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# To analyse Area effect, Yield effect and Interaction effect in change in production of major vegetables

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**Abstract**
Decomposition analysis was carried out to determine the extent of relative contribution of area, yield and then interaction which are responsible for the change in value of production of the vegetable under study in Chhattisgarh plains and Chhattisgarh state. The decomposition analysis was carried out to find out the contribution of area and yield towards increase/decrease in major vegetable crops production during the period under study 2004-05 to 2020-21.

**Keywords:** Area effect, Yield effect, Intraction effect, area, production and productivity

## Introduction
Chhattisgarh analyze the dynamics of growth and decomposition of major vegetable crops like tomato, brinjal, okra, and potato. This analysis helps understand growth trends and the factors contributing to production increases**.**

## Material and methods
### Selection of area
Chhattisgarh state of India was considered purposely for study purpose and all the 3 agro-climatic zones *viz* Chhattisgarh plain, Bastar plateau and northern hills were considered for detail investigation. Out of the three agro-climatic zones, the Chhattisgarh plain zone was selected only because the major vegetable area and production to be covered more than 60 percent of the Chhattisgarh state.

### Selection of Crop
The major vegetable crops *viz* potato, okra, brinjal, onion and tomato were selected for the study as area covered in these vegetable was found to be more than 60 percent in Chhattisgarh plain zone of Chhattisgarh state as compared to other vegetable in the Chhattisgarh plain zone of state.

### Nature and sources of data
This study is based on secondary data which is obtained from the website of Government of Chhattisgarh Agriculture Development and Farmer Welfare and Bio – Technology Department (agriportal.cg.nic.in).

### Period of Study
The data was collected for the period of 17 Years from 2004-05 to 2020-21.

### Analytical tool
For estimation of contribution of area and yield towards change in production (positive/negative) the following model (Sharma 1977) [3] was used.

### Percentage share of average yield in total production

$$\text{Yield Effect} = \frac{(Yn-Yo)Ao}{Pn-Po} \text{X } 100$$

**2. Percentage share of area in total production**

$$\text{Area Effect} = \frac{(An-Ao)Yo}{Pn-Po} X\ 100$$

**Percentage share of area and yield (simultaneous variation) interaction towards total production**

$$\text{Interaction Effect} = \frac{(An-Ao)(Yn-Yo)}{Pn-Po} X\ 100$$

$A_o/P_o/Y_o$ = Triennium average (2004-05 to 2006-07) of area, production and yield of selected Crops
$A_n/P_n/Y_n$ = Triennium average (2018-19 to 2020-21)) of area, production and yield of selected crops
$Y_o = P_o/A_o$
$Y_n = P_n/A_n$

**Result and Discussion**
The decomposition analysis was carried out to find out the contribution of area and yield towards increase/decrease in major vegetable crops production during the period under study 2004-05 to 2020-21.

**Brinjal**
In Chhattisgarh plains zone and Chhattisgarh state area (51.69 and 79.73%), yield (44.57 and 16.51%) and interaction (3.74 and 3.76%) effect shown positive change in production of brinjal which was found to be 330.85 (202.53%), 475.13 (210.89%) thousand metric tonnes, respectively.
Which show that production of brinjal in Chhattisgarh plain and Chhattisgarh state is increasing because area under the crop is increasing mean area effect is more prominent as compare to yield and Interaction Effect.

**Tomato**
In Chhattisgarh plains zone and Chhattisgarh state area (49.24, 66.12%), yield (41.08, 25.43%) and interaction (9.68, 8.45%) effect shown positive change in production of tomato which was found to be 627.86 (275.57%), 833.21 (263.31%) thousand metric tonnes, respectively.
Which show that production of brinjal in Chhattisgarh plain and Chhattisgarh state is increasing because area under the crop is increasing mean area effect is more prominent as compare to yield and Interaction Effect.

**Potato**
In Chhattisgarh plains zone area (33.66%) and interaction (3.99%) effect shown negative, yield (137.65%) effect shown positive change in production of potato which was found to be 235.62 (202.94%) thousand metric tonnes, respectively.
In Chhattisgarh state area (122.47%) effect shown positive, yield (20.89%) and interaction (1.58%) effect shown negative, the change in production of potato which was found to be 363.72 (135.72%) thousand metric tonnes, respectively.

**Okra**
In Chhattisgarh plains zone and Chhattisgarh state area (7.37, 84.29%), yield (92.31, 84.29%) and interaction (0.33, 3.94%) effect shown positive change in production of okra which was found to be 121.05 (125.35%), 186.17(122.92%) thousand metric tonnes, respectively.
Which show that production of brinjal in Chhattisgarh plain and Chhattisgarh state is increasing because area under the crop is increasing mean area effect is more prominent as compare to yield and Interaction Effect.

**Onion**
In Chhattisgarh plains zone and Chhattisgarh state area (47.76, 84.85%), yield (44.21, 10.27%) and interaction (8.08, 4.88%) effect shown positive change in production of onion which was found to be 213.49 (473.31%), 334.07(404.88%) thousand metric tonnes, respectively.
Which show that production of brinjal in Chhattisgarh plain and Chhattisgarh state is increasing because area under the crop is increasing mean area effect is more prominent as compare to yield and Interaction Effect.

**Other vegetable crop**
In Chhattisgarh plains zone and Chhattisgarh state area (61.90, 69.19%), yield (15.25, 11.36%) and interaction (22.85, 19.45%) effect shown positive change in production of other vegetable crop which was found to be 1900.62 (247.62%), 2773.20 (287.84%) thousand metric tonnes, respectively.
Which show that production of brinjal in Chhattisgarh plain and Chhattisgarh state is increasing because area under the crop is increasing mean area effect is more prominent as compare to yield and Interaction Effect.

**Total vegetable crop**
In Chhattisgarh plains zone and Chhattisgarh state area (57.46, 84.36%), yield (34.64, 11.73%) and interaction (7.9, 3.91%) effect shown positive change in production of total vegetable crop which was found to be 3429.50 (242.11%), 4965.50(247.41%) thousand metric tonnes, respectively.
Which show that production of brinjal in Chhattisgarh plain and Chhattisgarh state is increasing because area under the crop is increasing mean area effect is more prominent as compare to yield and Interaction Effect.

**Table 1:** Area Effect, Yield Effect, Interaction Effect in major vegetable in the Chhattisgarh plain and Chhattisgarh state

| Crop | CG Plains | | | Chhattisgarh state | | |
|---|---|---|---|---|---|---|
| | Area Effect (%) | Yield Effect (%) | Interaction Effect (%) | Area Effect (%) | Yield Effect (%) | Interaction Effect (%) |
| 1. Brinjal | 51.69 | 44.57 | 3.74 | 79.73 | 16.51 | 3.76 |
| | (171.02) | (147.46) | (12.37) | (378.82) | (78.44) | (17.86) |
| 2. Tomato | 49.24 | 41.08 | 9.68 | 66.12 | 25.43 | 8.45 |
| | (309.16) | (257.92) | (60.78) | (550.92) | (211.89) | (70.41) |
| 3. Potato | -33.66 | 137.65 | -3.99 | 122.47 | -20.89 | -1.58 |
| | -(79.31) | (324.33) | -(9.40) | (445.45) | -(75.98) | -(5.75) |
| 4. Okra | 7.37 | 92.31 | 0.33 | 84.29 | 11.77 | 3.94 |
| | (8.92) | (111.74) | (0.40) | (156.92) | (21.91) | (7.34) |
| 5. Onion | 47.76 | 44.21 | 8.08 | 84.85 | 10.27 | 4.88 |
| | (101.96) | (94.38) | (17.25) | (283.46) | (34.31) | (16.30) |
| 6. Other vegetables | 61.9 | 15.25 | 22.85 | 69.19 | 11.36 | 19.45 |
| | (1176.48) | (289.84) | (434.29) | (1918.78) | (315.04) | (539.39) |
| 7. Total crop | 57.46 | 34.64 | 7.9 | 84.36 | 11.73 | 3.91 |
| | (1970.59) | (1187.98) | (270.93) | (4188.90) | (582.45) | (194.15) |

**Decomposition analysis of area, production and productivity in Chhattisgarh plains and Chhattisgarh state**

Decomposition analysis was carried out to determine the extent of relative contribution of area yield and then interaction which are responsible for the change in value of production of the vegetable under study in Chhattisgarh plains and Chhattisgarh state.

**Area effect**

It Chhattisgarh plain and Chhattisgarh state was found to be positive and maximum other vegetable (61.90%) followed by total vegetable (57.46%), brinjal (51.69%), tomato (49.24%) onion (47.76%) and okra (7.37%), Chhattisgarh state was found to be positive and maximum onion (84.85%) followed by total vegetable (84.36%), brinjal (79.73%), other vegetable (69.19%) tomato (66.12%) and okra (84.29%). The wild the area effect found to be negative in case of potato in Chhattisgarh plains 33.66 percent and positive (122.47%) in Chhattisgarh state.

Which shows that maximum area effect is more promising that production in case of other vegetable, total vegetable, brinjal, tomato and onion. Which is around 50% contribution of the production because the area effect.

**Yield effect**

It Chhattisgarh plain and Chhattisgarh state was found to be positive and maximum brinjal (44.57%), tomato (41.08%), okra (92.31%), onion (44.21%), other vegetable (15.25%) and total vegetable (34.64 and 11.36%), respectively. It Chhattisgarh state was found to be positive and maximum brinjal (16.51%), tomato (25.43%), okra (11.77%), onion (10.27%), other vegetable (11.36%) and total vegetable (11.36%), respectively. The potato was found positive yield effect of 137.65 percent in Chhattisgarh plain and negative yield effect of 20.89 percent in Chhattisgarh state. The potato was found positive yield effect of 137.65 percent in Chhattisgarh plain and negative yield effect of 20.89 percent in Chhattisgarh state.

Which shows that maximum yield effect is more promising that production in case of other vegetable, total vegetable, brinjal, tomato and onion. Which is around 50% and 70% contribution of the production in Chhattisgarh plain and Chhattisgarh state because the yield effect.

**Interaction effect**

It Chhattisgarh plain and Chhattisgarh state was found to be positive and maximum brinjal (3.74%), tomato (9.68%), okra (0.33%), onion (8.08%), other vegetable (22.85%) and total vegetable (7.90%), respectively. It Chhattisgarh state was found to be positive and maximum brinjal (3.76%), tomato (8.45%), okra (3.94%), onion (4.88%), other vegetable (19.45%) and total vegetable (3.91%), respectively. The potato was found negative interaction effect of 3.99 and 1.58 percent in Chhattisgarh plain and Chhattisgarh state.

**Conclusion**

The total increase in area, production and productivity was mainly brought by the expansion in area and production enhancement which ultimately become possible due to the increase in productivity as compared to the contribution of acreage leads to conclude that the brinjal, tomato, onion and potato producer are adopting the production technologies to some extent in production of these crops.

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