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Constraints and prominence of rapeseed-mustard cultivation in Rajasthan

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Abstract

The present investigation was undertaken in Rajasthan state with a view to study about growth rate, yield variations and identify the constraints in obtaining the potential yields of rapeseed-mustard. Out of 33 districts, there were 10 districts which are high in area and production of mustard-mustard. Area of rapeseed-mustard experienced negative growth rate during period I (1998-99 to 2005-06) while positive growth rate during period II (2006-07 to 2006-14) and period III (2014-15 to 2021-22). Compound annual growth rate (CAGR) of area was registered 1.0 % during overall period of study which was significant at 5 % level of significance. During period I area was declined to -3.1 % while period II achieved highest growth rate of 3.1 %. Area and production of rapeseed-mustard during 1992-93 were 2.22 mha and 1.71 mt, respectively. Whereas in 2005-06 finding showed that the area was significantly decreased to 3.55 mha and production increased to 4.38 mt in comparison to previous year. In 2021-22 area slightly increased to 4.17 mha and the production reached to 7.16 mt.

Keywords: *Constraints, potential yield, rapeseed-mustard*

Introduction

Agriculture plays a significant role in Indian economy. During the covid-19 pandemic agriculture sector play a crucial role to sustain the Indian economy. Indian agriculture sector had several revolutionary structural changes from green revolution to sustain the economy during covid-19. India is self-sufficient in food grain, fruits and vegetables but the same time India is importing a huge amount of edible oils from other countries. Edible oils are the most important commodity after petroleum and gold accounting for 40 % of agriculture import bill and 3 % of total import bill (Anonymous, 2023). Around 60 % of domestic consumption demand is to meet by imports (Anonymous, 2023). India's import expenditure on edible oil went up to US$17 billion to $18 billion in 2021-22 from US$ 10.92 billion in 2020-21. The government has already undertaken several initiatives to attain self-sufficiency in edible oils.

Indian mustard (*Brassica juncea* L.) is an important *Rabi* oilseed crop which belongs to family "Cruciferae". Mustard seeds are known by different names in different part of country e.g. *Sarson, Rai* or *Raya, Toria* or *Lahi*. The oil content in mustard seeds varies from 37-49 %, the seeds are highly nutritive containing 38-57 % eruric acid, and 27 %, oleic acid, 17-25 %, proteins, 8-10 %, 6-10 % moisture, and 10-12 % extractable substances (Pandey *et al.,* 2013). This is a potential crop in winter season due to its wider adaptability and suitability to exploit residual moisture (Mukherjee, 2010). Globally, rapeseed mustard is grown by more than seventy nations including India. The global mustard occupied area 36.54 mha with the production of mustard and its oil is around 72.80 mt and 16-18 mt, respectively (Anonymous, 2021). India contributes 28.3 % and 12.0 % in world acreage and production. India produces around 10.11 mt of rapeseed-mustard next to China (15-16 mt) and Europe (14-15 mt) with significant contribution in world mustard industry (Anonymous, 2021). In India mustard play significant role in Indian economy, sharing 14 % of gross cropped area and accounting nearly 1.5 % of gross national production and 80 % of the value of all agricultural products. Domestic production of edible oils meets only 50 % of the total requirements, while rest is imported (Choudhary *et al.,* 2023). It is third most important edible oilseed crop after soybean and groundnut sharing 27.8 % in the India's oilseed economy. (Sahoo *et al.,* 2018). In India it is mainly grown in Rajasthan, UP, Haryana, Madhya Pradesh and Gujarat states. This crop accounts for nearly one-third of the oil produced in India, making it the country's key edible oilseed crop. In Rajasthan, mustard is largely grown in the Tonk district with 0.28 mha and 0.48 mt production followed by Alwar, Bharatpur, Ganganagar etc. with recorded highest productivity of 1.85 t/ha in Alwar district. (Nadaf, 2021). The present investigation was conducted with the objectives to **s**tudy the status of rapeseed-mustard in Rajasthan as well as in India, and to identify the constraints in harvesting potential yields of rapeseed-mustard in Rajasthan.

Materials and Methods

The study utilises both primary and secondary data. The secondary data were collected from various published

sources. Primary data were collected through personal interview methods. National level data were collected from 1998 while the state data were collected from 1990 onwards to 2021-22. The district level data were collected and analysed from 1998 onwards till 2021-22. The data on rapeseed-mustard was analysed from 2000 onward to the latest available time, 2022-23. The whole data grouped into three different period groups including period I between 1992-93 to 2001-02, period II between 2002-03 to 2011-12, and period III between 2012-13 to 2021-22 considering all three variables i.e. area, production and productivity of rapeseed-mustard. Data were compiled and statistically analysed for comparison using Microsoft Excel program. The following exponential model was used to determine the compound annual growth rate (CAGR) of rapeseed–mustard area, production and productivity (Sharma and Singh, 2014):

$Y_t = ab^t$

Where, Y_t is a variable for which growth rate is calculated at t^{th} period, t is time variable, a is constant and b = (1+ r), 'r' is compound growth rate.

log Y = log a + t log b

log b = (log Y – log a)/t

log (1+ r) = (log Y – log a)/t

Assume (log Y – log a)/t = X

Therefore; r = antilog 'X' – 1

Compound annual growth rate (%) = (antilog 'X' – 1) ×100

Since 'X'= log b

r (%) = [antilog log b – 1] ×100

The student t test was used to determine the significance of the estimated compound annual growth rates.

Results and Discussion

The compound annual growth rates (CAGR) were calculated for the rapeseed-mustard during 1992-93 to 2001-02 (period I), 2002-03 to 2011-12 (period II), 2012-13 to 2021-22 (period III) and 1992-93 to 2021-22 (overall period) and the result are presented in Table 1. Rapeseed-mustard registered decline in area and production during period I with CAGR of 3.1 % and 0.1%, respectively. During period II area, production and productivity showed significant increment with a CAGR of 3.1 %, 6.7 % and 1.8 %, respectively. Production of rapeseed-mustard increased significantly (5.8 %) during period III even though there was slightly increase in area (1.9%) due to high and significant positive growth in productivity (2.8 %). The results discovered to be comparable to the growth investigated by Snehdeep *et al*. (2017). The overall CAGR of 29 years for area under rapeseed-mustard in Rajasthan was 1.0 %, while for production and productivity growth rate were 3.4 % and 2.2 %, respectively. It might be due to the ability of the rapeseed-mustard to perform better even in dry conditions.

Table 1: Compound annual growth rate of area, production and productivity of rapeseed-mustard in Rajasthan

Variables	Period I 1992-93 to 2001-02	Period II 2002-03 to 2011-12	Period III 2012-13 to 2021-22	Overall
Area	-3.1	3.1*	1.9	1.0*
Production	-0.1	6.7*	5.8*	3.4*
Productivity	2.9	1.8*	2.8*	2.2*

*Significant at 5 %level of significance

As far as per hectare yield is concerned it shows positive but significant CAGR of 2.2 % for overall period. Rate of expansion of productivity was positive with CAGR of 2.9 % in Period I and 2.8 % of CAGR during Period III. Period II experienced CAGR of 1.8 %.

Phase I (1998-99 to 2005-06)

In the first phase, result showed that highest CGAR in area under cultivation of mustard was found in Hanumangarh (22%), followed by Ganganagar (9.0%) and Bikaner (9.0%), while least growth rate in area under rapeseed-mustard was found in Jodhpur (1.6%). Production CGAR also varies across the districts, Hanumangarh (21.4 %), Bikaner (18.1 %) and in Karauli (17.5 %) had the highest CGAR, and Ganganagar (3.8 %) and Jodhpur (4.7 %) had the lowest.

Phase II (2006-07 to 2013-14)

In the second phase, the result showed the area under rapeseed-mustard in Tonk increased with CAGR of 6.9 % while production was increased with 18.7 % CAGR due to increase in productivity (11.0 %). This could be indicating improved agricultural practices, technology adoption or other factors contributing to enhanced yield and the productivity.

Phase III (2014-15 to 2021-22)

In phase III, the finding revealed that Sawai Madhopur had the lowest growth rate in area (0.3 %) while production (7.6 %) and productivity (7.9 %) showed greater increasing trends. Production levels vary across districts, with some district like Bikaner (24.2 %) and Jodhpur (15.2 %) experiencing substantial

Table 2: Compound annual growth rate (CAGR) of area, production and productivity of rapeseed-mustard in major district of Rajasthan during Period 1998-99 to 2021-22

Period interval	Variables	Districts									
		Ganganagar	Alwar	Tonk	Bharatpur	Hanumangarh	Sawai madhopur	Bikaner	Jodhpur	Jaipur	Karauli
Phase I											
1998-99 to 2005-06	Area (%)	9.0	6.8	4.7	8.6	22.0*	5.7	9.0	1.6	6.7	9.2
	Production (%)	3.8	7.6	9.2	10.2	21.4	13.6	18.1	4.7	10.6*	17.5*
	Productivity (%)	4.4	0.8	4.3	1.4	0.1*	7.6	8.3	6.3	3.6	7.6
Phase II											
2006-07 to 2006-14	Area (%)	1.9	0.4	6.9	0.9	2.1	1.6	2.7	1.0*	0.3	1.0
	Production (%)	3.9	0.7*	18.7	3.3	3.2	4.7	4.4	2.1	5.7	2.3
	Productivity (%)	5.9	1.1	11.1*	2.4	5.5	2.9	7.3	0.3*	5.2	3.3
Phase III											
2014-15 to 2021-22	Area (%)	6.3	3.6	2.6	5.0	8.3	0.3	19.7	10.9*	3.2	3.4
	Production (%)	10.3	10.3	10.8	9.8	9.1	7.6	24.2*	15.2	10.6	8.5
	Productivity (%)	3.8	6.4*	8.0	4.6	0.7*	7.9	3.8	5.8	7.2	4.9

*Significant at 5 %level of significance

improvements and others showing more modest gains. The Fig. 1 indicates the area and production of rapeseed-mustard for 30 years, in which we found that the area and production in 1992-93 were 2.22 mha and 1.71 mt, respectively. Whereas in 2005-06 findings showed that the area was significantly decreased to 3.55 mha and production increased to 4.38 mt in comparison to previous year. In 2021-22 area slightly increased to 4.17 mha and the production was highest with 7.16 mt.

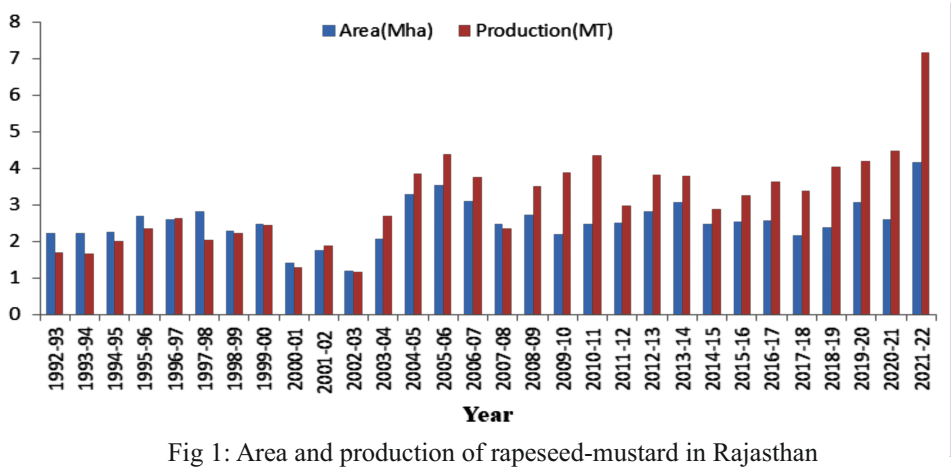

Fig 1: Area and production of rapeseed-mustard in Rajasthan

The analysis of farmer's responses on rapeseed-mustard production includes demographic profiling of the farmer households, their cropping details and acreage under rapeseed-mustard crop, marketing of rapeseed-mustard; various input cost related factors influencing the crop productivity such as labour and machine used, operational cost variables; and the perception of the farmer households on yield enhancement. The farmers mostly grow rapeseed-mustard crop on own land. For rapeseed-mustard, seed and fertilizer use, higher machine hours and farming experience have positive effect on crop yield in Rajasthan, whereas the increasing machine and irrigation cost impacts the crop yield. In Rajasthan, the farmers who used higher fertilizers, seeds and labours do not get higher yield of but the farmers who invested more on labour, seed, fertilizer and irrigation charges (as proxy to higher irrigation with uniform applicable rates) got higher rapeseed-mustard yield in the state. In Rajasthan, except the increasing machine and pesticide cost, all other factors such as higher labour, machine and fertilizer use, higher cost incurred on seed and irrigation helped farmers to get better rapeseed-mustard yield.

Conclusion

Area of rapeseed mustard experienced negative growth rate during period I (1998-99 to 2005-06), while positive growth rate during period II (2006-07 to 2006-14) and period III (2014-15 to 2021-22). CAGR of area was registered 1.0 % during overall period of study. During period I area was declined to -3.1 %. Period II achieved highest growth rate of 3.1 %. Total production of rapeseed-mustard in Rajasthan attained compound annual growth rate of 3.4 % for overall change. Among all three sub periods CAGR were highest and significant during period II which was 6.7 % and period I reported lowest growth rate of -0.1 %. Period III reported significant CAGR of 5.8 %. The area and production of rapeseed-mustard for 30 years' data in which we found that the area and production in 1992-93 were 2.22 mha and 1.71 mt, respectively. Whereas in 2005-06, area was decreased significantly to 3.55 mha and production was increased to 4.38 mt in comparison to previous year. In 2021-22, area was slightly increased to 4.17 mha and the production was increased to 7.16 mt. Therefore, ensuring the timely availability of inputs to the farmers such as improved and quality seed along with other inputs is important. Efforts for a stable domestic and trade policy with a long-term vision including all the stakeholders on all edible oil products to strengthen industry and farmers to stabilize prices, technological developments, smooth flow of raw materials and to enhance the industrial efficiency.

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Table 3: Farmers responses and factors affecting the rapeseed-mustard yield

Perception	Farmers responses (%)
1. Perception on oilseed yield	
Satisfied with the yield?	65.5
Think yield can be further improved?	98.9
Rapeseed-mustard crop profitable than other crops?	97.0
Got improved subsidized seed for Rapeseed & Mustard?	80.2
Got any training on rapeseed-mustard crop production?	82.3
Cover the rapeseed-mustard crops for insurance?	71.5
Soil testing ever performed on your field?	78.9
- If yes, using fertilizers as recommend	11.7
Adopted any post-harvest practice for oilseeds?	75.8
2. Factors impacting rapeseed-mustard yield	
Climate	15.7
Seed quality	92.8
Soil quality	80.1
Fertilizers	94.1
Irrigation	95.2
3. Satisfaction and awareness on input uses	
Seed	98.0
Seed treatment/ fungicide	97.2
Fertilizer	95.2
Weedicide	94.7
Pesticides	93.4
Manure	90.8
Irrigation	65.0
Seed	38.0
Seed treatment/ fungicide	98.0
Fertilizer	8.9
Weedicide	10.5
Pesticides	2.3
Manure	5.6
Irrigation	22.7
Seed	98.7
Seed treatment/ fungicide	97.5
Fertilizer	90.2
Weedicide	92.3
Pesticides	95.2
Manure	90.4
Irrigation	97.3

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