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# Decomposition analysis of pigeon pea and chickpea in Marathwadaregion of Maharashtra state

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**Abstract**
The paper examines the decomposition analysis of area, production and productivity of pigeon pea and chickpea in Marathwada region of Maharashtra State. Marathwada region was selected purposively for the present study. The analysis is primarily based on secondary data related to area, production and productivity of pulses crops. To study, growth and instability in area production and productivity of selected pulses crops viz. pigeon pea and chickpea crops. Data were collected from various sources. The data were collected from the Epitome of agriculture for the period of 30 years i.e. from 1986-87 to 2015-16. The entire study was split into three periods. The compound growth rates were tested for their significance. The results shows that, the results of the decomposition analysis showed that yield effect was the a major source of productivity chickpea and pigeon pea followed by area and interaction effect.

**Keywords:** Decomposition analysis, pigeon pea, chickpea, Marathwada, Maharashtra

## Introduction
Pulses have a unique role to play in the global nitrogen cycle, pulse fix atmospheric nitrogen in soils. The introduction of pulses into crop rotations actively helps to fix nitrogen in the soil and also reduce the greenhouse gas emission to the environment from subsequent crops therefore it maximizes the environmental benefits.

Pulses are grown in more than 171 countries. The world's major producers of pulses are India (23.1 per cent), China (12.08 per cent), Myanmar (7.57 per cent), Canada (6.7 per cent) and Brazil (4.03 per cent) which together account for half of the global output (Shingne *et al*., 2017). India is largest producer (25 per cent of global production), consumer (27 per cent of world consumption) and importer (14 per cent) of pulses in the world (Chavan *et al*., 2017). Pulses account for around 20 per cent of the area under food grains and contribute around 7-10 per cent of the total food grains production in the country. Though pulses are grown in both *Kharif* and *Rabi* seasons, *Rabi* pulses contribute more than 60 per cent of the total pulse production. Gram is the most dominant pulses having a share of around 40 per cent in the total production followed by Arhar at 15-20 per cent and Black gram and Green gram at around 8-10 per cent each. The major pulses producing states are Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh, Karnataka and Andhra Pradesh which together accounts for about 80 per cent of the total production.

The pulses in India are grown in semi-arid areas which face high rainfall variability adding to high instability and low productivity. Best parcel of lands with irrigation facility is usually reserved for other crops by farmers. The progress of pulses has always been lukewarm in spite of the overall impressive growth of Indian agriculture. The government has focused on improving pulse production through various programmes like in 1967 it established the All India Coordinated Pulses Improvement Project (AICRIP), which was later elevated to the Indian Institute of Pulses Research (IIPR). Pulses also have received significant attention in different five-year plans, including the Intensive Pulses District Program launched during the Fourth Five-Year Plan (1969-1974), National Pulses Development Program launched during the Seventh Five-Year Plan (1985-89), Technology Mission on pulses 1986 and a special food grain production program launched in 1988-1989, National Pulses Development Project in 1990-91, Integrated Scheme of Oilseeds, Pulses, Oil palm and Maize in 2004 (ISOPOM).National Food Security Mission in 2007-08 being implemented in 171 identified districts of 14 major pulses growing states and A3P i.e. Accelerated Pulses Production Programme (2010) but supply remain down the line compared to the demand and country has to heavily relies on imports to bridge the supply-demand gap. The growth in production and productivity of pulses has lagged behind the population growth rate which resulted into a

decline in per capita availability of pulses from 66 g/day during triennium ending (TE) 1965 to 47.20 g/day during 2016 against Indian Council of Medical Research (ICMR) norms of 40 g/day (Chavan *et al*., 2017).

Maharashra is one of the major pulse productivity states. Government of India has all the pulse development programme *viz;* Intensive pulses district programme, National pulse development programme, technology mission of pulses, ISOPOM, NFSM and A3P which aims to improve the pulse production.

Inspite these programme, there is gap between demand and supply of pulses of national level. So, this particular study was under taken to know the effect of there pulses development programme (which were implemented in Maharashtra) on performance of the pulses in the state. The specific objective of the study was to estimate growth rates of area, production and yield of major pulse crops in Marathwada region.

## Methodology

### Collection of Data

Marathwada region was selected purposively for the study. The entire eight district of Marathwada region was selected. The analysis is primarily based on secondary data related to area, production and productivity of pulses. The growth in area, production and productivity of two major pulses, *viz*; Pigeon pea and Chickpea were studied. The time series secondary data were collected from various sources *viz*; Epitome of Agriculture – Part II published by Government of Maharashtra. The official website of Department of Agriculture, Government of Maharashtra. The data were collected for the period of 30 years i.e. from 1986-87 to 2015-16. The entire study was split into three sub periods. The sub period was framed as Period-I: 1986-87 to 1995-96, Period-II: 1996-97 to 2005-06, Period-III: 2006-07 to 2015-16 and Overall Period: 1986-87 to 2015-16. Specifically data were collected as Government of India has launched from 1986-87, Technology Mission on Pulses during 1986 to increase the production of pulses, to reduce import and to achieve self-sufficiency in pulses.

### Decomposition Analysis

To measure the relative contribution of area and yield towards the total output, a decomposition model suggested by Minhas & Vidhyanathan and redeveloped by Sharma was used. In the decomposition analysis the change in production was taken as the effect of three factors such as yield effect, area effect and interaction effect. Though, Minhas and Vaidyanathan (1965) mentioned the importance of technology in the growth of agriculture they did not bring in their analysis. It should be noted that irrigation is very important factor whose effects spans all the component of crop output which is not studied by any of the studies. One needs to consider all these factors and develop a decomposition scheme. It would be good area to explore the sources of agricultural growth through decomposition analysis in the recent past as agriculture growth is decelerating and by doing so an effective policy measure could be implemented for a better growth performance in agriculture. Sharma (1977) also decomposed the total change in the value of production into seven components using the decomposing procedure depicted as under $X = P0A0\Delta Y \times A0Y0\Delta P + P0Y0\Delta A + P0\ \Delta A\ \Delta Y + P0\ \Delta A\ \Delta Y + Y\Delta\ A\ \Delta P + \Delta A\ \Delta Y\ \Delta P$ Where, X was output in the value term, A = Area under the crops, Y = Yield and subscript 0 represent base period and Δ represent the change. The first three terms on the right hand side indicates the yield, area. Whereby the remaining represents their interaction

$\Delta P = A0\ \Delta Y + Y0\ \Delta A + \Delta A\ \Delta Y$

Where,

ΔP = Change in production

A0 = Area in base year

Y0 = Yield in the base year

Yt = Yield in the current year

At = Area in the current year

ΔA = Change in area (At-A0)

ΔY = Change in the yield (Yt - Y0)

Change in production = Yield effect + Area effect + Interaction effect. Thus, the total change in production was decomposed into three effects viz. Yield effect, area effect and interaction effect due to change in yield and area.

## Results and Discussion

### Pigeon pea

Growth decomposition of pigeon pea in districts of Marathwada region and at Maharashtra state. The decomposition of pigeon pea production in area, yield and interaction effects presented in Table 1 and which demonstrate that per cent contribution of area, yield and their interaction for increasing production of pigeon pea in all districts of Marathwada region. During period-I, the result clearly indicated that, the area effect (4.31 per cent) was least responsible for increasing the production of pigeon pea in Marathwada region with yield effect (104 per cent) and interaction effect -10.16. Interaction effect was negative for all the districts. Aurangabad district recorded highest area effect (19.76 per cent). Lowest area effect was found in the Nanded district (0.69 per cent). In all the districts of Marathwada region yield effect was the major contributor to the production of pigeon pea crop i.e. more than (90 per cent). During period-II, it was noticed that yield effect has got domination over the area effect. In Marathwada region as a whole area effect was found only (1.80 per cent) whereas, yield effect was found (97.81 per cent) and interaction effect was (6.57 per cent). In Parbhani district highest area effect (14.19 per cent) was recorded. Lowest area effect was found in the Nanded district (0.77 per cent). Highest yield effect was found in the Beed district (108 per cent). During this period also, yield effect was more than area effect on production of pulses crops in all the districts of During period-III, the area effect (2.14 per cent) was least responsible for increasing the production of pigeon pea in Marathwada region. In Marathwada region area effect, yield effect and interaction effect was recorded on (2.14 per cent), (89.99 per cent) and (7.72 per cent), respectively. Interaction effect was positive for all the districts except Beed. The Aurangabad district recorded highest area effect (30.75 per cent). Lowest area effect was found in the Latur district (1.77 per cent). Highest yield effect was also found in the Beed district i.e. 107 per cent. Yield effect was more than area effect in production of pulses in all the districts of Marathwada region. During overall period, it was noticed that yield effect has dominated over the area effect. In Marathwada region as a whole area effect was found only (2.84 per cent) whereas, yield effect was found (99.55 per cent) and interaction effect was (-5.10 per cent). Hingoli district recorded highest area effect of (14.52 per cent). Lowest area effect was found in the Nanded district (2.17 per cent). Highest yield effect was also found in the Hingoli district (114.85 per cent). In Maharashtra state as a whole interaction effect was negative in all period except period-III wherein interaction effect was positive. The area

effect was highest in period-III (5.21 per cent). The yield effect was highest in period-I (100.3 per cent). The lowest area effect was found in period-II (1.83 per cent). The present results are in the line with the findings of Nethrayini and Mundinamani (2013) [4].

**Table 1:** Growth decomposition of Pigeon pea in districts of Marathwada region and at Maharashtra State.

| Sr. No. | Name | Period-I | | | Period-II | | | Period-III | | | Overall | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Area effect | Yield effect | Interaction effect | Area effect | Yield effect | Interaction effect | Area effect | Yield effect | Interaction effect | Area effect | Yield effect | Interaction effect |
| 01 | Aurangabad | 19.79 | 106.2 | -13.14 | 10.42 | 85.83 | 12.26 | 30.75 | 53.64 | 9.97 | 14.43 | 78.53 | 0.65 |
| 02 | Jalna | 4.50 | 109.1 | -20.98 | 5.84 | 78.01 | 19.57 | 8.15 | 91.94 | 4.73 | 4.96 | 91.21 | 5.48 |
| 03 | Beed | 6.97 | 93.48 | -7.77 | 3.36 | 107.6 | -1.05 | 13.38 | 107.4 | -13.08 | 6.19 | 97.62 | -7.13 |
| 04 | Latur | 1.96 | 101.4 | -3.34 | 1.86 | 105 | 0.35 | 1.77 | 100 | 1.25 | 5.58 | 97.82 | -11.03 |
| 05 | Osmanabad | 5.40 | 95.18 | -0.80 | 2.02 | 86.24 | 15.48 | 9.42 | 62.01 | 18.84 | 5.71 | 79.25 | 13.32 |
| 06 | Nanded | 0.69 | 91.31 | 4.97 | 0.77 | 100 | 2.27 | 2.25 | 96.41 | 2.16 | 2.17 | 107.89 | -8.81 |
| 07 | Parbhani | 6.51 | 90.70 | -6.06 | 14.19 | 90.24 | -23.63 | 1.81 | 83.69 | 12.85 | 12.54 | 88.74 | -16.49 |
| 08 | Hingoli | NA | NA | NA | 11.57 | 105 | -15.38 | 5.27 | 81.63 | 6.07 | 14.52 | 114.85 | -39.26 |
| 09 | Marathwada | 4.31 | 104 | -10.16 | 1.80 | 97.81 | 6.57 | 2.14 | 89.99 | 7.72 | 2.84 | 99.55 | -5.10 |
| 10 | Maharashtra | 3.98 | 100.3 | -7.18 | 1.83 | 102.6 | -1.29 | 5.21 | 95.14 | 4.62 | 5.14 | 99.01 | -4.18 |

**Note:** Period-I: 1986-87 to 1995-96, Period-II: 1996-97 to 2005-06, Period-III: 2006-07 to 2015-16, Overall Period: 1986-87 to 2015-16.

**Chickpea**

4.4.2 Growth decomposition of chickpea in districts of Marathwada region and at Maharashtra state. The decomposition of chickpea production in area, yield and interaction effects presented in Table 2 and which demonstrate the per cent contribution of area, yield and their interaction for increasing production of chickpea in all districts of Marathwada region. During period-I, the result clearly indicated that, the area effect of 20.46 per cent was least responsible for increasing the production of chickpea in Marathwada region with yield effect (45.65 per cent) and interaction effect 36.87. Interaction effect was positive for all the districts except Nanded. The Nanded district recorded highest area effect (54.39 per cent). Lowest area effect was found in the Osmanabad district (16.61 per cent). Highest yield effect was also found in the Osmanabad district (65.95 per cent). During period-II, it was noticed that yield effect has dominated the area effect. In Marathwada region as a whole area effect was found only (14.10 per cent) whereas, yield effect found (53.85 per cent) and interaction effect was (29.52 per cent). The Parbhani district recorded highest area effect (38.90 per cent). Lowest area effect was found in the Osmanabad district (4.26 per cent). Highest yield effect was also found in the Osmanabad district (91.88 per cent). During this period also, yield effect was more than area effect on production of chickpea crops in all the districts of Marathwada region. During period-III, the area effect (11.14 per cent) was least responsible for increasing the production of chickpea in Marathwada region. In whole Marathwada region area effect, yield effect and interaction effect was recorded (11.14 per cent), (53.95 per cent) and (23.53 per cent), respectively. Interaction effect was positive for all the districts except Beed. The Beed district was recorded highest area effect (45.52 per cent). Lowest area effect was found in the Latur district (3.43 per cent). Highest yield effect was also found in the Nanded district (71.21 per cent). During this period also, yield effect was more than area effect in production of chickpea crops in all the districts of Marathwada region. During overall period, it was noticed that yield effect has got domination over the area effect. In Marathwada region as a whole area effect was found only (16.74 per cent) whereas, yield effect was found (49.40 per cent) and interaction effect was (26.83 per cent). The Beed district recorded highest area effect (54.39 per cent). Lowest area effect was found in the Latur district (10.19 per cent). Highest yield effect was also found in the Jalna district (70.95 per cent). Interaction effect was positive for all the districts except Beed and Jalna. In Maharashtra state as a whole interaction effect was positive in all period. The area effect was highest in overall period (28.16 per cent). The yield effect was highest in period-III (47.84 per cent). The lowest area effect was found in period-I 23.76. So it can be conclude that in this period also area effect was responsible for increasing production of chickpea in the Marathwada region of Maharashtra state. The present results are in the line with the findings of (Chatterjee *et al*., 2014) [1].

**Table 2:** Growth decomposition of Chickpea in districts of Marathwada region and at Maharashtra State.

| Sr. No. | Name | Period-I | | | Period-II | | | Period-III | | | Overall | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Area effect | Yield effect | Interaction effect | Area effect | Yield effect | Interaction effect | Area effect | Yield effect | Interaction effect | Area effect | Yield effect | Interaction effect |
| 01 | Aurangabad | 24.92 | 36.56 | 44.85 | 36.79 | 41.13 | 24.02 | 22.05 | 50.42 | 35.21 | 18.24 | 45.65 | 37.39 |
| 02 | Jalna | 20.42 | 56.40 | 19.28 | 20.30 | 44.29 | 35.36 | 9.81 | 64.59 | 29.34 | 21.39 | 70.95 | -1.58 |
| 03 | Beed | 19.28 | 51.63 | 40.81 | 27.38 | 60.97 | 11.50 | 45.52 | 49.06 | -0.37 | 54.39 | 38.88 | -1.19 |
| 04 | Latur | 35.14 | 38.71 | 37.22 | 8.77 | 52.52 | 30.12 | 3.43 | 62.58 | 18.93 | 10.19 | 47.56 | 21.09 |
| 05 | Osmanabad | 16.61 | 65.95 | 26.62 | 4.26 | 91.88 | 5.09 | 40.15 | 56.09 | 11.52 | 24.93 | 69.42 | 14.03 |
| 06 | Nanded | 54.39 | 65.34 | -10.87 | 35.59 | 52.27 | 19.56 | 10.98 | 71.41 | 14.21 | 23.11 | 71.21 | 26.62 |
| 07 | Parbhani | 22.07 | 45.12 | 31.13 | 38.90 | 47.91 | 15.21 | 25.82 | 38.91 | 32.84 | 28.95 | 50.03 | 29.94 |
| 08 | Hingoli | NA | NA | NA | 22.17 | 53.72 | 22.80 | 12.47 | 67.77 | 15.20 | 12.61 | 49.01 | 15.13 |
| 09 | Marathwada region | 20.46 | 45.65 | 36.87 | 14.10 | 53.85 | 29.52 | 11.44 | 53.95 | 23.53 | 16.74 | 49.40 | 26.83 |
| 10 | Maharashtra State | 23.76 | 43.52 | 29.28 | 25.94 | 35.00 | 32.27 | 26.64 | 47.84 | 16.57 | 28.16 | 36.46 | 30.32 |

**Note:** Period-I: 1986-87 to 1995-96, Period-II: 1996-97 to 2005-06, Period-III: 2006-07 to 2015-16, Overall Period: 1986-87 to 2015-16.

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