Sources of growth to Indian groundnut: A state-wise decomposition analysis

Murlidhar Meena*, K.A. Khunt1 and Khorajia Husen1

ICAR-National Research Centre on Seed Spices, Ajmer-305 206, Rajasthan, India.

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ABSTRACT

The sources of growth has direct connotation with agricultural development policies. Growth from area expansion and price is unsustainable; whereas as if it comes from yield enhancement is sustainable over a long run. This paper has analysed the patterns and sources of growth to groundnut production in India from 1985-86 to 2014-15. Increase in value of groundnut produce was measured during 1985-86 and 94-95 as result of technology mission on oilseeds launched during mid-80s. Decrease in VOP during 1995-96 and 2004-05 may be because of adverse effect of trade liberalisation in this period. Restoration took place in last ten years from 2005-06 to 2014-15, where groundnut VOP increased in the country and to the maximum of 55 per cent in Tamil Nadu. Diversification effect was measured negative at the country as well as at major states in post-WTO periods indicated the drifting away of groundnut acreage to the other crops, is needed to be taken care by appropriate policy measures at central and state levels.

Key words: Area effect, Diversification effect, Price effect, Value of produce, Yield effect.

INTRODUCTION

Groundnut is the fifth most important oilseed produced in the world (Flecher and Shi, 2016) is grown in more than hundred countries round the globe. It is native of South America, was introduced to India during the first half of 16th century (John et al., 1955). Talawar (2004) mentioned that this crop spreaded and from Madras to Gujarat, and gradually to all the way down to the south-west of India between 1910 and 1945. Currently in India, Andhra Pradesh (26.38 and 19.61%), Gujarat (29.79 and 33.30%), Karnataka (14.45 and 9.75%), Maharashtra (6.66 and 6.82%) and Tamil Nadu (9.12 and 15.31%) are major groundnut growing states (area and production % share to nation’s total respectively) jointly contributes 80 and 75 per cent of area and production, respectively to the nation’s total. During last thirty years (1985 to 2015), the production of groundnut has increased by 22.69 per cent from 5.62 (TE 1987) to 7.27 (TE 2015) million tonnes. Wherein real value term it increased by 36.36 per cent from 10,55,641 to 16,58,715 lakh rupees in the corresponding triennium endings. This increase in production was outcome of yield enhancement from 805 to 1437 kg/ha against shrinking groundnut acreage from 6.98 mha (TE 1987) to 4.99 mha (TE 2015). This study is based on real value of groundnut produce (VOP). The value of produce is the combined effect of area, yield and price of a crop. Therefore area, yield and price contributes as major source of growth in the value of produce of an agricultural commodity. The sources of growth has connotation with agricultural development policies. If area expansion contributes a major share to the growth to a crop it reflects an unsustainable trend because land is limited and non-expandable natural resource. Similarly, growth due to price is also not sustainable in long run. The growth comes from the yield increases represents technology improvement is only sustainable source of growth over a long run. Therefore efforts should be targeted towards yield improvement for the sustainable growth in a crop (Minot et al., 2006).

MATERIALS AND METHODS

This study is purely based on secondary data collected from various sources. The data on value of groundnut produce (VOP), its area and yield, gross cropped area (GCA), states total cropped area(TCA) in all the major states was collected for last thirty years from 1985-86 to 2014-15. To make study more comparative, whole study period was divided into three equal sub period viz: 1985-86 to 1994-95 (Period 1), 1995-96 to 2004-05 (Period 2) and 2005-06 to 2014-15 (Period 3) along with overall period i.e. 1985-86 to 2014-15. The information on area, production and yield was collected from Directorate of Economics & Statistics, DAC&FW website (http://eands.dacnet.nic.in).The national and state-wise value of groundnut produce was collected from Ministry of Statistics and Program Implementation (MOSPI). The VOP to different base years was adjusted to same base year (2004-05) with appropriate linking factors given by Office of Economic

*Corresponding author’s e-mail: meenamurlidhar@gmail.com
1Junagadh Agricultural University, Junagadh- 362 001, Gujarat, India.
Adviseer, Govt. of India. Then real VOP was calculated by using consumer price index of respective years. The real price of groundnut was estimated by dividing its real value of output by its level of production in respective year. To quantify the sources of growth to Indian groundnut decomposition analysis was employed. Decomposition analysis is a mathematical technique used to partition an aggregate into its component elements. The change in value of groundnut produce was decomposed into area, yield, price and diversification effect. The growth accounting approach developed by Minot, et.al. (2006) was followed. Under this approach, the change in gross revenue from production of a crop can be decomposed into (1) change in total cropped area, (2) change in yield, (3) change in real price, and (4) a residual represents the interaction among area, yield and price factors. Other than area, yield and price diversification is also one more source of change represents reallocation of area from one to other crops. The contribution of area, yield, price and diversification was captured using the equation given below:

$$R = \sum_{i=1}^{n} A_i Y_i P_i$$ .................................................(1)

Where,

$$R = \text{Gross revenue from } n \text{ crop,}$$

$$A_i = \text{Area under crop } i,$$

$$Y_i = \text{Yield, and}$$

$$P_i = \text{Real price per unit.}$$

$$A_i = \text{can be further expressed as the share of crop } i \text{ in the total cropped area, } a_i = \frac{A_i}{\sum_{i=1}^{n} A_i}$$

and substituting this in above equation (1) we get

$$R = \left( \sum_{i=1}^{n} a_i Y_i P_i \right) A_i. .................................................(2)$$

The total derivative of both sides of equation 2 provides the absolute contribution of changes in these components to the change in gross revenue

$$dR = \left( \sum_{i=1}^{n} a_i Y_i P_i \right) d \left( \sum_{i=1}^{n} A_i \right) + \left( \sum_{i=1}^{n} A_i \right) d \left( \sum_{i=1}^{n} a_i Y_i P_i \right)$$

$$d \left( \sum_{i=1}^{n} A_i Y_i P_i \right). .................................................(3)$$

Equation 3 is only an approximation, as it excludes the interaction term. The second term on the right-hand side of this equation can be further decomposed from a change in sums to the sum of changes, as follows

$$dR = \left( \sum_{i=1}^{n} a_i Y_i P_i \right) d \left( \sum_{i=1}^{n} A_i \right) + \left( \sum_{i=1}^{n} A_i \right) \left( \sum_{i=1}^{n} a_i Y_i \right) dP_i$$

Further expansion of the second term results in the following expression:

$$dR = \left( \sum_{i=1}^{n} a_i Y_i P_i \right) d \left( \sum_{i=1}^{n} A_i \right) + \left( \sum_{i=1}^{n} A_i \right) \left( \sum_{i=1}^{n} a_i Y_i \right) dP_i.)$$

The first term on the right-hand side of this equation represents the change in gross revenue due to a change in total cropped area. The second term on the right-hand side captures the change in gross revenue due to a change in the real prices of commodities. The third term measures the change in gross revenue due to a change in crop yields or technology. The fourth term represents the change in gross revenue associated with changes in crop area share to total cropped area. Dividing both sides of final equation by the overall change in gross revenue of a crop gives us the proportionate share of each source in the overall change in gross revenue or agricultural growth.

**RESULTS AND DISCUSSION**

Groundnut acreage in the country has shrunken by 49 per cent which decrease from 7.12 mha in 1985-86 to 4.76 mha in 2014-15. Yield enhancement from 718 to 1552 kg/ha in respective years, coupled with price increase resulted increase in groundnut VOP in the country (Fig. 1). The real value of groundnut produce in India increased by 47 per cent at compound growth (CGR) of 0.33 per cent per annum from 8, 25,943 to 15,55,045 lakh rupees from 1985-86 to 2014-15 (Table 1). VOP recorded more than 4 per cent growth per annum in period 1 and period 3 but it decelerated in period 2. In period 1 groundnut VOP increased by 40 per cent from 8,25,942.93 to 13,80,763.10 lakh rupees from 1985-86 to 1995-96. Similarly it also increased by 14 per cent from 11,24,082.53 to 15,55,045.29 lakh rupees from 2006-07 to 2014-15 at the CGR of 4.03 per cent. But it decreased in between from 16,25,639.20 to 13,40,331.63 Lakh rupee from 1996-97 to 2004-05 because of decreasing trend in its production at country level (Fig. 1). Therewas positive growth in period 1 was measured in all the states with a maximum of 15 per cent in Gujarat followed by Maharashtra (5.12%). In period 2 except Gujarat all major states shown positive growth in period 1 was measured in all the states with a maximum of 15 per cent in Gujarat followed by Maharashtra (5.12%). In period 2 except Gujarat all major states shown positive growth in period 1 was measured in all the states with a maximum of 15 per cent in Gujarat followed by Maharashtra (5.12%). In period 2 except Gujarat all major states shown positive growth in period 1 was measured in all the states with a maximum of 15 per cent in Gujarat followed by Maharashtra (5.12%). In period 2 except Gujarat all major states shown positive growth in period 1 was measured in all the states with a maximum of 15 per cent in Gujarat followed by Maharashtra (5.12%).
cent since introduction of Bt-cotton in 2004. Karnataka and Tamil Nadu recorded higher growth in period 3 than period 1 and negative growth in Period 2 and overall period whereas in Maharashtra VOP increased at faster rate in period 1 than period 3.

Instability index was estimated to check the variation in groundnut VOP over the period. At country level groundnut VOP was found more volatile in post-WTO period (1995-96 to 2014-15) compared to pre-WTO period (1985-86 to 1994-95). Because production and real price become more volatile in post-WTO period with instability of 55.50 and 17.72 per cent, respectively compared to pre-WTO period where instability was 25.38 and 9.41 per cent, respectively. It might be due to increased interaction of domestic market with international markets in globalised era.

Figure 2 shown the real value of groundnut produce in major growing states from 1985-86 to 2014-15. Maximum growth with highest instability (1.06) in Gujarat among all states in overall study period indicated the vulnerability of the states VOP as it is the largest groundnut producing state in the country, faced higher consequences of changing prices. Over the period instability in Gujarat and Maharashtra has decreased whereas in southern states it increased in post-WTO periods.

To quantify the sources of growth to groundnut in the country a change in value of its produce equal to 75,548 lakh rupees during period 1 was decomposed into area, yield and price.

Table 1: Performance of groundnut value of produce (VOP, in Lakh rupees) in India and major growing states

| Period | Particulars | All India | Andhra Pradesh | Gujarat | Karnataka | Maharashtra | Tamil Nadu |
|--------|-------------|-----------|----------------|---------|------------|-------------|------------|
|        | Average     | 1340763.76 (100) | 355707.94 (25.63) | 260475.77 (19.43) | 169609.33 (12.65) | 137188.81 (10.23) | 236365.44 (17.63) |
| 1986-95 | Growth (%)  | 4.52 | 4.54 | 15.16 | 3.86 | 5.12 | 3.68 |
|        | Instability | 0.19 | 0.27 | 1.50 | 0.20 | 0.32 | 0.15 |
|        | Average     | 128906.31 (100) | 267761.28(20.76) | 447034.84(34.66) | 133615.52(10.36) | 103165.08(8.00) | 190600.88(14.78) |
| 1996-05 | Growth (%)  | -3.52 | -7.18 | 1.42 | -8.47 | -5.82 | -6.16 |
|        | Instability | 0.38 | 0.54 | 0.95 | 0.39 | 0.17 | 0.24 |
|        | Average     | 1409217.60(100) | 237820.93(16.88) | 502908.01(35.69) | 94507.09(6.71) | 76107.76(5.40) | 172486.77(12.24) |
| 2006-15 | Growth (%)  | 4.03 | 0.16 | -2.36 | 6.27 | 1.56 | 4.62 |
|        | Instability | 0.34 | 0.63 | 0.76 | 0.42 | 0.16 | 0.23 |
| 1986-2015 | Average   | 1345680.74(100) | 295272.91(21.94) | 394014.20(29.28) | 136043.87(10.11) | 106789.23(7.94) | 202016.24(15.01) |
| Growth (%) | 0.33 | -2.03 | 4.50 | -2.65 | -2.40 | -1.41 |
| Instability | 0.31 | 0.49 | 1.06 | 0.34 | 0.22 | 0.21 |

Source: Calculations based on data from Directorate of Economics & Statistics, DAC & FW (2016) and MOSPI (2016).
Central Government in 1986 to increase the production of oilseeds, to reduce import and achieve self-sufficiency in edible oils. The contribution of yield effect (6%) was recorded higher than area and price in this period. Yield increased by 28 per cent from 719 to 1007 kg/ha in 1985-86 to 1995-96, and area also increased from 7.1 Mha in 85-86 to 7.5 Mha in 95-96 resulted in positive change. Groundnut area share to GCA was 3.9 per cent in 86-86, increased to 4.1 per cent in 95-96 resulted in positive diversification indicated that area from other crops was attracted towards groundnut cultivation. But this positive impact of TMOP was short lived and could not be forwarded in period 2 as indicated by decrease in VOP equal to 38,934.81 lakh rupee in this period. Area, yield, price and diversification all the effects were measured negative in this period. The highest lose to Indian groundnut during this period was from decrease in real prices resulted a loss of 1,876 lakh rupee value. Almost equally decreased by diversification effect to the tune of 1,860 lakh rupee was found. The situations worsened further by very low yield, below a ton/ha during 96-97, 99-00, 2000-01 and 02-03 resulted in negative yield effect of 706 lakh rupees.

Diversification of groundnut acreage to the other crops resulted in area share of groundnut decreased from 4 to 3.4 per cent from 1996-97 to 2004-05 resulted in negative diversification. Hence period 2 was very disappointing for groundnuts crop in the country. Coming back to track with revival in period 3, there was increase of 43,851 lakh rupee in value of groundnut produce. It was mainly sourced through yield and price improvement and also from area effect to some extent. The diversification effect was still measured negative because area share of groundnut to GCA at country level was continue to fall further from 2.9 per cent in 06-07 to 2.4 per cent in 2014-15. In overall period at country level groundnut real VOP almost doubled from 8,25,942.94 to 15,55,045.29 lakh rupee from 1985-86 to 2014-15. The last column of Table 2 revealed that in this overall period the main source of groundnut growth in India was yield effect with contribution of 14.53 per cent to total change in overall period followed by price effect with 7.53 per cent share. Highest yield effect indicate that research and technology have contributed the maximum share in this overall growth. More than this, there was positive interaction among area, yield and price. Although there was a setback in first ten years since WTO and trade liberalisation but it was taken care over the period with good recovery in last ten years and it can be improved further in years to come.
Further, a state-wise decomposition was also carried out to identify the sources of growth in all the major groundnut growing states. In Andhra Pradesh, there was positive change in VOP in period 1 (87,048 lakh rupee) and period 3 (38,122 lakh rupee) but due to decreasing trend in VOP during period 2 there was net decrease of 41,199 lakh rupee in groundnut VOP in overall study period (Table 3).

Decomposition of change in VOP into area, price, yield and diversification effect revealed that there was positive contribution of 4,672.77 and 3,485.34 lakh rupee from area and price effect, respectively whereas yield and diversification effect was measured negative in overall period. The most up setting observation was that out of total thirty studied years the groundnut yield in Andhra Pradesh was harvested less than a ton/ha except in 1993-94, 95-96, 98-99, 2000-01 and 07-08. More than this groundnut yield in the state shown decreasing trend from 795 to 766 kg/ha from 1985-86 to 2014-15. Diversification effect was measured negative indicated that groundnut area in Andhra Pradesh has drifted away to other high value crops as result its area share in states TCA reduced to half from 13.76 to 7.45 per cent from 1985-86 to 2014-15.

In period 1, negative price effect indicated decrease in real prices during this the period. The area and diversification effect was measured positive with 2,165.77 and 8,385 lakh rupee adding to the VOP in this period, clearly indicated the significant impact of TMOP. In this period area share of groundnut to states TCA increased from 13.76 to 17 per cent from 1985-86 to 1994-95 with a maximum of 18.81 per cent in 1991-92 resulted in almost 10 per cent share to total change in period 1. During period 2, groundnut acreage in the state decreased from 22 to 18 lakh ha from

Table 3: Sources of growth to groundnut value of produce in Andhra Pradesh

| Particulars          | 1986-95 | 1996-05 | 2006-15 | 1986-2015 |
|----------------------|---------|---------|---------|-----------|
| Change in VOP        | 87048.01| -16670.19| 38122.44| -41199.73|
| Area                 | 2165.77 | -535.41 | 3042.41 | 4672.77   |
| Yield                | 327.02  | -4918.04| 4287.96 | 1134      |
| Price                | -1299.41| 321.24  | 4463.50 | -7469.81 |
| Diversification      | 8385.02 | -10352.25| -9057.85| -11025.08|
| Interaction          | 77469.60| -150885.74| 35386.43| -38029.70|

Source: Calculations based on data from Directorate of Economics & Statistics, DAC & FW (2016) and MOSPI (2016).

Table 4: Sources of growth to groundnut value of produce in Gujarat

| Particulars          | 1986-95 | 1996-05 | 2006-15 | 1986-2015 |
|----------------------|---------|---------|---------|-----------|
| Change in VOP        | 244030.76| 102103.95| 47865.61| 394000.32|
| Area                 | 4860.30 | 1581.99 | 6826.11 | 13268.40 |
| Yield                | 13606.62| 15387.83| 16354.70| 45349.15 |
| Price                | 2846.17 | 5799.71 | -4516.27| -7245.81 |
| Diversification      | 2791.00 | 321.24  | 4463.50 | 3485.34   |
| Interaction          | 219926.67| 10352.25| 35386.43| -38029.70|

Source: Calculations based on data from Directorate of Economics & Statistics, DAC & FW (2016) and MOSPI (2016).
96-97 to 04-05 resulting its area share to states TCA reduced from 16 to 14 per cent in respective years. Groundnut yield also decreased from 930 to 890 kg/ha from 96-97 to 04-05. It was recorded still low at 557 and 660 kg/ha in 02-03 and 03-04, respectively. Decreasing trend in yield was continue in period 3 also. The negative area, yield and diversification effect amplified with negative interaction combined to a highest negative change in VOP by 1,66,370 lakh rupee in period 2. This negative yield effect was depressing and point to ponder which calls the special attention for yield improvement of the crop in the state with HYVs and advance production technologies. The major challenges for groundnut cultivation in Andhra Pradesh are scarcity of water for supplementary irrigation and its cultivation under resource poor situation. In the state around half to the states total groundnut acreage comes from a single district i.e. Anantpur (46% of state total) where yield of groundnut is very low varying between 500 to 600 kg/ha was the serious issue to be noticed. There is need to consider it seriously for improvement of this crop in state. In period 3 an increase in VOP was measured to the amount of 38,122 lakh rupee which was shared equally through yield and price enhancement. Area effect was also measured positive along with interaction. Negative diversification effect pointed out the decreasing share of groundnut area to TCA.

Table 4 depicts the sources of growth to groundnut in Gujarat where positive change in VOP was noticed in all the periods including the overall study period. Gujarat was the only state among all the major groundnut growing states where increase in groundnut value of produce was measured throughout the study years. This over whelming performance of groundnut in Gujarat makes this crop proud. Groundnut output in the state recorded the highest positive change in value of produce among all the major states. In the overall study period there was positive change of 3,94,000 lakh rupee in VOP where main sources to this gain was yield (11.51%) followed by area effect (3.37%). Except in period 1 price effect was found negative indicated the decrease in real prices of groundnut in post-WTO period resulted in negative contribution of 7,469 lakh rupee in overall period. In period 1, VOP increased by 2,44,030 lakh rupee as result of positive contribution from area, yield, price and diversification to the tune of 4,860, 13,606, 2,846 and 2,791 lakh rupee, respectively together with positive interaction effect of 2,19,926 lakh rupee. During period 2, price effect was measured negative because real prices decreased from 21,312 to 16,973 Rs/ton from 1996-97 to 2004-05. The area under groundnut increased by one lakh ha in period 2 resulted in positive area effect. Yield was the major contributor to this growth with 15 per cent contribution in total change. Yield almost doubled from 540 kg/ha in 1995-96 to 943 kg/ha in 2004-05. The share of groundnut to states TCA increased from 16.67 to 17.77 per cent from 1996-97 to 2004-05 with the maximum of 19 per cent in 2002-03. The interaction of area, yield and price was measured with positive contribution. In period 3 and overall period also, diversification effect was measured negative indicated the diversification of groundnut area to other crops resulted in decreased share of groundnut in states TCA from 17 to 11 per cent from 2004-05 to 2014-15, respectively. This might be because of increased cotton area in state since introduction of Bt-cotton for commercial cultivation in 2004. Yield improvement played a key role in increasing value of groundnut produce in state in period 3. Yield effect was measured to contribute 34 per cent to total change as result of 20 per cent yield improvement from 1734 to 2154 kg/ha from 2004-05 to 2014-15, respectively. The increase in yield effect over the periods is good sign indicated advancement in groundnut production technologies in the state. Patnaik and Shah (2015) in their study on decomposition of agricultural growth in Gujarat have identified price effect as main source of a growth with more than 10 per cent share to agricultural growth in Gujarat. Here in case of groundnut growth yield was the main source of growth in Gujarat especially in last one decade is good sign as growth from price change in unsustainable in long run.

Birthal et al., (2014) measured the poor performance in real value of groundnut output in southern India representing Andhra Pradesh, Karnataka and Tamil Nadu. They found the decreasing share of groundnut area in gross cropped area from 12.7 per cent in 1990s to 9.6 per cent in 2000s. Real value of groundnut output decreased at 3 per cent per annum during 90s and was almost stagnant in 2000s. Similar results were also obtained in present study. The real value of groundnut produce in Karnataka increased in pre-WTO period from 1,14,078.37 to 1,98,503.811 from 1985-86 to 1995-96, resulted a positive change of 39,664 lakh rupee in groundnut VOP in period 1 (Table 5). The area, yield and diversification effect was found to contribute

| Particulars | 1986-95 Value | 1996-05 Value | 2006-15 Value | 1986-2015 Value |
|-------------|---------------|---------------|---------------|-----------------|
| Change in VOP | 39664.55 | 92180.08 | 16346.38 | 36169.15 |
| Area | 820.58 | 1561.67 | 1795.71 | 293.84 |
| Yield | 3219.71 | 1561.67 | 1795.71 | 39664.55 |
| Price | 654.72 | 11.77 | 15.64 | 0.06 |
| Diversification | 293.84 | 15.64 | 15.64 | 0.06 |
| Interaction | 35390.20 | 5.49 | 15.64 | 39664.55 |

Source: Calculations based on data from Directorate of Economics & Statistics, DAC & FW (2016) and MOSPI (2016).
positively whereas price effect was measured as negative due to decreased in real prices from 18,685 to 17,185 Rs/ton. In period 1, groundnut area expanded by additional 2 lakh ha contributed 820 lakh rupee to total VOP increase. Yield in the state increased from 698 to 787 kg/ha from 1985-86 to 1994-95 added 2,775 lakh rupee to total change in VOP. The area share of groundnut to states TCA increased from 9 to 10 per cent yielded 2,158 lakh rupee valued groundnut in period 1. Hence period 1 was fruitful to this crop in state. Period 2 was found unfavourable as there was negative change in groundnut VOP in state. Real VOP in this period reduced to less than half from 2,00,019 to 91,346 lakh rupees from 1996-97 to 2004-05 as result of negative area, yield and diversification effect. Groundnut area in Karnataka decreased by more than 2 lakh ha consequently its area share to state TCA falls from 9.96 to 7.56 per cent from 1996-97 to 2004-05, resulted in negative area and diversification effect. Price effect was positive but was very meagre could not make an accountable contribution. The performance of groundnut in period 3 rejuvenated with a positive change of 16,346 lakh rupee. It was result of positive yield and price effect with the contribution of 1,561 and 3,219 lakh rupee. Yield in state improved from 645 to 768 kg/ha and real prices increased by 35 per cent from 13,613 to 21,009 Rs/ton from 2005-06 to 2014-15. On the other hand area and diversification was measured negative in period 3. Groundnut area in Karnataka shrunken by 4 lakh ha from 10.4 to 6.54 lakh ha from 2005-06 to 2014-15 resulting decrease in groundnut production from 6.7 to 5 lakh tonnes in respective years. Its area share in state TCA area falls from 7.98 to 5.43 per cent in respective years. The inverse area and diversification effect was taken care by good yield and price effect resulted in positive change in groundnut VOP in period 3. In overall study period due to decrease in state groundnut production by 40 per cent from 7 to 5 lakh tonnes from 1985-86 to 2014-15 there was negative change of 36,169 lakh rupee in its VOP. The area, yield and price effects were found to contribute low compared to negative diversification and adverse interaction among each other resulted in net loose to the groundnut VOP in Karnataka (Table 5). The 16 per cent of total loose was due to diversification of its area to the other crops. The negative diversification effect in post-WTO periods was because of decrease in groundnut area share to half, from 10 per cent in 1996-97 to 5 per cent in 2013-14 to states TCA. The technology advancement has paved in term of yield enhancement during study period but these findings gave signals to improve yield further with HYVs and INM. So that share of groundnut in overall growth of southern states (was negative in 90s (-13%) and in 2000s (-2.1%); Birthal et al., 2014) can be improved.

Similar to Karnataka, in Maharashtra also, the value of groundnut produce was found to decrease in post-WTO period whereas positive change was measured in period 1 i.e. pre-WTO. The VOP increased by 32 per cent from 96,025 to 1,41,560 lakh rupee from 1985-86 to 1994-95. The major contributor of this gain was yield effect contributing 10.65 per cent total change as yield increased by 400 kg/ha in this period. Area effect was found to contribute 658 lakh rupee, area under groundnut increased by more than 2.5 lakh ha in first four years of this period but decrease in later six years, confined area share to 1.45 per cent to the total change. Price effect was measured negative due to decrease in real prices from 18,685 to 17,185 Rs/ton from 1985-86 to 1994-95. Diversification was measured negative due to decreased area share to states TCA in this period. Value of produce decreased by 14,893 lakh crore rupees during overall period, mainly because of higher negative change in period 2 (57,905.40 lakh rupees) than period 3 (2,523.74 lakh rupees). Result indicated recovery in VOP in period 3 as result of higher prices in this period. Real prices in the state in later period increased from 13,613 in 1996-97 to 21,009 Rs/ton in 2014-15 with the maximum of 26,685 Rs/ton in 12-13 resulted in big price effect of 82 per cent to the tune of net addition of 2,065 lakh rupees crop value in period 3. The area effect was measured positive in all the periods in Maharashtra including overall period as result of increase in TCA in state from 20,566 to 22,036 thousand ha from 1985-86 to 2014-15. In overall study period yield was the major contributing factor to the total change in groundnut VOP in Maharashtra with 31 per cent share to total change is good sign. Groundnut yield in this state continuously increased from 707 kg/ha in 1985-86 to 1,159 kg/ha in 2014-15 but still there is large scope to improve further as there exist a wide yield gap compared to national average and more if compared to Gujarat and Tamil Nadu. There is need tobridge this gap in years to come for the betterment of the groundnut farmers in the state. The diversification effect was found negative in all the periods due to continuously decreasing area share of groundnut to states TCA to less than half from 3.22 per cent in 1985-86 to 1.48 per cent in 2014-15 (Table 6).

Table 6: Sources of growth to groundnut value of produce in Maharashtra

| Particulars | 1986-95 | 1996-05 | 2006-15 | 1986-2015 |
|-------------|---------|---------|---------|-----------|
| Value       | Percent | Value   | Percent | Value     | Percent | Value   | Percent |
| Change in VOP | 45535.67 | 100.00 | -57905.40 | -100.00 | -2523.74 | -100.00 | -14893.48 | -100.00 |
| Area        | 658.54  | 1.45    | 212.61  | 0.37    | 36.55    | 1.45    | 907.70    | 6.09    |
| Yield       | 4848.97 | 10.65   | -159.20 | -0.27   | -37.02   | -1.47   | 4652.76   | 31.24   |
| Price       | -1523.60 | -3.35  | 2.95    | 0.01    | 2065.15  | 81.83   | 544.50    | 3.66    |
| Diversification | -720.31 | -1.58  | -4521.26 | -7.81   | -1989.90 | -78.85  | -7231.46  | -48.55  |
| Interaction | 42272.06 | 92.83  | -53440.51 | -92.29  | -2598.53 | -102.96 | -13766.98 | -92.44  |

Source: Calculations based on data from Directorate of Economics & Statistics, DAC & FW (2016) and MOSPI (2016).
Table 7 represents the sources of growth to groundnut in Tamil Nadu. It is the highest yielding state as more than one third of this crop is grown under irrigated condition. In period 1, yield varied between 1,551 to 1,944 kg/ha which was higher than rest of the states. With great boost it increased continuously in period 2, from 1,774 in 2005-06 to 2,752 kg/ha in 2014-15. The performance of this crop in the state was found excellent in Period 1 where VOP increased by 58,185 lakh rupee. Area, yield and diversification effect was found positive and maximum contribution was made through yield enhancement. In period 1, the yield of groundnut increased by 22 per cent, from 1,261 to 1,628 kg/ha from 1985-86 to 94-95. In second period value of groundnut produce decreased from 2,25,582 to 1,45,648 lakh rupees from 1996-97 to 2004-05. Then after it again increased from 1,59,019 to 1,94,632 lakh rupees from 2005-06 to 2014-15, resulting decrease in VOP by 1,35,882 lakh rupee in period 2 and increase in VOP by 59,976 lakh rupee in period 3. During the whole study period, change in VOP was measured negative to 17,720 lakh rupees because of more adverse effect during first ten years of liberalisation. The decomposition analysis of change in real VOP in overall study period spelt out the positive contribution from yield contributing 54 per cent increase in total change. But countable decrease in VOP was measured due to diversification of groundnut acreage to the high value crops in the state. The area share of groundnut to states TCA decreased from almost 15 to 6 per cent in 1985-86 to 2014-15. The area effect was also measured negative as groundnut area in Tamil Nadu reduced to almost one third in the study period from 9.3 to 3.3 lakh from 1985-86 to 2014-15. Other than yield, price effect also contributed positively in period 3 accounted to 6,442 lakh rupees value in period 3. The point to surprise here was that in spite of highest yield in Tamil Nadu indicating better technology in state, groundnut area share to states total crop area is falling very drastically i.e. acreage under groundnut is shrinking rapidly. The major source of growth in state was yield which clearly pointed out the contribution of research and technology to VOP growth is good sign, but issue need to analyse further is groundnuts falling area in Tamil Nadu and also in other major groundnut growing states.

CONCLUSION

The value of groundnut produce in the country and in major states has increased during 1985-86 to 1994-95 as positive impact of Technology Mission on Oilseeds of mid 80’s. Decreased in its VOP was seen during 1995-96 to 2004-05 may be because of adverse impact of agricultural trade liberalisation in mid 90’s. In last ten years value of groundnut produce in India has shown revival trend from 2005-06 to 2014-15, along with major states except in Maharashtra. Yield was assessed as main source of growth in groundnut VOP in the country, can be improved further with HYVs and Integrated Nutrient Management and by increasing irrigation coverage in the crop. Yield effect was followed by price and area effect. At the country level area, yield and price interaction was found positive. Diversification was positive in pre-WTO period turned in to negative in post-WTO period need to be taken care through appropriate policy supports at central and state levels.

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