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# Performance of rapeseed-mustard in India- a temporal analysis

PP Kumar[1*], SV Ramana Rao[2], VK Choudhary[1] AK Koshta[1], MA Khan[1], ML Lakhera[1] and I Krishna Teja[3]

[1]*Indira Gandhi Krishi Vishwavidyalaya, Raipur 492012, Chhattisgarh, India*
[2]*ICAR-Indian Institute of Oilseeds Research, Hyderabad 500030, Telangana, India*
[3]*Agriculture College Aswaraopet, Professor Jayashankar Telangana State Agricultural University, Hyderabad 500030, Telangana, India*
[*]*Corresponding author: praveenpaladugu6@gmail.com*
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## Abstract

The performance of rapeseed-mustard in India using time series data from 1967-68 to 2019-20 was examined. The total period was divided into period I, II and III to analyze the trends, compound annual growth rate (CAGR), decomposition analysis, instability analysis and impact of technological change in production of rapeseed-mustard. The study revealed that performance of rapeseed-mustard during different periods was noteworthy. An upward increasing trend was evidenced for area, production and yield in all the three periods signifying the progress of rapeseed-mustard while the CAGR analysis revealed acceleration for area, production and yield. The decomposition analysis indicated that change in production of rapeseed-mustard were due to yield effect and area effect during period I; area expansion during period II and; area effect and yield effect during period III. The crop was relatively stable with lower instability with regard to area, production and yield resulting to sustained production. Technological progress on production of rapeseed-mustard was observed in periods I and III, while area expansion contributed to production growth in all the three periods. Technology regress was not evidenced in rapeseed-mustard indicating the power of technology(s) developed under the National Agricultural Research and Education System. To increase the production of rapeseed-mustard, technology assemblage is warranted in high area-low productivity districts; diversification to newer agro-eco regions and in selected rice-fallow ecosystems. To task strides towards "Make in India" and "Atmanirbhar Bharat", focus on value chains is important towards doubling of farmers income and for promoting rural entrepreneurship.

***Keywords:*** *Compound annual growth rate, instability analysis, rapeseed-mustard, technological progress, trends*

## Introduction

Oilseeds in India play an important role following cereals to the agricultural economy. The country achieved self-sufficiency in oilseeds during the first half of 1990's but could not sustain the same during the present millennium owing to a platter of market and non-market forces. The country has witnessed imports doubling from 9.5 to 19.5 kg/annum during the present millennium and has now attained the status of being the world's largest importer of vegetable oils. During 2020-21, the import bill was ₹ 82,098 crores. Although oilseeds in India have progressed in terms of increased production through increase in productivity during the present millennium, the increased production could not match the ever-increasing per capita consumption primarily due to changing life styles increasing out of home consumption, rising per capita income, increasing population and price elasticity favouring increased consumption. This resulted to dependency on imports and hence addressing the demand supply gap is of paramount importance by increasing domestic production of edible oils in the country.

India grows annual oilseeds on an area of over 25.74 million hectares, producing 30.55 million tonnes, with a productivity of around 1188 kg per hectare for the quinquennium ending (QE) 2019-20. Rapeseed-mustard is a major annual edible oilseed crops contributing to approximately 25% of the total oilseed production in India. The country's rapeseed-mustard group of crops comprises a number of oil-yielding Brassicas, *viz.*, Indian mustard, *Toria*, Brown *Sarson*, Yellow *Sarson*, *Taramira* and *Gobhi Sarson*. It occupied 6.16 million hectares, with a production of 8.30 million tonnes and a productivity of 1348 kg/ha for QE 2019-20. It ranks second in area, next to soybean and thus is an important oil-bearing crop for the country on account of its higher oil content (39-44 %). Rapeseed-Mustard is cultivated during *Rabi* season and largely confined to Rajasthan, Madhya Pradesh, Uttar Pradesh, Haryana, West Bengal, Assam, Jharkhand,

Gujarat, North Eastern States and Bihar. These states account for 96% of the area and production of rapeseed-mustard.

An attempt was made to examine the performance of rapeseed-mustard since inception of the AICRP on Oilseeds that includes mustard and attempts to throw light on interventions that can enable for further increasing the productivity and production of rapeseed-mustard thereby adding more to the domestic edible oils kitty. The present study was conducted to examine the performance of rapeseed-mustard in India with the objectives, 1) to examine the growth rates in area, production and yield of rapeseed-mustard, 2) to estimate the effect of area, productivity and interaction on change in rapeseed-mustard production, 3) to estimate the instability of rapeseed-mustard, and 4) to examine the impact of technical change on production of rapeseed-mustard.

## Materials and Methods

The present study made use of the time series data on area, production and yield of rapeseed-mustard for the period 1966-67 to 2019-20 from the published sources *viz.*, Directorate of Economics and Statistics, Government of India.; Statistical Compendium, ICAR-Indian Institute of Oilseeds Research. The data was analyzed for the different time periods as indicated below for drawing meaningful conclusions.

| Period | Particulars | Reference period |
|---|---|---|
| I | Inception of all India coordinated research project (AICRP) on oilseeds that includes mustard to the genesis of technology mission on oilseeds (TMO) | 1967-68 to 1985-86 |
| II | TMO to operationalization of WTO | 1986-87 to 1999-2000 |
| III | Post liberalization period | 2000-01 to 2019-20 |

## Estimation of compound annual growth rates (CAGR)

In order to estimate the CAGR, below given exponential time trend equation was used.

$$Y=a\,b^{t} \quad (1)$$

It becomes linear when converted to log form,

$$\text{i.e., } \text{Ln } Y=\text{Ln } a + t \text{ Ln } b_1 \quad (2)$$

Where, Y: variable whose growth rate is being computed, t: time trend (1, 2…n), a and b are regression coefficients to be estimated. This form implies a constant growth rate over time, a characteristic, which made it most popular among the economists. There will be a constant deceleration if b < 0. A value of b=0 indicates absence of any trend and a positive value for b indicates a constantly accelerating growth. In the context of growth rates estimation through the exponential time trend equation, Dandekar (1980) observed that when the exponential form is used, taking the parameter B (=Ln b) as the annual growth rate was not correct. Instead, the formula for finding growth rate ($e^B$-1) is derived as follows:

Using the compounding formula,

$$Y_t=Y_0(1+r)^t \quad (3a)$$

or

$$\text{Ln}Y_t=\text{Ln } Y_0 + t \text{ Ln } (1+r) \quad (3b)$$

or

$$\text{Ln}Y_t=A + tb \text{ where} \quad (3c)$$

$$A = \text{Ln } Y_0 \text{ and } B = \text{Ln } (1+r) \quad (4)$$

This equation is the log linear form of the exponential function and gives CAGR when differentiated with respect to t as follows:

$$1/Y_t.dY_t/dt = \text{Ln}(1+r) \quad (5)$$

$$e^B = 1 + r \quad (6)$$

$$r = e^B - 1 \quad (7)$$

Thus, the CAGR (%) is given by $(e^B - 1) \times 100$.

In this paper, Y represents the area or production or productivity of the crops.

## Estimating the effect of area, productivity and interaction on change in production

The following procedure was adopted to estimate the effect of area, productivity and their interaction on change in production of rapeseed-mustard:

$$P= P_n-P_o \text{(Change in production)}; P_o=A_o * Y_o; P_n = A_n * Y_n$$

Where, $P_o$= Production in the base year, $P_n$= Production in the current year, $A_o$= Area in the base year, $A_n$= Area in the current year, $Y_o$= Yield in the base year, $Y_n$=Yield in the current year, "A=Change in Area ($A_n$-$A_o$), "Y=Change in Yield ($Y_n$-$Y_o$).

Finally,

$$P=P_n - P_o = \underbrace{A_o*\Delta Y}_{\text{Yield effect}} + \underbrace{Y_o*\Delta A}_{\text{Area effect}} + \underbrace{\Delta A*\Delta Y}_{\text{Interaction effect}}$$

The change in production when pronounced more through yield effect indicates that the productivity / technology has contributed to the production while the change in production when pronounced more by area effect indicates area expansion contributing to the change in production while. In this paper, estimation of the effect of area, productivity and their interaction on change in production of rapeseed-mustard was done for the three respective periods as mentioned above. However, the triennium averages of the respective base and current years were considered while estimating to minimize and/or eliminate the biasness to arrive at meaningful conclusions.

## Instability (Cuddy-Della Valle Index)

Instability in area, production and productivity is estimated to examine the extent of risk in those variables using Cuddy-Della Valle Index (Cuddy and Della Valle, 1978). Linear trend was fitted to the original data of the area, production and productivity of rapeseed-mustard for the study period. The trend coefficients were tested for their significance. Wherever the trend of series was found to be significant; the variation around the trend rather than the variation around mean was used as an index of instability. The formula suggested by Cuddy and Della (1978) used to compute the degree of variation is given below:

$$= CV \times \sqrt{(1 - \overline{R^2})}$$

Here, CV is the coefficient of variation in per cent, and $\overline{R^2}$ is the adjusted coefficient of determination from a time trend regression.

## Impact of technological change

In order to examine the impact of technological change on production, the following equation was estimated:

$$Y = a \times {}^{\beta}e^{\lambda t}$$

In logarithmic form, it becomes: $\text{Ln } Y = \text{Ln } a + \beta \text{Ln } X + \lambda t$

Where, Y: Production of crop (lakh tonnes), X=Area under the crop (lakh tonnes), t = Time in years (1, 2, 3, …n), Ln a = Intercept, β and λ are the regression coefficients associated with area and time, respectively. A positive value for λ indicates a technological progress and a negative value indicates a technological regress (Sarup *et al*., 1997). The significance of regression coefficients and goodness of fit were tested by t test and F test respectively.

## Results and Discussion

The results of the present study are analyzed and discussion is centric to the objectives spelt out for the individual periods *viz.*, *Period I:* Inception of AICRP on oilseeds including rapeseed-mustard to the genesis of TMO (1967-68 to 1985-86), *Period II:* TMO to operationalization of WTO (1986-87 to 1999-2000), and *Period III:* Post WTO period (2000-01 to 2019-20).

## Trends in area, production and productivity

The trends in area, production and productivity of rapeseed-mustard for the period 1967-68 to 2019-20 has been presented in Table 1 and Figure 1. It was observed that during period I, for QE 1971-72, the average area was 32.45 lakh ha, average production was 15.77 lakh tonnes and average productivity was 485 kg/ha. The same for QE 1985-86 was 40.13 lakh ha, average production of 25.90 lakh tonnes and average productivity of 647 kg/ha. This period envisaged an increase of 23.67 % in area contributing to increased production of 64.22 % that could be attributed to the technologies that have emanated with the inception of AICRP on rapeseed-mustard which witnessed 32.85 % increase in productivity. During period II, the data reveals that the average area increased to 65.35 lakh ha for QE 1999-2000 from 47.84 lakh ha for QE 1990-91while the production increased to 57.62 lakh tonnes as against 39.58 lakh tonnes for the QE 1999-2000 over QE 1990-91. The additional area and production evidenced during the above period was 17.51 and 18.04 %, respectively. The implementation of TMO and the continued efforts of the NARES, ably supported by the developmental agencies involved in rapeseed-mustard, perhaps, paved way for sustained increase in area and production, besides holding intact the consolidation of the gains made during the earlier period. During period III, wherein the edible oilseeds sector in the country witnessed severe turbulence due to demand supply imbalances primarily due to a steep increase in the per capita consumption of edible oils, rapeseed-mustard had made remarkable role to the oilseed economy of the country. During this period, the area increased to 61.55 lakh ha for QE 2019-20 from 53.68 lakh ha for QE 2004-05 while the production increased to 83.05 lakh ha from 54.07 lakh tonnes for the aforesaid periods. It was observed that while area increased by 7.68 lakh ha, the

Table 1: Trends in area (lakh ha), production (lakh tonnes) and productivity (kg/ha) of rapeseed-mustard during 1967-68 to 1985-86

| Period-I | Area | Production | Productivity | Period II | Area | Production | Productivity | Period III | Area | Production | Productivity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1967-68 | 32.44 | 15.68 | 483 | 1986-87 | 37.19 | 26.05 | 700 | 2000-01 | 44.77 | 41.90 | 936 |
| 1968-69 | 28.70 | 13.47 | 469 | 1987-88 | 46.19 | 34.55 | 748 | 2001-02 | 50.73 | 50.83 | 1002 |
| 1969-70 | 31.73 | 15.64 | 493 | 1988-89 | 48.32 | 43.77 | 906 | 2002-03 | 45.44 | 38.80 | 854 |
| 1970-71 | 33.23 | 19.75 | 594 | 1989-90 | 49.67 | 41.25 | 831 | 2003-04 | 54.28 | 62.91 | 1159 |
| 1971-72 | 36.14 | 14.33 | 396 | 1990-91 | 57.82 | 52.29 | 904 | 2004-05 | 73.16 | 75.93 | 1038 |
| 1972-73 | 33.19 | 18.08 | 545 | 1991-92 | 65.53 | 58.63 | 895 | 2005-06 | 72.77 | 81.31 | 1117 |
| 1973-74 | 34.57 | 17.04 | 493 | 1992-93 | 61.93 | 48.03 | 776 | 2006-07 | 67.90 | 74.38 | 1095 |
| 1974-75 | 36.80 | 22.52 | 612 | 1993-94 | 62.89 | 53.28 | 847 | 2007-08 | 58.26 | 58.34 | 1001 |
| 1975-76 | 33.39 | 19.36 | 580 | 1994-95 | 60.58 | 57.58 | 950 | 2008-09 | 62.98 | 72.01 | 1143 |
| 1976-77 | 31.29 | 15.51 | 496 | 1995-96 | 65.47 | 60.00 | 916 | 2009-10 | 55.88 | 66.08 | 1183 |
| 1977-78 | 35.84 | 16.50 | 460 | 1996-97 | 65.45 | 66.60 | 1017 | 2010-11 | 69.00 | 81.79 | 1185 |
| 1978-79 | 35.44 | 18.60 | 525 | 1997-98 | 70.41 | 47.00 | 668 | 2011-12 | 58.94 | 66.04 | 1121 |
| 1979-80 | 34.71 | 14.28 | 411 | 1998-99 | 65.13 | 56.60 | 869 | 2012-13 | 63.63 | 80.29 | 1262 |
| 1980-81 | 41.13 | 23.04 | 560 | 1999-2000 | 60.27 | 57.90 | 961 | 2013-14 | 66.46 | 78.77 | 1185 |
| 1981-82 | 43.99 | 23.82 | 541 | - | - | - | - | 2014-15 | 57.99 | 62.82 | 1083 |
| 1982-83 | 38.27 | 22.07 | 577 | - | - | - | - | 2015-16 | 57.46 | 67.97 | 1183 |
| 1983-84 | 38.74 | 26.08 | 673 | - | - | - | - | 2016-17 | 60.74 | 79.17 | 1304 |
| 1984-85 | 39.87 | 30.73 | 771 | - | - | - | - | 2017-18 | 59.77 | 84.30 | 1410 |
| 1985-86 | 39.80 | 26.81 | 674 | - | - | - | - | 2018-19 | 61.24 | 92.56 | 1511 |
| - | - | - | - | - | - | - | - | 2019-20 | 68.56 | 91.24 | 1331 |

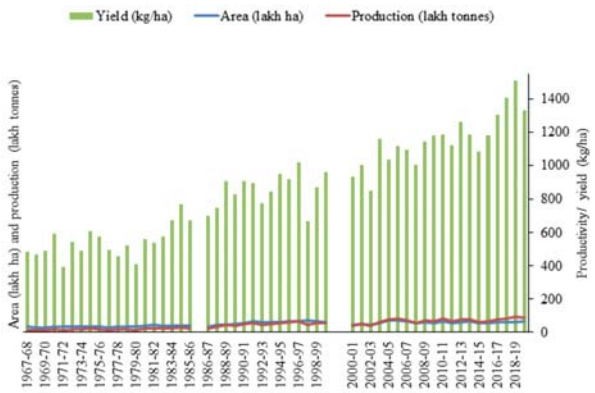


Fig. 1: Trends in area, production and yield of rapeseed-mustard in India (1967-68 to 2019-20)

additional production accrued was 28.97 lakh tonnes (14.67 % increase in area; 53.58 % increase in production) that could be primarily attributed due to an increase in productivity by 350 kg/ha. The technologies from the NARES created an enabling environment for the sustained performance of rapeseed-mustard during this period despite increase in per capita consumption of edible oils. It is thus evident, that an increasing upward trend was witnessed in all the three periods although here were inherent fluctuations for the three components during period I and II. These fluctuations gradually reduced and evened out to minor fluctuations but revealed an increasing upward trend during period III.

## Compound annual growth rates (CAGR)

The CAGR was worked out for the aforesaid periods and presented in Table 2. It is evidenced from the data that the growth rate was positive and above unity for area, production and productivity in all the periods except for area during Period III. It was observed that during period I, the growth rate was highest for production (3.41 %) followed by yield and area (1.78 and 1.60 %, respectively). The coefficients were significant at 1 % for area, production and productivity. During period II, the growth rate was highest (4.62 %) for production followed by area and productivity (3.53 and 1.08 %, respectively). The coefficients were significant at 1 % for area and production while it was non-significant for yield. In period III, the growth rate was highest in production (2.90 %) followed by yield and area (1.94 and 0.94 %, respectively). The coefficients were significant at 1 % for production and productivity while it was non-significant for area.

The above analysis clearly reveals that rapeseed-mustard evidenced accelerated growth in the country. During period I, the accelerated growth in area due to expansion of area coupled with technology(s) that have spread due to the AICRP on rapeseed-mustard paved way for giving a boost to the production growth. While in period II, the accelerated growth in production mostly evidenced was due to growth in area on account of the implementation of TMO. During period III, wherein the globalization was perpetual across the country, it is noteworthy to mention that the production growth rate evidenced during this period was largely due to the growth in productivity. In other words, the technologies that have emanated during this period from the NARES paved way for sustained growth in production of rapeseed-mustard, despite the fact that area growth was less than unity but not significant. This is a testimony that the crop had evidenced vertical growth in productivity which is indeed the need of the hour not confined to rapeseed-mustard per se but across all annual oilseed crops of the country.

Table 2. Compound annual growth rates of rapeseed-mustard in India (1967-68 to 2019-20)

| Period | Area (%) | Production (%) | Productivity (%) |
|---|---|---|---|
| Period I (1967-1968 to 1985-1986) | 1.60*** | 3.41*** | 1.78*** |
| Period II (1986-1987 to 1999-2000) | 3.53*** | 4.62*** | 1.08 |
| Period III (2000-2001 to 2018-2019) | 0.94 | 2.90*** | 1.94*** |

***Significant at 1 % level, **Significant at 5 % level, *Significant at 10 % level

## Effect of area, productivity and interaction to change in production

The contribution of area and yield to the change in production of rapeseed-mustard in the three periods through decomposition analysis has been presented in Table 3. The results revealed that in period I, 53.56 % of change in production evidenced in rapeseed-mustard was attributed to yield effect (technology) while area effect and interaction effect contributed to 31.71 and 14.73 %, respectively to the change in production. In period II, the change in production was primarily due to area effect (88.91 %) while yield effect (technology) and interaction effect contributed to 7.46 and 3.63 %, respectively. During period III, area effect and yield effect contributed to 49.64 and 33.23 %, respectively while interaction effect contributed to 17.13 per cent. It can be deciphered from the above analysis that during period I, the average

Table 3: Decomposition analysis of area, production and productivity of mustard in India (1967-68 to 2019-20)

| Period | Change in production (million tonnes) | Productivity effect (%) | Area effect (%) | Interaction effect (%) |
|---|---|---|---|---|
| Period I (1967-1968 to 1985-1986) | 1.295 | 53.6 (0.69)* | 31.7 (0.41) | 14.7 (0.19) |
| Period II (1986-1987 to 1999-2000) | 1.905 | 7.5 (0.14) | 88.9 (1.69) | 3.6 (0.07) |
| Period III (2000-2001 to 2018-2019) | 4.552 | 33.2 (1.51) | 49.6 (2.26) | 17.1 (0.78) |

*Figures in parenthesis indicate contribution to production in million tonnes under the respective periods.

change in production (1.295 million ha) more pronounced through yield effect (technology) was due to the inroads made with the establishment of AICRP on rapeseed-mustard. The technology disseminated paved way for breaking the yield barriers and giving a boost to the production. Further, with the technology making inroads, the area effect through area expansion also added to the production kitty of rapeseed-mustard in the country. During period II, the average change in production (1.905 million tonnes) was predominantly due to area effect *i.e.,* area expansion contributing to 88.91 % of the change in production of rapeseed-mustard. This area expansion was due to the concerted efforts of the implementation of the TMO. As against the previous period, the yield effect during this period could not make significant inroads perhaps due to large scale expansion of rapeseed-mustard inclusive of marginal and infertile soils wherein the power of technology could not be visualized at farm level. This may be on account of higher level of technical inefficiencies at farm level where technology assemblage could not percolate. During period III, the area effect accounted to 49.64 % of the change in production followed by 33.23 % due to yield effect (technology). The interaction effect accounted for 17.13 % of the change in production. This period indicates that area expansion and the implementation of the advocated technologies played a major role in giving a fillip to the change in production. While the increased area added to change in production, the technology(s) adopted at the farm level paved way for sustained increase in the production. As against the previous period, the average change in production of rapeseed-mustard was 4.552 million tonnes indicating the importance of mustard production to the edible oilseeds sector of the country during this millennium.

It is thus evidenced from the above that the change in production of rapeseed-mustard in the individual periods revealed an ever upward increasing trend owing to area expansion coupled with adoption of the recommended technologies (yield effect) developed from time to time under the NARES. This paved way for sustained production of rapeseed-mustard in the country.

## Instability in area, production and yield

The instability analysis through Cuddy-Della approach estimated for area, production and productivity components has been presented in Table 4. It can be observed from the table that during period I, the instability was the lowest with regard to area (6.73) followed by productivity (14.67) and production (16.77). In period II, similar trend was observed with the instability index of 9.84, 14.99 and 11.56 for area, production and productivity respectively. During period III, it was observed that the instability of productivity was low (7.72) followed by area and production (12.38 and 15.07 respectively). It can be deciphered from the above that rapeseed-mustard evidenced relatively lower instability for the three components *viz.,* area, production and productivity components. Although the instability in area increased from 6.73 during period I to 12.38 % during period III, this increase was not alarming to result any major jerks to the rapeseed-mustard economy of the country. With regard to the instability of production inter-alia the three periods,

Table 4: Instability analysis of area (A), production (P) and productivity (Pd) of rapeseed-mustard in India

| Details | Period - I | | | Period - II | | | Period - III | | |
|---|---|---|---|---|---|---|---|---|---|
| | A | P | Pd | A | P | Pd | A | P | Pd |
| Mean | 35.75 | 19.65 | 544.94 | 58.35 | 50.25 | 856.28 | 60.50 | 70.37 | 1155.19 |
| Std. deviation | 3.83 | 4.85 | 93.75 | 9.44 | 10.99 | 101.79 | 7.98 | 14.79 | 157.42 |
| CV (%) | 10.72 | 24.68 | 17.20 | 16.18 | 21.86 | 11.89 | 13.18 | 21.02 | 13.63 |
| Adjusted $R^2$ | 0.61 | 0.54 | 0.27 | 0.63 | 0.53 | 0.05 | 0.12 | 0.49 | 0.68 |
| (1-Adjusted $R^2$) | 0.39 | 0.46 | 0.73 | 0.37 | 0.47 | 0.95 | 0.88 | 0.51 | 0.32 |
| Instability Index | 6.73 | 16.77 | 14.67 | 9.84 | 14.99 | 11.56 | 12.38 | 15.07 | 7.72 |

the fluctuations registered were not of any significance to jeopardize the overall production of rapeseed-mustard in the respective periods. With regard to yield component, the instability index revealed a continuous declining trend from 14.67 during period I to 7.72 during period III. This indicates that the yield parameter was quite stable that has perhaps contributed to sustained productivity and production of rapeseed-mustard in the country. It can be concluded that in all the three periods, the instability with respect to area, production and productivity components were operating at a very low scale ultimately leading to overall stability and sustenance of rapeseed-mustard production in the country.

## Impact of technological change on production

Technological change is a key driver of Indian agriculture and hence, a key determinant of production growth. In analyzing the technical change, use of a time trend variable as a proxy for technical change is commonly adopted (Alston *et al*., 1995). In order to assess impact of technological change on production of rapeseed-mustard, the production of rapeseed-mustard was regressed on area under the crop and time, taken as a proxy for technological change. The results of the regression analysis have been presented in Table 5. It was observed that the estimated model was a good fit as indicated by high values of coefficients of multiple determination ($R^2$) ranging from 0.58 to 0.86. The results suggest that technological progress on production of rapeseed-mustard was observed in periods I and III as evidenced from the positive significant coefficients. It was interesting to observe, that in all the three individual periods, area expansion contributed to production growth of rapeseed-mustard in the country as explained by the positively significant regression coefficients The differential impacts of technological progress and area on production could be perhaps attributed to the farm level variations in the efficiency, extent and scale of adoption of technologies, management practices and also due to variations in the agro-eco sub regions of the cropped areas. It can be concluded that in rapeseed-mustard, technology regress was not evidenced from 1967-68 till 2019-20 in any of the three periods under study which is again a testimony that the time-tested technologies developed under the NARES system have enabled for contribution to the production and complimented for area expansion which together have contributed to the production of rapeseed-mustard in the country.

## Conclusions

Table 5: Impact of technological change in production of rapeseed-mustard (1967-68 to 2019-20)

| Period | Regression Coefficients | | | $R^2$ |
|---|---|---|---|---|
| | Constant | Area | Time | |
| Period I | -2.417 (1.70) | 1.475*** (0.50) | 0.169** (0.06) | 0.58 |
| Period II | 1.191*(0.92) | 0.617***(0.10) | 0.186 (0.12) | 0.79 |
| Period III | -0.370 (0.71) | 1.058*** (0.18) | 0.126*** (0.03) | 0.86 |

***significant at 1 % level, ** significant at 5 % level; * significant at 10 % level

It can be concluded that the performance of rapeseed-mustard during different periods has been very progressive and steady. An upward increasing trend was evidenced for area, production and productivity in all the three periods signifying the progress of rapeseed-mustard to the edible oils of India. The compound annual growth rates suggest that acceleration was evidenced for area, production and productivity signifying the inroads made by the crop. The decomposition analysis revealed that change in production of rapeseed-mustard were due to productivity effect and area effect during period I; area expansion during period II and; area effect and productivity effect during period III. The crop was relatively stable with respect to area, production and yield components resulting to sustained production. Technological progress on production of rapeseed-mustard was observed in periods I and III while area expansion contributed to production growth in all the three periods. Technology regress was not evidenced in rapeseed-mustard indicating the power of technology(s) developed under the NARES coupled with area expansion which together have contributed to the production of rapeseed-mustard in the country. It is imperative that the inroads made need to be sustained considering the increasing demand supply situation faced by the country. In this direction, to further enhance the productivity, special emphasis is to be made on improving the productivity in high area-low productivity districts of the country. Technology assemblage is warranted to reduce the yield gaps. Efforts are required to explore towards diversification by introducing the crop to newer agro-eco regions of the country and in selected rice-fallow regions of the country for enhancing the productivity. Towards “Make in India” and “Atmanirbhar Bharat”

focus should be towards value chains in mustard on cluster approach enabling towards doubling of farmers income and promotion of rural entrepreneurship.

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