



## TMC MMI 5.1: Total factor productivity of cotton in India

### INTRODUCTION

Total Factor Productivity (TFP) is an attempt to measure the amount of increase in the total output, which is not accounted by increase in total inputs. It is computed as the ratio of aggregate Output Index to the aggregate Input Index. In recent years, agriculture has been experiencing diminishing returns to input use and a significant proportion of the gross cropped area has been facing stagnation or negative growth in TFP. What proportion of contribution do cotton have in this regard could be extricated. An increase in agricultural investments especially in research and development is urgently needed to stimulate growth in TFP. Recognizing that there are serious yield gaps and that there are already proven paths for increasing productivity, it is highly pertinent for India to maintain steady growth rate in TFP. As TFP increases, the cost of production would decline and the market price would stabilize at a lower level. A TFP that rises over time is interpreted as evidence of productivity growth that can be attributed to factors other than increasing quantities of inputs. The State wise Total Factor Productivity (TFP) of cotton for the period 1980-81 to 2004-05 was estimated during 2008-09. During the year 2009-10 an attempt was made to estimate district level TFP of Cotton in Punjab, Maharashtra and Tamil Nadu. Compound growth rates of these indices were worked out and their significance were tested.

### OBJECTIVES

- : To examine the trends in area, production and productivity of cotton in major cotton growing States of India and issues related to overall performance of the cotton crop.
- : To construct the district-wise total factor productivity indices under different agro climatic zones of cotton growing States in India.

- : To examine changes in TFP of cotton and to identify the factors influencing such changes. To suggest policies and strategies to sustain the growth in TFP by district and region wise with reference to cotton economy.

### SAILIENT FINDINGS

Data on district level cost of production of cotton, quantities of inputs used in cotton and productivity of cotton were collected for the districts of Punjab Maharashtra and Tamil Nadu from cost of cultivation scheme of respective State Agriculture Universities for the period 1991-92 to 2007-08 as per the availability of the data.

#### Punjab

In Punjab district wise TFP indices were estimated for Bathinda and Mansa districts for which data was available for the period 1991-92 to 2007-08.

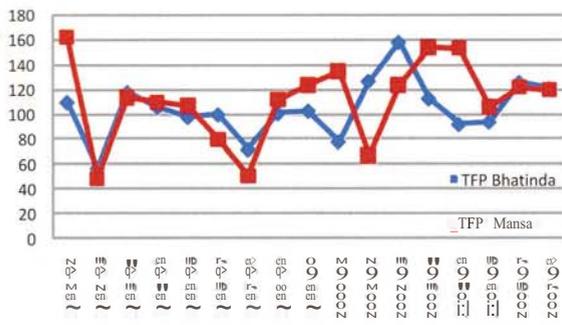
#### Bathinda

TFP of cotton in Bathinda district showed a positive trend during the period of analysis. TFP increased at a compound rate of 1.78 percent per annum during this period. Growth of total Output index(TOI) was positive while total input index(TII) was negative during this period. Growth of TFP during 1990s was less when compared with that of 2000s

#### Mansa

In this district TFP of cotton increased at the rate of 2.16 percent per annum during the period of analysis. Growth of output index was positive while input index showed a negative growth during this period. During 1990s growth rate of TFP was negative while it was positive after 2000-01 in this district.

**Fig 5.1.1 : TFP index of cotton in Punjab**



**MAHARASHTRA**

In central zone TFP indices were worked out for ten major cotton growing districts of Maharashtra. The districts for which TFP estimated were Yavatmal, Wardha, Buldhana, Akola and Amravati of Vidarbha region and Aurangabad, Beed, Jalna, Nanded and Parbhani district of Marathwada region. The analysis was carried out for the period 1991-92 to 2007-08 as per the availability of the data. The growth rates of TFP were worked out separately for first period (1991-2000) and second period (2000-2008) as well as for overall period.

**Yavatmal**

During the period of analysis total factor productivity of cotton increased at the rate of 2.78 percent per annum, where as total output index increased at the rate of 3.38 percent per year. Growth of total input index was not significant. This indicates that TFP is the main factor contributing to output growth which accounted for 82 percent of output growth. Hence in this district growth of cotton output is sustainable and its growth can be further improved by increasing the inputs. If we examine period wise growth rates it is clear that during the first period (1991-2000) growth of total factor productivity was not significant. Total output index and total input index showed a negative growth. During second period (2001-09) compound growth rate of total factor productivity was 2.86 percent per annum while total output index was 3.14 percent. Contribution of total factor productivity to total output growth during this period was 90 percent.

**Wardha**

In Wardha district cotton occupies an area of 83900 ha with a production of 111900 bales of cotton. During the period of analysis total input index showed a negative growth of -3.66 percent per annum while growth of total output index was not significant. But total factor productivity increased at the rate of 4.01 percent showing that cotton production in this district is sustainable. Cotton output growth can be increased by increasing the quantity of inputs used in cotton production. This can be achieved by removing the constraints which are limiting the input use. Total input index growth was negative during 1991-00 and positive during 2001-09. Similarly growth of total output index and total factor productivity was more during 2001-09 when compared with 1991-00. This shows that the condition of cotton production is improving.

**Buldhana**

Buldhana is another important cotton growing district in Maharashtra with an area of 1.96 lakh ha under cotton cultivation. Analysis revealed that growth of total factor productivity of cotton was positive and significant during both the periods as well as overall period in this district. Total factor productivity increased at the rate of 2.46 percent per year. Cotton output registered a growth of 6.10 percent per annum in this district. The sustainability of this output growth is indicated by the positive growth of total factor productivity. In this district total factor productivity growth was comparatively less during 2001-09 when compared with that of 1991-00. This again is a cause of concern. The factors which slowed down the growth of total factor productivity needs to be corrected. Anyhow after 2005-06 the total factor productivity index showed improvement

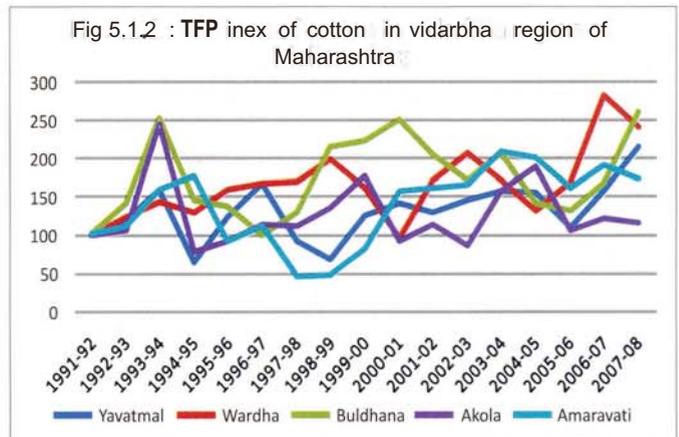
**Akola**

Akola ranks second in area and third in production among the ten districts. Total factor productivity indices showed a non significant growth during the period of analysis in this district. Output index showed a positive growth of 2.16 percent per annum. This growth is not sustainable as it was driven by the growth of input index. Decadal analysis indicates this growth is due to the positive output growth achieved during 2001-07. Though total factor productivity contributed to this growth, input growth was major factor. It is very important to sustain this growth by backing up total factor productivity growth. During 1991-00 total input index as well as total output index showed negative growth of -2.56 percent and -1.87 percent per annum respectively. During second period (2001-09) though the growth of total input index was not significant, total output index showed a positive growth of 3.46 percent per annum. Total factor productivity growth during this period was 2.84 percent.

**Amravati**

During overall period though total factor productivity showed positive growth, the growth of output index was not significant. This was due to the negative growth in input index. This shows that there are serious problems which limits the input use. These needs to be corrected to make positive growth in output. Growth of all the three indices was negative during 1991-00. During this period

**Fig 5.1.2 : TFP index of cotton in vidarbha region of Maharashtra**



total factor productivity decreased at the rate of -5.02 percent whereas the growth of total input index and total output index was -2.70 and 7.72 percent respectively. But during 2001-09 total factor productivity showed a positive growth of 2.93 percent per year where as total output index showed 2.40 percent growth. This clearly indicates that cotton production is attaining sustainability.

#### Aurangabad

Aurangabad has an area of 2.09 lakh ha under cotton producing 2.38 lakh bales of lint with a productivity of 194 kg lint per ha. In this district growth of total factor productivity was not significant during the period of analysis. But total output index showed a positive growth of 4.9 percent which was due to the positive growth of total input index. Though output recorded positive growth its sustainability is of doubt as it was not supported by the total factor productivity growth. If we examine two periods separately output showed positive growth in both the periods. In first period it was due to input growth only. During this period total factor productivity growth was negative. But the growth of output in second period was the results of positive growth in TFP as well as TII. But the contribution of TFP was more, which is a positive sign. Growth of total input index was higher during first period where as growth of total output index was higher during second period.

#### Seed

Beed registered a positive total factor productivity growth during the period of analysis. Total factor productivity increased at a compound rate of 2.02 percent per year. In this district growth of all the three indices were nonsignificant during 1991-00, But they were positive during the second period. This district showed a spectacular increase in output as well as total factor productivity during the second period. The limiting factors to productivity may have been eliminated during the second period. This growth in output is sustainable as it was caused due to the productivity growth.

#### Jalna

In Jalna total factor productivity growth was positive during overall period as well as both the individual periods. TII showed a positive growth of 2.08 percent while TOI and TFP indices showed 5.69 and 3.62 percent compound growth per year. Growth of total input index was not significant during both the periods. Growth of

total factor productivity and total output index was comparatively higher during the second period. This indicates that there are no major problems in cotton production in Jalna which limits the output growth and it is sustainable in longrun.

#### Nanded

In this district output growth was positive in the overall period as well as individual periods. Similarly total factor productivity also showed a positive growth during both the periods as well as overall period indicating the sustainability of output growth. During the overall period total factor productivity growth was 3.02 percent per annum. Growth in TOI and TII was 4.60 and 1.59 percent

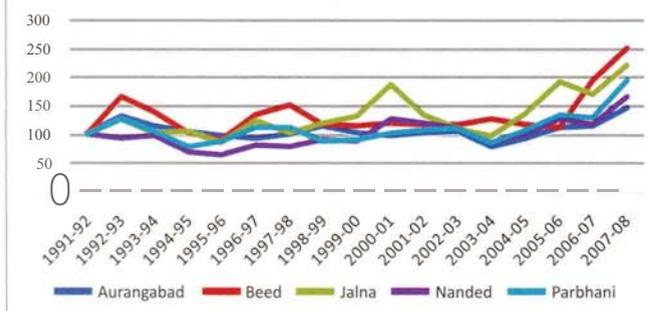
#### Parbhani

In Parbhani growth of total factor productivity was negative during 1991-00. But it registered a positive growth of 9.23 percent during 2001-08. Similarly both total output index and total input index showed a negative growth in the first period and positive growth during the second period. But all the three indices showed a positive growth during overall period. TII and total output index increased at 2.05 percent and 4.01 percent while total factor productivity increased at the rate of 2.06 percent per annum. This indicates that cotton production recovered from serious problems in second period and moving towards sustainability. This sustainability has to be maintained in the future.

Out of ten districts eighth districts showed positive significant TFP growth during the period of analysis (table 5.1.1). Out of these eight districts in amaravati and Wardha output growth is not significant and input growth was negative. But the output levels was maintained due to the growth in TFP. Output growth can be further improved by improving the input growth. In Two districts Akola and Aurangabad TFP growth was not significant. But these two districts showed positive output growth which was due to the growth in inputs. In these two districts output growth can be further improved by stimulating the productivity growth.

If we observe decadal growth rates, it is clear that during the second period TFP growth was high in all the districts. Introduction of new technologies like Bt cotton, new insecticides etc may have caused this growth. During the first period six districts showed positive total factor productivity growth while four districts showed negative growth. Highest total factor productivity growth was observed in Buldhana followed by Jalna and Wardha. Total factor productivity growth was negative in Amaravati, Aurangabad, Beed and Parbhani during this period. During the second period total factor productivity growth was positive in all the ten districts. During this period total factor productivity growth was highest in Beed followed by Jalna and Parbhani. During the overall period no district registered negative growth of total factor productivity. Highest total factor productivity growth was observed in Amaravati followed by Wardha and Jalna

Fig 5.1.3 : TFP index of cotton in Marathwada region of Maharashtra



**Table 5.1.1 : CGR of total factor productivity during different periods in Maharashtra**

District	1991-2001	2001-2009	1991-2009
Yevatmal	0.39	2.86	2.78
Wardha	2.35	7.79	4.01
Buldhana	6.08	2.70	2.46
Akola	0.70	2.84	0.96
Amaravati	-5.02	2.93	4.67
Aurangabad	-1.34	5.70	0.13
Beed	-0.21	11.21	2.02
Jalna	4.22	10.92	3.62
Nanded	1.24	5.37	3.02
Parbhani	-0.98	9.23	2.06

**TAMILNADU**

In Tamil Nadu district wise estimation of the TFP was not done due to the insufficiency of data. Hence agro-climatic zone wise total factor productivity of cotton was estimated for Cauvery Delta, Southern, North-East, North-West, and western zones for the period 1995-96 to 2003-04.

**Cauvery Delta zone**

This zone includes Trichy, Karur, Parambalur, Thanjavur, Thiruvarur and Nagapattinam districts. The results indicated that there was a fluctuation in total input and total output indices. In this zone total output index showed a negative growth of 4.99 percent. This was due to the negative growth of TFP, which registered a negative growth of 4.94 percent during the period of analysis. This clearly indicates that cotton production in this zone is not sustainable.

**Southern Zone**

This zone includes Pudukkottai, Madurai, Theni, Dindigul, Ramanathapuram, Sivaganga, Tirunelveli, Thoothukudi and Virudhunagar districts. Contrary to Cauvery Delta Zone, in this zone TFP of cotton showed a positive growth during the period of analysis indicating that cotton output growth is sustainable. In this zone output index increased at the rate of 5.51 percent while input index increased at the rate of 0.97 percent only.

**North Eastern Zone**

This zone includes Kancheepuram, Thiruvallur, Vellore, Thiruvannamalai, Villupuram and Cuddalore districts. As in Cauvery Delta Zone, in this zone also TFP showed a negative growth. TFP decreased at the rate of 5.4 percent during the period of analysis. Both TOI as well as TII showed negative growth. But decrease in output index was more than the decrease in Input index which caused the negative TFP growth. Some measures needs to be taken to make cotton production sustainable.

**North Western Zone**

This zone includes Salem, Dharmapuri, Namakkal, and Krishnagiri districts. In this zone TOI decreased at the rate of 1.00 percent per annum, though there was a positive TFP growth of 4.05 percent per annum. This was due to the negative growth in total input index. This indicates the presence of bottlenecks in input use which

needs to be corrected to have a positive output growth.

**Western Zone**

This zone includes Erode and Coimbatore districts. In this zone also output index showed a negative growth, which was a result of negative growth both in TFP as well as input index, indicating that cotton production is not sustainable. There are serious obstacles in input growth as well as productivity growth in this zone. The value of TII has increased from 0.83 in 1995 to 0.96 in 2003, which explains the increase in the cost of all the inputs over the years.

