Impact of technology mission on oilseeds and pulses on pulse production in Karnataka

K.R. NETHRAYINI AND S.M. MUNDINAMANI

ABSTRACT: The Technology Mission on Oilseeds (TMO) was launched during 1986 by the Central Government to increase the production of oilseeds. Subsequently, pulses were also brought within the purview of the Mission during 1990-91. Pulses are the second most important food crops after cereals. Karnataka is the major producer of pulses and ranks in top five pulses producing states in India. This study covers the changes in area, production and yield of pulses during pre and post Technology Mission on Oilseeds and Pulses (TMOP) and decomposition effect of TMOP on production of pulses. District wise as well as state level secondary data were used. The study period was divided into period-I (Pre TMOP) from 1981-82 to 1989-90, period-II (Post TMOP) from 1990-91 to 2009-10 and period-III from 1981-82 to 2009-10 (overall). The analytical tools employed were Compound growth rate and Hazell’s Decomposition analysis. The results showed that the increase in production from Pre TMOP (0.33 %) to Post TMOP (3.27 %) is because of the yield increase which is mainly due to intervention of TMOP. The rate of increase in mean area was found to be the dominant source of pulse output growth in the state. The change in the variance of production for the state was contributed by the interaction between changes in mean yield and mean area was found to be negligible.

KEY WORDS: Technology Mission on Oilseeds and Pulses (TMOP), Compound growth rate, Hazell’s Decomposition analysis

INTRODUCTION

The Technology Mission on Oilseeds was launched during 1986 by the Central Government to increase the production of oilseeds, to reduce import and to achieve self-sufficiency in edible oils. Subsequently, pulses, oil palm and maize were also brought within the purview of the Mission during 1990-91, 1992 and 1995-96, respectively. The other schemes implemented under Technology Mission are Oilseeds Production Programme (OPP), National Pulses Development Project (NPDP), Accelerated Maize Development Programme (AMDP) and Oil Palm Development Programme (OPDP) and have been merged into one Centrally Sponsored Integrated Scheme of Oilseeds, Pulses, Oil palm and Maize (ISOPOM) being implemented since April 2004. Under this Scheme, financial assistance is provided for purchase of breeder seeds, production of foundation seeds, production and distribution of certified seeds, seed minikits, plant protection chemicals and equipments, weedicides, etc. to encourage farmers to grow oilseeds and pulses.

Pulses are the second most important food crops after cereals. India is the largest producer of pulses in the world with 25 per cent share in global production. Chickpea, pigeonpea, mungbean, uradbean, lentil, and fieldpea are important pulses contributing 39 per cent, 21 per cent, 11 per cent, 10 per cent, 7 per cent and 5 per cent to the total pulses production in the country. Pulses remain a major ingredient in the Indian diet. Over 20% of the population is strictly vegetarian, with pulses providing the main source of protein for these consumers. However, in India even non-vegetarians consume pulses in significant quantities. Pulses on account of their vital role in the nutritional security and soil ameliorative properties have been an integral part of sustainable agriculture since ages. According to estimates of agricultural department, the area covered under cultivation

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of pulses in 2010 was 28.75 lakh hectare, production of 14.69 lakh hectare and with yield of 511 kg/ha.

The major producers of pulses in the country are Madhya Pradesh which accounts 24% of India's production followed by Uttar Pradesh (16%), Maharashtra (14%), Andhra Pradesh (10%) and Karnataka (7%). These five states together accounting more than 75 per cent of total pulse production in the country.

Keeping in view the implementation of TMOP in the state, the present paper analyses the impact of TMOP on pulses in the Karnataka with the specific objectives to study the growth in area, production and yield of pulses in Karnataka during pre and post Technology Mission on oilseeds and pulses and to decompose the effect of Technology Mission on Oilseeds and Pulses on pulses production in the state.

**MATERIALS AND METHODS**

The study is based on the district wise as well as state level secondary data on area, production and productivity of total pulses. The data required for the study were collected from the Directorate of Economics and Statistics, Bangalore for the period from 1981-82 to 2009-10. To assess the impact of TMOP, the study period has been divided into sub-periods, as Period-I (1981-82 to 1989-90), period-II (1990-91 to 2009-10) and overall (1981-82 to 2009-10). Period-I represents the pre-TMOP period and period-II represents the post TMOP period and period-III represents the overall study periods. This would help us to examine whether introduction of TMOP have any impact on pulses production. For the convenience of analysis the divided districts are considered as undivided districts as the data used for analysis was from 1980.

**Compound growth rate analysis:**

Growth rate in area, production and yield of total pulses were computed for a period of 30 years from 1980-81 to 2009-10. In the present study, compound growth rates in area, production and productivity of total pulses in Karnataka as well as districts were estimated by using the exponential growth function (Angles, 2001) of the form,

\[ Y_t = a b^t U_t \]

where,

- \( Y_t \): area/production/ yield, of total pulses in year 't'.
- \( a \): Intercept
- \( b \): Regression coefficient
- \( t \): Year which takes values 1, 2, … n.
- \( U_t \): Disturbance term in year 't'.

The equation (1) was transformed into log-linear and written as

\[ \log Y_t = \log a + t \log b + \log U_t \]

Equation (2) was estimated by using Ordinary Least Square (OLS) technique.

The compound growth rate (\( g \)) was then estimated by the identity given in equation (3)

\[ g = (b - 1) \times 100 \]

where,

- \( \hat{g} \): Estimated compound growth rate per annum in percentage
- \( \hat{b} \): Antilog of log \( b \)

**Instability analysis:**

The extent of variability in area, production and productivity of total pulses were analyzed through coefficient of variation.

\[ C.V. = \frac{\text{Standard deviation}}{\text{Mean}} \times 100 \]

In order to analyze the sources of instability in pulses production, a method developed by Hazell (1982) was adopted. This method uses statistical identities to provide an exact decomposition of the components of change in the variance of pulses production.

To estimate the variability in production of pulses, the entire study period was divided into two sub periods namely, pre - TMOP and post – TMOP periods.Period-I from 1981-82 to 1989-90, while Period – II from 1990-91 to 2009-10. The time series data on area and productivity of total pulses were detrended to remove the trend component, using linear trend equation of the form

\[ Y_t = a + b t + U_t \]

where,

- \( Y_t \): area in hectare/ yield in kg/ha
- \( t \): time period in years
- \( a \): intercept
- \( b \): regression coefficient
- \( U_t \): residual term

The residuals were computed from the equation (4) and were then centered around their respective means for both periods. The resultant detrended time series data were of the following form.

\[ Y_t - \bar{Y} = U_t \]

where,

- \( \bar{Y} \): Mean yield
- \( U_t \): error in ‘t’ year

The production of pulses was computed using following equation.

\[ P_t = A_t \times Y_t \]

where,

- \( P_t \): Production of pulses in year ‘t’
- \( A_t \): Area under pulses in year ‘t’
Y = Yield of pulses in year ‘t’

The production variance and co-variance were decomposed to know the sources of change between the periods.

The variance in production during period-I (1981-82 to 1989-90) can be expressed as

\[ V(P_t) = \bar{X}_t^2 \cdot V(Y_t) + \bar{Y}_t \cdot V(A_t) + 2 \bar{A}_t \cdot \bar{Y}_t \cdot Cov(\bar{X}_t, \bar{Y}_t) - Cov(\bar{A}_t, \bar{Y}_t)^2 + R_t \]

... (7)

where,
- \( V(P_t) \) = Variance of production in period-I
- \( \bar{X}_t \) = Mean area in period-I
- \( \bar{Y}_t \) = Mean yield in period-I
- \( V(A_t) \) = Variance of area in period-I
- \( V(Y_t) \) = Variance of yield in period-I
- \( Cov(\bar{A}_t, \bar{Y}_t) \) = Covariance of area and yield in period-I
- \( R_t \) = Residuals in period-I

Similarly, each variable in period-II can be expressed in terms of its counterpart in period-I, plus the change in the variable between the two periods.

For example, \( \bar{X}_t + \bar{X}_t + \bar{X} \) and \( \bar{Y}_t = \bar{Y}_t + \bar{Y} \)

where,
- \( \bar{X} = \bar{X}_t - \bar{X}_t \)
- \( \bar{Y} = \bar{Y}_t - \bar{Y}_t \)

Therefore, the change in the variance of production of pulses between two periods is given by:

\[ \Delta V(P_t) = V(P_t) - V(P_t) \]

And this can be decomposed into various components as shown in Table A and B.

### RESULTS AND DATA ANALYSIS

The findings obtained from the present study are presented below:

**Growth in area, production and productivity of pulses:**

The compound growth rates of area, production and productivity of total pulses for period-I and period-II were computed and are presented in Table 1.

It is evident from the Table 1 that during the Period-I, the area and production of total pulses in the state showed a positive growth of 1.17 per cent per annum, which was found significant at 5 per cent level of significance and 0.33 per cent per annum, which was found non-significant, respectively. Whereas during Period-II both area and production exhibited substantial significant growth of 2.18 per cent and 3.27 per cent, respectively and both found to be significant at 1 per cent level of significance. The growth in yield of total pulses during Period-I was found to be negative (-0.82 %) where as during Period-II (1.06 %) and overall period (0.95%) it was positive. Whereas during overall period the area growth was marginal (1.39%) and found significant at 1 per cent level, production showed 2.35 per cent significant growth.

The major pulses producing districts were Gulbarga, Bidar, Bijapur, Bharadaw, Mysore, Raichur and Belgaum which covered more than 75 per cent of pulses area and contributed
more than 70 per cent of the total production. With respect to Gulbarga district Period-I, the area and production of total pulses showed a positive growth of 2.01 per cent per annum, which was found significant at one per cent level of significance and 1.95 per cent per annum, which was found non-significant. Whereas during Period-II both area and production exhibited substantial significant growth of 3.87 per cent and 7.99 per cent, respectively and both were found to be significant at one per cent level of significance. The growth in yield of total pulses during Period-I was found to be negative (-0.48%) where as during Period-II (3.09 %) and overall period (2.06%) it was positive. Whereas during overall period the area growth was marginal (3.26%) and found significant at 1 per cent level, production showed 6.39 per cent significant growth.

In case of Bidar district during Period-I area (7.96%), production (3.91%) and yield (0.37%) of total pulses showed the positive growth and found to be non-significant. Whereas in Period-II, the area under total pulses (1.18%) and production (0.75%) showed the marginal positive growth whereas yield of total pulses showed the negative growth (-0.42%). Similarly in overall period also both area (3.52%) and production (0.99%) of total pulses showed the positive growth whereas yield of total pulses showed the negative (-1.28%) growth. In Bijapur district during the Period-I both area (2.82%) and production (0.25%) showed the positive growth whereas yield showed negative growth (-2.53%). During the Period-II both area (4.16%) and production (5.18%) showed the positive growth and found significant at one per cent level of significance, whereas yield also showed the marginal positive growth (0.56%) but found non-significant. In overall period both area (2.62%) and production (3.92%) showed the significant positive growth, whereas yield showed the declining growth (-0.13%). In case of Dharwad district, during Period-I both area (2.80%) and production (1.31%) of total pulses showed the non-significant positive growth whereas yield of total pulses showed the negative growth (-1.43%). During Period-II area showed the positive significant growth of 2.62 per cent and production also showed positive growth (1.55%) but found non-significant, whereas yield of total pulses showed negative growth (-0.98%). In overall period also similar trend was seen.

In case of Mysore district during Period-I, area (-1.55%), production (-16.31%) and yield (-0.38%) of total pulses showed the declining growth rates over the year. Whereas in Period-II there was positive growth in area (4.81%), production (3.77%) as well as yield (3.77%) of total pulses. In overall period area of total pulses showed the significant positive growth (2.32%), whereas production of total pulses showed the negative growth (-1.39%) and yield also showed the non-significant positive growth (1.00%). With respect to Raichur district, during Period-I, the growth

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**Table 1: District wise compound growth rate of area, production and productivity of total pulses in Karnataka (%)**

<table>
<thead>
<tr>
<th>Districts</th>
<th>Period I</th>
<th></th>
<th></th>
<th>Period II</th>
<th></th>
<th></th>
<th>Overall period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>P</td>
<td>Y</td>
<td>A</td>
<td>P</td>
<td>Y</td>
<td>A</td>
</tr>
<tr>
<td>Bangalore</td>
<td>0.08</td>
<td>-0.47</td>
<td>-0.77</td>
<td>-3.62*</td>
<td>2.10**</td>
<td>5.69*</td>
<td>-2.46*</td>
</tr>
<tr>
<td>Belgaum</td>
<td>-0.66</td>
<td>-3.24</td>
<td>-2.60</td>
<td>1.70'</td>
<td>0.84</td>
<td>-0.84</td>
<td>-0.13</td>
</tr>
<tr>
<td>Bellary</td>
<td>3.10**</td>
<td>2.91</td>
<td>-0.16</td>
<td>1.56**</td>
<td>3.39'</td>
<td>1.80**</td>
<td>0.16</td>
</tr>
<tr>
<td>Bidar</td>
<td>7.96</td>
<td>3.91</td>
<td>0.37</td>
<td>1.18'</td>
<td>0.75</td>
<td>-0.42</td>
<td>3.52*</td>
</tr>
<tr>
<td>Bijapur</td>
<td>2.82**</td>
<td>0.25</td>
<td>-2.51</td>
<td>4.16'</td>
<td>5.18'</td>
<td>0.56</td>
<td>2.62'</td>
</tr>
<tr>
<td>Chikkamagalur</td>
<td>5.31**</td>
<td>4.30</td>
<td>-0.96</td>
<td>-2.47'</td>
<td>-2.02</td>
<td>0.46</td>
<td>-0.34</td>
</tr>
<tr>
<td>Chitradurga</td>
<td>1.27</td>
<td>-4.30</td>
<td>-4.18</td>
<td>0.56</td>
<td>0.80</td>
<td>0.66</td>
<td>-0.42</td>
</tr>
<tr>
<td>Dakshina Kannada</td>
<td>7.60'</td>
<td>10.54**</td>
<td>2.73</td>
<td>-3.82'</td>
<td>-2.86**</td>
<td>0.52</td>
<td>-1.47'</td>
</tr>
<tr>
<td>Dharwad</td>
<td>2.80</td>
<td>1.31</td>
<td>-1.43</td>
<td>2.62'</td>
<td>1.55</td>
<td>-0.98</td>
<td>2.21'</td>
</tr>
<tr>
<td>Gulbarga</td>
<td>2.01'</td>
<td>1.95</td>
<td>-0.48</td>
<td>3.87'</td>
<td>7.09'</td>
<td>3.09**</td>
<td>3.26'</td>
</tr>
<tr>
<td>Hassan</td>
<td>-1.95</td>
<td>-5.31</td>
<td>-4.30</td>
<td>-2.97'</td>
<td>-4.50'</td>
<td>-1.58</td>
<td>-1.70'</td>
</tr>
<tr>
<td>Kodagu</td>
<td>4.98</td>
<td>-15.79</td>
<td>-8.81'</td>
<td>1.91</td>
<td>8.39**</td>
<td>6.35'</td>
<td>-2.89</td>
</tr>
<tr>
<td>Kolar</td>
<td>-1.82</td>
<td>-14.93**</td>
<td>1.18</td>
<td>-0.12</td>
<td>-0.07</td>
<td>2.06</td>
<td>-1.12'</td>
</tr>
<tr>
<td>Mandya</td>
<td>-3.58</td>
<td>-20.99'</td>
<td>-0.97</td>
<td>-2.21**</td>
<td>-1.19</td>
<td>0.51</td>
<td>-2.64'</td>
</tr>
<tr>
<td>Mysore</td>
<td>-1.55</td>
<td>-16.31'</td>
<td>-0.38</td>
<td>4.81'</td>
<td>3.77'</td>
<td>0.66</td>
<td>2.32'</td>
</tr>
<tr>
<td>Raichur</td>
<td>0.54</td>
<td>-15.13'</td>
<td>-1.04</td>
<td>2.71'</td>
<td>5.18'</td>
<td>3.22'</td>
<td>0.52</td>
</tr>
<tr>
<td>Shimoga</td>
<td>6.71**</td>
<td>-10.40'</td>
<td>-3.67</td>
<td>-11.75'</td>
<td>-11.69'</td>
<td>0.06</td>
<td>-7.75'</td>
</tr>
<tr>
<td>Tumkur</td>
<td>-3.21</td>
<td>-18.70'</td>
<td>-0.03</td>
<td>-0.50</td>
<td>1.68</td>
<td>2.19'</td>
<td>-1.41'</td>
</tr>
<tr>
<td>Uttara Kannada</td>
<td>6.05</td>
<td>2.31</td>
<td>-2.92</td>
<td>-7.90'</td>
<td>-6.37'</td>
<td>1.66</td>
<td>-3.1'</td>
</tr>
<tr>
<td>State as whole</td>
<td>1.17**</td>
<td>0.33</td>
<td>-0.82</td>
<td>2.18'</td>
<td>3.27'</td>
<td>1.06</td>
<td>1.39'</td>
</tr>
</tbody>
</table>

* and ** indicates significance of values at P=0.01 and 0.05, respectively.
rate of area under total pulses was marginal (0.54%) whereas both production (-15.31%) and yield (-1/0.4%) of total pulses showed the declining growth rates over the year. But in Period-II, area (2.71%), production (5.18%) and yield (3.22%) of total pulses were showed the positive growth rates and found significant at one per cent level of significance. Whereas in overall period, both area and yield of total pulses showed the marginal positive growth rates, but production was showed declining (-2.64%) growth rate over the year. In case of Belgaum district, during Period-I area, production and yield of total pulses were declining at the rate of -0.66 per cent, -3.24 per cent and -2.60 per cent, respectively. Whereas during Period-II the area as well as production of total pulses were showed the marginal positive growth rates but yield was showed the declining growth. Similarly in overall period also area (-0.13%), production (-0.46%) and yield (-0.33%) of total pulses showed the negative growth.

From the perusal of table, it may be noticed that the area has increased marginally from Pre TMOP to Post TMOP and yield under pulses has improved significantly. Thus the increase in production from Pre TMOP to Post TMOP is because of the yield increase.

The growth in area, production and productivity of pigeonpea in the state was impressive after the economic reforms. The growth in the production during this period was largely on the account of yield improvement as suggested by Bindukumar (2006).

The increase in productivity was because of the intervention of Technology Mission on Oilseeds and Pulses as under this scheme many provisions are provided to encourage farmers to grow pulses such as distribution of seed minikits, distribution of plant protection chemicals, plant protection equipments, weedicides, etc.

A relatively better performance of groundnut crop in the pre WTO period might be due to expansion in area, availability of improved oilseed production technology and its adoption, remunerative support prices and institutional support, particularly establishment of Technology Mission on Oilseeds (TMO) in 1986 as suggested by Hegde (2004).

### Per cent contribution to change in average production of total pulses:

To assess the per cent contribution to change in the average production of total pulses decomposition model was used. To estimate the variability in production of total pulses in state, two periods were considered. The results are presented in Table 2.

Perusal of Table 2 revealed that the variation in the average production of total pulses was due to the change in mean area (66.09 %) followed by change in mean yield (25.12 %), interaction between mean area and mean yield (7.28 %) and covariance between area and yield (1.98 %). Hence, the rate of increase in mean area was found to be the dominant source of output growth in the state. The results obtained is in conformity with the results of Krishnadas (2010) that in case of total spices, the dominant source of variation in average production is contributed by change in mean area of 93.93 per cent.

<table>
<thead>
<tr>
<th>Source of change</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in mean yield</td>
<td>25.12</td>
</tr>
<tr>
<td>Change in mean Area</td>
<td>66.09</td>
</tr>
<tr>
<td>Interaction between changes in mean area and mean yield</td>
<td>7.28</td>
</tr>
<tr>
<td>Change in yield and area covariance</td>
<td>1.98</td>
</tr>
<tr>
<td>Total change in mean production</td>
<td>100.00</td>
</tr>
</tbody>
</table>

**Table 2 : Components of change in Average pulses production in Karnataka**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Source of change</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Change in mean yield</td>
<td>13.78</td>
</tr>
<tr>
<td>2.</td>
<td>Change in mean area</td>
<td>3.89</td>
</tr>
<tr>
<td>3.</td>
<td>Change in yield variance</td>
<td>7.39</td>
</tr>
<tr>
<td>4.</td>
<td>Change in area variance</td>
<td>25.05</td>
</tr>
<tr>
<td>5.</td>
<td>Interaction between changes in mean yield and mean area</td>
<td>0.24</td>
</tr>
<tr>
<td>6.</td>
<td>Change in area yield covariance</td>
<td>35.77</td>
</tr>
<tr>
<td>7.</td>
<td>Interaction between changes in mean area and yield variance</td>
<td>4.90</td>
</tr>
<tr>
<td>8.</td>
<td>Interaction between changes in mean yield and area variance</td>
<td>5.82</td>
</tr>
<tr>
<td>9.</td>
<td>Interaction between changes in mean area and yield and change in area-yield covariance</td>
<td>15.54</td>
</tr>
<tr>
<td>10.</td>
<td>Change in residual</td>
<td>-12.38</td>
</tr>
<tr>
<td>Total change in variance</td>
<td>100.00</td>
<td></td>
</tr>
</tbody>
</table>

**Table 3 : Sources of change in the variance of average pulses production in Karnataka**
Sources of change in the variance of production:

The sources of change in the variance of total pulses production between the two sub periods at state level are presented in Table 3.

Table 3 revealed that the change in the variance of production at the state level was contributed by the interaction between changes in mean yield and mean area was found to be negligible. However, change in area yield covariance (35.77%), change in area variance (25.05%), interaction between changes in mean area and yield and change in area-yield covariance (15.54%), change in mean yield (13.78%), interaction between changes in mean yield and area variance (5.82%) and change in mean area (3.89%) contributed to the variability in the production of total pulses. In contrast, change in the yield variance, interaction between changes in mean area and yield variance, and residual terms accounted for 7.39 per cent, 4.90 per cent and -12.38 per cent, respectively to the stability of total pulses production.

Conclusion:

Although there is a positive growth in area, production and yield after inception of TMOP but the growth was meagre. If we look at the population growth the production of pulses will not be sufficient to meet the nutritional requirement as it is the rich source of protein, which has resulted in an overall decline in per capita availability from 66 gram per day in 1950s to 34.28 gram per day in 2000s. So, the mission has to focus on the increase in production through HYV’s and creating awareness in farmers on improved technologies. Policies and programmes should concentrate by increasing the area under cultivation to include non-traditional areas. Appropriate steps need to be undertaken to convince the farmers about the need to increase output of these crops through demonstration or other incentive means to adopt new technology. This needs agricultural extension and supportive institutional network with a clear understanding of technological parameters and constraints with a degree of professionalism.

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Literature Cited


Department of Agriculture and Co-operation, Ministry of Agriculture, GOI

Economic Survey of Karnataka 2010-11.


Webliography

www.iipr.res.in