$	52.58 (1.19)	-206.38 (-3.28)	167.62 (11.17)	137.49 (6.25)	-182.69 (-10.15)	6357.95 (16.69)	-421.87 (-35.16)	121.11 (1.73)	1531.3 (3.65)	-301651.74 (-54.27)
2002-03 to 2011-12										
ΔP	4800 (100)	530 (100)	27900 (100)	1100 (100)	-2730 (-100)	-7190 (-100)	710 (100)	30.04 (100)	25120 (100)	14960286.7 (100)
$Y_0\Delta A$	6254.89 (130.31)	-14388.28 (-2714.77)	17565.48 (62.96)	79.59 (7.24)	-3289.13 (-120.48)	4970.33 (69.13)	-369.49 (-52.04)	-210 (-699)	7373.95 (29.35)	3327850.64 (22.24)
$A_0\Delta Y$	-1190.77 (-24.81)	16512.86 (3115.63)	230.1 (0.82)	1008.06 (91.64)	1574.69 (57.68)	-11394.97 (-158.48)	1138.75 (160.39)	255.36 (850)	17280.65 (68.79)	9501505.99 (63.51)
$\Delta A\Delta Y$	-264.12 (-5.5)	-1594.57 (-300.86)	10104.42 (36.22)	12.34 (1.12)	-1015.56 (-37.2)	-765.36 (-10.64)	-59.26 (-8.35)	-15.32 (-51)	465.4 (1.85)	2130930.07 (14.24)
1982-83 to 2011-12										
ΔP	25800 (100)	14230 (100)	26200 (100)	3400 (100)	1770 (100)	64910 (100)	1810 (100)	-300 (-100)	137820 (100)	19803287 (100)
$Y_0\Delta A$	15518.45 (60.15)	-9768.55 (-68.65)	16303.67 (62.23)	1355.2 (39.86)	216.67 (12.24)	27065.95 (41.7)	262.92 (14.53)	-1195.88 (-398.63)	45648.7 (33.12)	4815656 (24.32)
$A_0\Delta Y$	3258.46 (12.63)	25866.06 (181.77)	1129.25 (4.31)	1545.97 (45.47)	1141.22 (64.48)	2482.35 (3.82)	1482.13 (81.89)	1307.3 (435.77)	71820.51 (52.11)	10114563 (51.08)
$\Delta A\Delta Y$	7023.09 (27.22)	-1867.51 (-13.12)	8767.09 (33.46)	498.83 (14.67)	412.11 (23.28)	35361.7 (54.48)	64.95 (3.59)	-411.41 (-137.14)	20350.79 (14.77)	4873067.5 (24.61)

Figures in parenthesis are in percentage

Only oilpalm development programmes are being implemented in Assam and Tripura. However other states of the region are allowed to implement the Oilseed Production Programme (OPP) under Macro Management Mode of Agriculture. The continuing shortage of cooking oils would suggest that the Oilseeds Technology Mission, OPP and growing oil palms have had little impact in the region as well as in the nation. At present, there is not much scope to expand the cultivable area under oilseeds. These energy-rich crops suffer from a number of constraints as they are grown in poor environment and are susceptible to pests and diseases. Non-availability of adequate quantity of quality seeds of improved varieties and lack of use of inputs like fertilizer, weed control and disease and pests protection are major constraints in oilseeds production in the region. Besides, farmers preferred to grow high-yielding cereals to earn higher profits. As major crops, oilseeds meet the country's needs for edible oils. A second yellow revolution is crying need of the hour which will become inevitable in view of population growth. Also, a technical breakthrough in hill farming is needed to maximize yield, productivity and farm income in the region. The future government policy should focus on developing new high-yielding varieties for the region. Research efforts are needed to strengthen the crop breading programs using new efficient technologies. Further, developing and establishing the bio-technology programs should be intensified to develop high yield varieties of the oilseed crops suitable to agro-climate conditions of the regions. Achieving the aim of making the region self-sufficient in oilseeds would have a great impact and contribution to the national agriculture and the economy and would help reduce dependence on foreign markets

References

Mohamed Elamin Abd Ellatif Mahir and Hag Hamad Abdelaziz, 2010. Estimation of Growth Rates and Analysis of its Components in the Gezira Scheme. *Research Journal of Agriculture and Biological Sciences*, 6(6): 885-890© 2010, INSInet Publication

Dhakre D. S., Bhattacharya D. 2013. Growth and Instability Analysis of Vegetables in West Bengal, India. *International Journal of Bio-resource and Stress Management*, 4(3):456-459

Sadiq, Mohammed Sanusi, 2014. Empirical growth rate analysis of rice production in Nigeria and its implication on food security: Comparative assessment of three economic reforms phases in Nigeria. Journal of Agricultural Economics, Extension and Rural Development: ISSN-2360-798X Vol. 1(12): pp 218-223, December, 2014. Copyright © 2014 Spring Journals

Marchenko Y (2009). Multiple-imputation Analysis Using Stata's mi Command. Presentation given to the 2009

UK Stata Users Group Meeting, London, UK, on September 10., 2009. StataCorp.

Satinder Kumar, Surender Singh, 2014. Trends in Growth Rates in Area, Production and Productivity of Sugarcane in Haryana. *International Journal of Advanced Research in Management and Social Sciences* Vol. 3 | No. 4 | April 2014 www.garph.co.uk IJARMSS | 117

Sonnad J. S., Raveendaran N., Ajjan **N**. Selvaraj K.N, 2011. Growth analysis of oilseed crops in India during pre and post - WTO periods. *Karnataka J. Agric. Sci.,24 (2) : (184-187)*

Dr. Priyanka Sahni, 2014. Trends in India's Exports: A Comparative Study Of Pre And Post Reform Period. *IOSR Journal of Economics and Finance (IOSR-JEF) e-ISSN: 2321-5933, p-ISSN: 2321-5925.Volume 3, Issue 2. Ver. I (Mar. - Apr. 2014), PP 08-18 www.iosrjournals.org* www.iosrjournals.org

Fasih UR Rehman, Ikram Saeed and Abdul Salam, 2011. Estimating growth rates and decompositionAnalysis of agriculture production in Pakistan: pre and post sap analysis. *Sarhad J. **Agric. Vol.27, No.1.***

Veerpaul Kaur Maan, Dr. Sandeep Kumar, 2012. State wise agricultural sector growth and performance. *International Journal of Application or Innovation in Engineering & Management (IJAIEM)* Web Site: www.ijaiem.org Email: editor@ijaiem.org, editorijaiem@gmail.com Volume 1, Issue 2, October 2012

Edwin Kenamu and M. Alexander. R. Phiri, 2014. Performance of Cotton Production in Malawi. *Scholarly Journal of Agricultural Science* Vol. 4(3), pp. 157-165 March, 2014. Available online at http:// www.scholarly-journals.com/SJAS, ISSN 2276-7118 © 2014 Scholarly-Journals

N.K. Pandey, Rajesh K. Rana, Arun Pandit and K.P. Chandran, 2005. Contribution OF Uttar Pradesh towards Indian Potato. *Potato J.* 32 (3-4) : 221-222, 2005

Abhey Singh Godara and Usha Poonia, 2013. Impact of Prices on Acreage and Income From Gram In Haryana *Internatonal journal of innovative research and development.* September, 2013 Vol 2 Issue 9.

Abhey Singh Godara and Usha Poonia, 2013. Impact of Prices on Acreage and Income From Gram In Haryana *Internatonal journal of innovative research and development.* September, 2013 Vol 2 Issue 9.