

## Comparative Trend Analysis of Mustard in Bundelkhand Region, Uttar Pradesh and India

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### ABSTRACT

The study analyses time series data (1996 to 2019) on dynamics of area, production and productivity of mustard in India, Uttar Pradesh and Bundelkhand region. The growth trend analysis suggested that in India and U.P, area under mustard was decreasing with the compound growth rate of 0.2 and 2 per cent per annum respectively whereas it was increasing with compound growth rate of 4 per cent annually in Bundelkhand region. Growth trend analysis for production also indicated same pattern, CGR of India was found 1.5, -0.5 per cent for U.P but in Bundelkhand region it was found 8 per cent. The growth trend analysis for productivity indicated compound growth rate of 1.7 per cent per annum at country level, 1.6 per cent U.P. and 4.3 per cent in Bundelkhand region. The instability indicated the highest variability in area observed in Bundelkhand region with 23.23 per cent and lowest in Uttar Pradesh with 11.7 per cent, highest variability in production was observed in Bundelkhand region with 48.0 per cent and lowest in India with 14.8 per cent and highest variability in productivity was observed in Bundelkhand region with 25.2 per cent and lowest in Uttar Pradesh with 8.2 per cent. Productivity effect on production variability of mustard was found highest in Uttar Pradesh followed by India and Bundelkhand respectively.

**Keywords:** Area, Compound annual growth rate, Decomposition, Production

### INTRODUCTION

Oilseeds have been considered as one of the oldest cultivated plants in human civilization and an indispensable part of the Indian diet. According to history, wild forms of mustard have been found in the Near East, southern Iran and in India indicate about its centre of origin. It is also grown as a leafy vegetable in China. However, U.S.A, China and India have emerged as top mustard producing countries due to its geography, adaptability and resource endowment. The transfiguration in agriculture sector over a long period through

intensive production system and innovation has made India now a self-reliant and self-sufficient country in terms of food grain production (284.83 million tones 2018). Oilseed are less affected in new diversified food basket. The estimated area, production and yield of rapeseed-mustard in the world was 36.59 million hectares, 72.37 million tonnes and 1980 kg/ha, respectively, during 2018-19. Globally, India account for 19.8 and 9.8 per cent of the total acreage and production. During the last eight years, there has been a considerable increase in productivity from 1840 kg/ha in 2010-11 to 1980 kg/ha in 2018-19 and production has

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also increased from 61.64 m t in 2010-11 to 72.42 m t in 2018-19. The productivity of India is the lowest among the major mustard growing countries. As against the Chile with highest productivity of 4.10 tonnes/ha, the Indian average yield was only 1.4 tonnes/ha during 2019-20. Longer crop duration and high carbon content in the soil are the major factors attributing to high productivity of rapeseed in western part of the World. Mustard production in India stands in between 8-9 million tons with a significant growth in between 2000 and 2019. In India, major production regions of Mustard are Rajasthan, Haryana, Uttar Pradesh, and Madhya Pradesh while the major consumption (as raw pellets) regions are Rajasthan, Uttar Pradesh, Haryana, and Punjab. Being a major rabi (winter season) oilseed crop with advantage of soil moisture conserved during monsoon, it has greater potential to increase the availability of edible oil from domestic production. Despite the high quality of oilseed and adaptability for varied agro-climatic conditions, the area, production and yield in India have been fluctuating due to various biotic and abiotic stresses coupled with India's domestic price support programme (Kumar *et al.*, 2016; Kumar *et al.*, 2018). Nevertheless, the crop has potential to ensure the nutritional security and contribute to livelihood security to the farmers. The highest productivity states are Haryana (2058 kg/ha), Gujarat (1745 kg/ha), Rajasthan (1720 kg/ha), Punjab (1523), U.P. (1483) and M.P. (1422) with overall national yield of 1499 kg/ha. (Directorate of Economics & Statistics, DAC&FW). In Uttar Pradesh, a significant rise has been sighted in the last ten years of Mustard's area, production and yield, the production has almost become doubled. Bundelkhand region which is a disadvantaged region also known for its dryland and rain fed conditions. Area wise, mustard is the third important crop of *rabi* season in this region (mostly taken as intercrop with wheat). With the limited sub-optimal resources, in the last ten years there has been a significant change in the area, production and productivity of mustard. The present study has identified the measures of growth and instability (area, production and yield), of mustard in India, U.P and Bundelkhand region which would help policymakers and government for planning and implementing of policy related to its production and trade.

## METHODOLOGY

The study was purely based on secondary data. The data was collected from, Directorate of Economics and Statistics, Food and Agriculture Organisation and Agricultural Statistics at a glance 2018, and Department of Economics and Statistics Uttar Pradesh. The data regarding area, production and yield of mustard in India, Uttar Pradesh and Bundelkhand were collected for last 23 years i.e. from 1996 to 2019. On the basis of the data collected for period, analysed using compound growth rates, instability and decomposition in area, production and productivity of mustard estimated to examine the fluctuation. Estimation of growth rate were worked out to examine the tendency of variable to increase, decrease or stagnant over a period of time. The rate of change of "Yt" per unit of time to express as a function of the magnitude of "Yt" itself is usually termed as the compound growth rate (CGR) which was expressed mathematically as:

$$CGR = [(t) (dYt dt)] = [(Yt+1-Yt Yt)] \quad \dots (1)$$

On multiplication of above expression by 100, the compound growth rate of Yt in percentage term was worked out. There are many alternative forms of growth function viz., linear exponential, modified exponential, Cobb-Douglas etc. which have been developed and used by the researcher. The mathematical form of log-linear function (also known as exponential function) used is as follows:

$$Yt = Ae^{bt} \quad \dots (2)$$

Instability was measured by using co-efficient of variation. The standard deviation as percentage of means called as co-efficient of variation.

$$CV = \sigma \mu \times 100$$

Where, CV = Co-efficient of variation

$\sigma$  = Standard deviation of the variable

$\mu$  = Mean of the variable

To estimate the contribution of area, productivity and interaction of the two in total production, the following additive scheme of decomposition was used:

$$P = A_0 (Y_n - Y_0) + Y_0 (A_n - A_0) + \Delta A \Delta Y$$

$$1 = [(Y \Delta A)/P] [(A \Delta Y)/P] [(\Delta A \Delta Y)/P]$$

Where, P = Change in production

A<sub>0</sub> = Area in base year

A<sub>n</sub> = Area in current year

Y<sub>0</sub> = Yield in base year

Y<sub>n</sub> = Yield in current year

ΔA = Change in area (A<sub>n</sub> – A<sub>0</sub>)

ΔY = Change in yield (Y<sub>n</sub> – Y<sub>0</sub>).

## RESULTS AND DISCUSSION

The compound growth trend equations were fitted to assess growth trend in area, production and productivity of Mustard in India, Uttar Pradesh and Bundelkhand region. It was found that in India area under the mustard crop has decreased from 6550 thousand hectares to 6230 thousand hectares with a negative and non-significant growth rate of -0.2 per cent.

The production of mustard in the country increased from 6.66 million tonnes to 9.34 million tonnes from 1996-2019. The production growth performance during overall period was 1.5 per cent per annum, mainly attributed by yield growth which was found significant with a positive growth rate of 1.7 per cent per annum. In Uttar Pradesh area and production showed a decreasing trend having negative growth rate but yield was having an increasing trend in overall period and was found significant with a positive growth rate of 1.6 per cent per annum. While in Bundelkhand region, area, production and yield had shown increasing trends during this period. The area under mustard cultivation increased from 29 thousand hectares to 70.8 thousand hectares with a positive and significant growth rate of 4.1 per cent. In the same order Bundelkhand region's production growth performance during this period was found significant with a positive growth rate of 8.1 per cent per annum, attributed by area and yield growth. The yield growth performance was also found significant with a positive growth rate of 4.3 per cent. A perusal of Table 1 indicates compound

**Table 1: Compound growth trend in area, production and productivity of Mustard in India, U.P. and Bundelkhand region**

| Mustard    | Particulars                             | India | Uttar Pradesh | Bundelkhand |
|------------|-----------------------------------------|-------|---------------|-------------|
| Area       | Beginning year area (000' ha)           | 6550  | 1198.5        | 29.0        |
|            | End year area (000' ha)                 | 6230  | 753           | 70.8        |
|            | No. of observation                      | 23    | 23            | 23          |
|            | Coefficient                             | 0.029 | 52.6          | 47.6        |
|            | R <sup>2</sup> (%)                      | 0.001 | 0.71          | 0.69*       |
|            | Growth rate (%)                         | -0.2  | -2.0          | 4.1         |
| Production | Beginning year production (000' tonnes) | 6660  | 1247.8        | 12.73       |
|            | End year production (000' tonnes)       | 9340  | 1117.1        | 71.26       |
|            | No. of observation                      | 23    | 23            | 23          |
|            | Coefficient                             | 19.5  | 1.7           | 23.3        |
|            | R <sup>2</sup> (%)                      | 0.48* | 0.076         | 0.51*       |
|            | Growth rate (%)                         | 1.5   | -0.5          | 8.1         |
| Yield      | Beginning year yield (kg/ha)            | 1017  | 1041          | 369         |
|            | End year yield (kg/ha)                  | 1499  | 1483          | 1005        |
|            | No. of observation                      | 23    | 23            | 23          |
|            | Coefficient                             | 52.5  | 22.3          | 5.2         |
|            | R <sup>2</sup> (%)                      | 0.71* | 0.65*         | 0.63*       |
|            | Growth rate (%)                         | 1.7   | 1.6           | 4.3         |

(\*significant at 1 per cent level and \*\*significant at 5 per cent level)

growth rate of area, production and productivity of mustard in India, U.P. and Bundelkhand region.

### Instability Analysis of Mustard

In order to study the instability in the area, production and productivity of mustard in India, U.P. and Bundelkhand region during the study period, coefficient of variation was worked out. An analysis of fluctuations in crop output is important for understanding the nature of food security and income stability. The extent of the fluctuations depends upon the crop production technology, weather conditions, socio-economic environment, input management and several other factors (Kaushik, 1993). The analysis reveals that area variability was observed maximum in Bundelkhand region (23.23%) followed by Uttar Pradesh (11.7%). The production variability of India and Bundelkhand region were found significant, it was found maximum in Bundelkhand region (48.0%) followed by India (14.8%). In case of yield variability also, India and Bundelkhand region were found significant, it was found maximum in Bundelkhand region (25.2%) followed by India (8.6%). The increasing tendency of area, production and yield in the Bundelkhand region attributed to the fact that oilseeds are grown mostly in the unirrigated areas and were dependent on rain (Table 2).

### Decomposition of Production Variability of Mustard

To examine the contribution of area, productivity and their interaction between both, effects on the variability of total production, decomposition schemes, decomposition of production variability into its different components was done. During the period, the yield effect in India as well as in Uttar Pradesh was found dominating over the area effect and also from the

interaction effect this was because of the negative growth rate found during the period. Whereas in case of Bundelkhand the interaction effect was found dominating over area effect (1.8%) and yield effect (1.6%) (Table 3).

**Table 3: Decomposition of Production, Area, and Productivity of Mustard in India, U.P. and Bundelkhand region**

| Components                                  | India  | U.P.   | Bundelkhand |
|---------------------------------------------|--------|--------|-------------|
| Area effect $\Delta A.Y_0$ (%)              | -34.88 | -46.37 | 1.8         |
| Yield effect $\Delta Y.A_0$ (%)             | 31.57  | 52.97  | 1.6         |
| Interaction effect $\Delta A. \Delta Y$ (%) | -15.42 | -19.69 | 2.3         |

A comparison was drawn in between India, Uttar Pradesh and Bundelkhand region to see the mustard's Compound growth rate, instability and decomposition for the period of 1996-2019. The growth trend analysis suggested that in India and U.P, area under mustard decreasing with the compound growth rate of 0.2 per cent and 2 per cent per annum respectively where as it was found increasing with compound growth rate of 4 per cent annually in Bundelkhand region. Growth trend analysis for production also indicates same pattern CGR of India was found 1.5 per cent, -0.5 per cent for U.P but in Bundelkhand region it was found 8 per cent. The growth trend analysis for productivity indicated compound growth rate of 1.7 per cent per annum at country level, 1.6 per cent U.P. and 4.3 per cent in Bundelkhand region. The highest variability in area was observed in Bundelkhand region with 23.23 per cent and lowest in Uttar Pradesh with 11.7 per cent, highest variability in production was observed in Bundelkhand region with 48.0 per cent and lowest in India with 14.8 per cent and highest variability in productivity was observed in Bundelkhand region with 25.2 per cent and

**Table 2: Instability analysis of area, production and productivity of Mustard in India, U.P. and Bundelkhand region**

| Mustard    | India |       | U.P.  |       | Bundelkhand |        |
|------------|-------|-------|-------|-------|-------------|--------|
|            | CV    | CV#   | CV    | CV#   | CV          | CV#    |
| Area       | 12.2  | 12.2  | 22.06 | 11.7* | 41.9        | 23.23* |
| Production | 20.6  | 14.8* | 18.7  | 19.9  | 69.2        | 48.0*  |
| Yield      | 16.2  | 8.6*  | 34.5  | 33.0  | 30.8        | 25.2*  |

(\*significant at 1 per cent level and \*\*significant at 5 per cent level)

lowest in Uttar Pradesh with 8.2 per cent. Productivity effect on production variability of mustard was found highest in Uttar Pradesh followed by India and Bundelkhand respectively.

### CONCLUSION

India is the second largest producer of mustard in the world but still it is a long way to lead international market. In order to improve the productivity mustard cultivation needs improvement in research facility and modern technology along with identification of those areas which can perform better and result better productivity. As the leading producer state is Rajasthan but particularly Bundelkhand region of U.P. has shown better results in Compound annual growth rate for productivity, area and production. Even though productivity showed increasing trend there is a need to increase the productivity levels which ultimately help in increase in domestic production and gain good foreign exchange through export as still major part of the mustard oil is imported. All the parameters under study have significantly shown a fluctuating trend but the productivity showed an increasing trend over the years. Agricultural pricing policy plays a key role in increasing both farm production and incomes. Findings from this research paper are not only an initial effort from this perspective but also provide future issue for research and suggest necessary policy guidelines for future production and marketing strategies of the country.

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