

RESEARCH PAPER

Temporal Variations in Area, Production and Productivity of Food Grain and Oilseed Crops in Rajasthan, India

Devendra Kumar Verma^{1*}, Nikita Khoisnam², Guneshori Maisnam³ and Ranjit Subba⁴

¹Department of Agricultural Economics, College of Agriculture, Navgaon, Sri Karan Narendra Agriculture University, Jobner, Rajasthan, India

²Department of Agricultural Economics and Extension School of Agriculture, Lovely Professional University, Phagwara, Rajasthan, India

³Amity Institute of Organic Agriculture, Amity University, Noida, India

⁴Agricultural Extension, K.V.K. Gyalshing, West Sikkim, India

*Corresponding author: devendraecon2407@gmail.com (ORCID ID: 0000-0001-9834-997X)

Received: 14-09-2024

Revised: 29-11-2024

Accepted: 07-12-2024

ABSTRACT

Indian economy is an emerging economy, but it is still an agricultural economy because here, most people earn their livelihood from agriculture. The present study for temporal changes in Rajasthan time series, data on area, production and yield per hectare of food grain and oilseeds crops were collected from 1976-77 to 2018-19. The area under wheat, bajra, maize, urad, moong, rapeseed & mustard and soybean was increased by 67.12 %, 2.68 %, 12.91 %, 333.19 %, 1009.40 %, 729.27 % and 3089.07 %, respectively from 1976-79 to 2016-2019. The area under barley, gram, sesamum, was reduced by -47.01%, -12.41 % and -34.59 % which was shifted towards pulses, and oilseeds and cereal crops like moong, urad, soybean, rapeseed & mustard and wheat. During the study period, production of wheat, barley, bajra, maize, gram, urad, moong, rapeseed & mustard, sesamum and soybean was increased by 360.62 %, 39.42 %, 256.42 %, 166.65 %, 11.23%, 565.41 %, 1776.25 %, 2487.47 %, 32.73 %, and 6019.05 %, respectively. The yield of wheat, barley, bajra, maize, gram, urad, moong, rapeseed & mustard, sesamum and soybean was increased by 174.96 %, 161.39 %, 242.27 %, 138.83 %, 26.78 %, 55.40 %, 69.25 %, 214.14 %, 103.16 % and 90.61 %, respectively period of study. The area under barley, gram and sesamum reduced during the study period. Therefore, technological support through varietal improvement and extension support is required. Enhance minimum support prices of cereals, oil seeds and pulses crops farmers motivated for cultivation of these crops.

HIGHLIGHTS

- ① The area under selected crops in Rajasthan changed remarkably from 1976-77 to 2018-19.
- ① The area under wheat, bajra, maize, urad, moong, rapeseed & Mustard and Soybean was increased while barley, gram and sesamum recorded reduced area during the study period.
- ① During the study period, production and yield showed unprecedented increased levels in all the selected crops.
- ① The spread of technology and other factors affecting crop production in the state made the drastic change in production and yield of selected crops of Rajasthan over a period of time.

Keywords: Area, production, yield, cereals, oilseed and pulses

Cereal crops provide essential nutrients and energy in the everyday human diet through direct human consumption and also via meat production since they comprise a major livestock feed, India produces a variety of crops belonging to cereals, pulses, oilseeds, fruits and vegetables, condiments, sugar,

fibres, narcotics etc. Oilseed crops are the most

How to cite this article: Verma, D.K., Khoisnam, N., Maisnam, G. and Subba, R. (2024). Temporal Variations in Area, Production and Productivity of Food Grain and Oilseed Crops in Rajasthan, India. *Econ. Aff.*, 69(04): 1603-1612.

Source of Support: None; **Conflict of Interest:** None



important commercial crops of India. In terms of acreage, production and economic value, these crops are second after food grains (Narayan, 2016). Rajasthan occupies nearly 10.4 per cent geographical area of the country. The state with its huge geographical area of 342.7 lakh hectares is the largest state of India and agriculture is reflected to be the main stay of rural crowds. Agriculture and allied activities account for nearly one fourth of the Gross State Domestic Product (GSDP) against 14 per cent at National Level. Agriculture is rain-fed in most parts of the state and prone to high production risks. In order to satisfy the requirements of the farms as well as the community, farmers in the state have evaluated various combinations of crops, livestock, horticulture and forestry, etc. Production of cereals, oilseeds, vegetables, pulses, fruits, milk and other commodities be fitting to diverse agro-climatic situations has been a matter of great concern for the rural people. With the decline in the share of agriculture in the GDP, Indian economy has faced structural changes. Even Though a fall in its share from 55.11 per cent in 1950-51 to 13.90 per cent in 2015-16 (Hazari, 2015). Despite two big reasons the importance of agriculture has not diminished. First, the country achieved self-sufficiency in food grain production at the macro level, but still is a food deficit country facing massive challenges of high prevalence of malnourished children and high incidence of rural poverty. There is a high demand on agriculture to produce more and to increase income for farmers. Second, the rural workforce's reliance on agriculture for jobs did not decline in relation to its sectoral contribution to GDP. As a result, the income gap between the agricultural and non-agricultural sectors has increased (Chand *et al.* 1999). The experiences of developed countries have shown that there has been a transition of labour-power from agriculture to non-agricultural generally and, in particular, to the manufacturing sector. This had brought improved agricultural production growth and higher incomes (Gollin *et al.* 2002). Under these situations, higher growth in agriculture assumes huge importance and is a matter of worry for policy makers and research scholars in current times.

Sustained growth in crop production can be attained provided the sustainable growth in productivity with higher yield, at the same time outpacing the

growth in cost of production. Adequate returns from the crop encourage farmers to continue with the crop over the years in the cropping structure and also effect changes in crop mix in non-traditional areas. The question ascends whether cost of cultivation of crop is rising or profitability is decrease from crops? Against this backdrop, it is related to understand the changes in cost of cultivation and profitability from crop cultivation over time (Devi and Jadav, 2018).

MATERIALS AND METHODS

The present investigation was based on information collected from Cost of Cultivation Scheme running in the Department of Agricultural Economics & Management, Rajasthan College of Agriculture, Udaipur. Total twenty-two crops undertaken in the scheme at national level for computation of cost of cultivation of crops for which data were collected in Rajasthan. Out of these, ten crops were taken under the present study. The crops included namely wheat, barley, bajra, maize, gram, urad, moong, rapeseed & mustard, sesamum and soybean. Whole Rajasthan state has been purposively selected for the study. The study was based on secondary data for the analysis. Time series data on area, production and yield per hectare of selected crops in Rajasthan were collected from the Directorate of Economics and Statistics (DES), Directorate of Agriculture (DOA) and Rajasthan State Agriculture Department (RSAD). These data were compiled for the Rajasthan state and the triennium averages for different periods were worked out for all the selected crops. For temporal changes in production, area and yield time series data on area, production and yield per hectare of selected crops were collected from 1976-77 to 2018-19.

The changes in cropping pattern of major food grains crops and oilseed crops in Rajasthan was examined for the period from 1976-77 to 2018-19. To analyses the temporal changes in area, production and productivity, the entire study period i.e. 1976-77 to 2018-19 has been covered taking decade-wise triennium ending average, i.e., from 1976-79, 1986-89, 1996-99, 2006-09 and 2016-19. Besides, absolute change in area, production and productivity, in overall decades has been also calculated. The time period has been divided into four decades namely first decade started from (1976 to 1986), second

decade (1986-1996), third decade (1996- 2006) and fourth decade (2006-2016).

RESULTS AND DISCUSSION

Temporal Changes in Area, Production and Productivity of food grain Crops in Rajasthan

The results of temporal changes in area under major food grain crops are presented in Table 1

Fig. 1. It can be seen from the table that the average area under cultivation of wheat crop decreased from 18.74 lakh hectare to 17.15 lakh hectare from 1976-79 to 1986-89 (triennium average). After that it increased to 26.40 lakh hectare in 1996-99 and again decreased to 24.84 lakh hectare in 2006-09. The highest percentage change in area of wheat about 53.90 was noticed from 1986-89 to 1996-99 (triennium average). In last decade the area under

Table 1: Temporal Changes in Area under Major Food Grain Crops in Rajasthan (1976-2018)

Crop	Year	Area (ha)	Change in area over previous decade (ha)	Per cent change in area over decade	Change in area overall decades (ha)
Wheat	1976-79	1874190			
	1986-89	1715459	-158731	-8.46	1258111
	1996-99	2640159	924700	53.90	(67.12 %)
	2006-09	2483959	-156200	-5.91	
	2016-19	3132301	648342	26.10	
Barley	1976-79	488104			
	1986-89	253168	-234936	-48.13	-229495
	1996-99	222424	-30744	-12.14	(-47.01 %)
	2006-09	256128	33704	15.15	
	2016-19	258609	2481	0.96	
Gram	1976-79	1795263			
	1986-89	1125911	-669352	-37.28	-222904
	1996-99	2182924	1057013	93.88	(-12.41 %)
	2006-09	1167170	-1015754	-46.53	
	2016-19	1572359	405189	34.71	
Maize	1976-79	773301			
	1986-89	889551	116250	15.03	99843
	1996-99	947849	58298	6.55	(12.91 %)
	2006-09	1047165	99316	10.47	
	2016-19	873144	-174021	-16.61	
Bajra	1976-79	4071126			
	1986-89	4855278	784152	19.26	109176
	1996-99	4532355	-322923	-6.65	(2.68 %)
	2006-09	5075050	542695	11.97	
	2016-19	4180302	-894748	-17.63	
Urad	1976-79	159029			
	1986-89	150081	-8948	-5.62	529881
	1996-99	194812	44732	29.80	(333.19 %)
	2006-09	129992	-64820	-33.27	
	2016-19	688910	558918	429.96	
Moong	1976-79	205371			
	1986-89	238395	33024	16.08	2073029
	1996-99	585758	347363	145.70	(1009.40 %)
	2006-09	901885	316127	53.97	
	2016-19	2278400	1376515	152.62	
Total Food grain crops	1976-79	27960087			
	1986-89	27506519	-453568	-1.62	9348504
	1996-99	33498013	5991494	21.78	(33.43 %)
	2006-09	32593368	-904645	-2.70	
	2016-19	37308591	4715223	14.46	

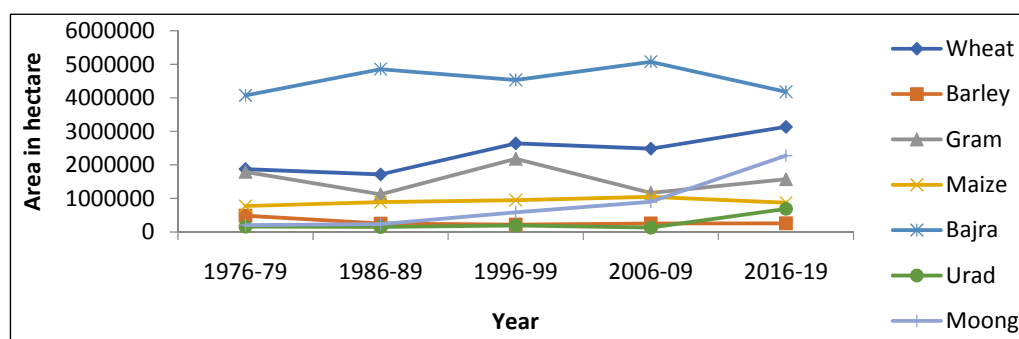


Fig. 1: Trend in area of food grains during the study period (1976-2018) in Rajasthan

wheat increased to 31.32 lakh hectare indicating absolute increase of about 12.58 lakh hectare during overall decades under study. This reveals positive change in wheat area of about 67.12 per cent during last four decades in Rajasthan (i.e. from mid-1970s to mid-2010s). These results were in confirmative with (Sunita *et al.* 2017) study of bajra in Haryana state. In Rajasthan, Barley occupied about 4.88 lakh hectare area during 1976-79 (triennium average, i.e. 1976-77, 1977-78 and 1978-79), which drastically declined to 2.53 lakh hectare in 1986-89 and further to 2.22 lakh hectare in 1996-99 (triennium average). The percentage change in area of barley in first and second decades under study was reported negative (-48.13 per cent and -12.14 per cent respectively). However, from last two decades, it has shown upward movement and reached to 2.59 lakh hectare in 2016-19. But during overall decades under study, the barley crop lost nearly 2.29 lakh hectare area, noticed percentage reduction of about 47.01. These finding were also in consonance with studies done by (Acharya *et al.* 2012) in Karnataka state. The average area under gram crop decreased from 17.95 lakh hectare in 1976-79 to 15.72 lakh hectare in 2016-19 (triennium average) and it was observed 222904 hectares (-12.41 per cent) during the overall decades under study in Rajasthan. A significant increase in average area of maize crop was found till triennium average 2006-09 and thereafter it declined. During the last decade, the reduction in area was 16.61 per cent in maize crop. In general, over all there was an increase in area of maize by 12.91 per cent during last four decades. A significant decline in average area under bajra crop was noticed during the second and last decade and reduction was 322923 and 894748 hectares, respectively. The overall area of bajra had increased by 2.68 per cent during the study period. On the other hand, a quantum jump in

the overall area under cultivation of urad crop was observed and increase was 333.19 per cent during all decades under study. The average area under moong crop increased from 2.05 lakh hectare in 1976-79 to 22.78 lakh hectare in 2016-19 (triennium average). Over the study period of time the increase was of 2073029 hectares (1009.40 per cent). The area under total food grain crops was considerably reduced during first and third decade, while there was significant increase last decade. The overall increase in total area of food grains was 93.48 lakh hectare (33.43 per cent) during the overall decades under study. Similar finding was observed by (Rijoy and Bhat, 2017).

The spread of technology and other factors affecting crop production in the state made the drastic change in production of selected crops of Rajasthan over a period of time and it has been shown in Table 2 and given in Fig. 2. The average total production increased to remarkable levels in all the crops during the study period. An increase in the total production was attributed to either expansion of area or increase in productivity or both. The total food grains production during the ending of triennium average 2016-19 was enhanced by 225.28 per cent over the triennium average 1976-79. These results were confirming the findings of (Avinash and Patil, 2018) in various study of moong in Rajasthan state.

It was interesting to note that the yields per hectare of all the selected crops of Rajasthan showed sustainability over a period of time (Table 3 & Fig. 3). It showed the positive impact of research carried out by Agricultural Universities of Rajasthan in releasing many promising varieties of different crops and also the efforts of extension wings of SAUs and the state government. The yield of total

Table 2: Temporal Changes in Production under Food Grain Crops in Rajasthan (1976-2018)

Crop	Year	Production (Tonne)	Change in production over previous decade (Tonne)	Per cent change in production over decade	Change in production overall decades (Tonne)
Wheat	1976-79	2581593			
	1986-89	3425028	843435	32.67	9309803 (360.62 %)
	1996-99	6787618	3362590	98.17	
	2006-09	7389666	602048	8.86	
	2016-19	11891396	4501730	60.91	
Barley	1976-79	629498			
	1986-89	397423	-232075	-36.86	248170 (39.42 %)
	1996-99	435655	38232	9.61	
	2006-09	669649	233994	53.71	
	2016-19	877668	208019	31.06	
Gram	1976-79	1479578			
	1986-89	734007	-745571	-50.39	166287 (11.23 %)
	1996-99	1689793	955786	130.21	
	2006-09	809287	-880506	-52.10	
	2016-19	1645864	836577	103.37	
Maize	1976-79	626551			
	1986-89	723819	97268	15.52	1044192 (166.65 %)
	1996-99	1091175	367356	50.75	
	2006-09	1636855	545680	50.00	
	2016-19	1670743	33888	2.07	
Bajra	1976-79	1091497			
	1986-89	1390717	299220	27.41	2798895 (256.42 %)
	1996-99	2208414	817697	58.79	
	2006-09	3991730	1783316	80.75	
	2016-19	3890392	-101338	-2.53	
Urad	1976-79	60364			
	1986-89	35148	-25216	-41.77	341305 (565.41 %)
	1996-99	74802	39654	112.82	
	2006-09	49606	-25196	-33.68	
	2016-19	401669	352063	709.71	
Moong	1976-79	57594			
	1986-89	49615	-7979	-13.85	1023016 (1776.25 %)
	1996-99	155084	105469	212.57	
	2006-09	353750	198666	128.10	
	2016-19	1080610	726860	205.47	
Total Food grain crops	1976-79	19540268			
	1986-89	20188610	648342	3.31	44020694 (225.28 %)
	1996-99	37288639	17100029	84.70	
	2006-09	44423775	7135136	19.13	
	2016-19	63560962	19137187	43.07	

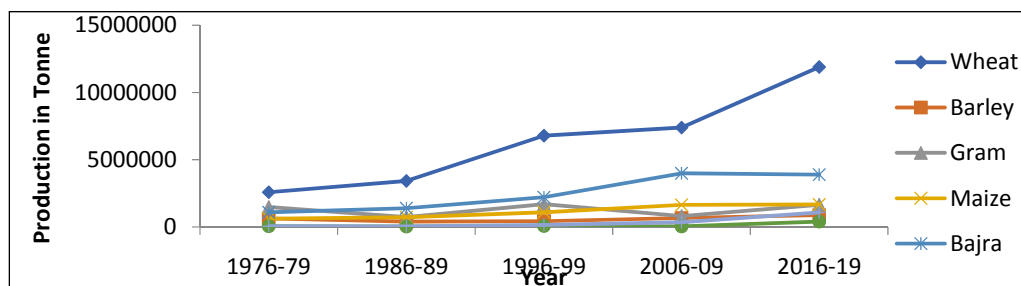
**Fig. 2:** Trend in production of food grains during the study Period (1976-2018) in Rajasthan State

Table 3: Temporal Changes in Yield under Food Grain Crops in Rajasthan (1976-2018)

Crop	Year	Productivity (Kg/ha.)	Change in Productivity over previous decade (Kg/ha.)	Per cent change in Productivity over decade	Change in Productivity overall decades (Kg/ha.)
Wheat	1976-79	1382			
	1986-89	1994	612	44.28	2418
	1996-99	2576	582	29.18	(174.96 %)
	2006-09	2983	407	15.79	
	2016-19	3800	817	27.38	
Barley	1976-79	1303			
	1986-89	1547	244	18.72	2103
	1996-99	1964	417	26.95	(161.39 %)
	2006-09	2590	626	31.87	
	2016-19	3406	816	31.50	
Gram	1976-79	825			
	1986-89	645	-180	-21.81	221
	1996-99	770	125	19.37	(26.78 %)
	2006-09	703	-67	-8.70	
	2016-19	1046	343	48.79	
Maize	1976-79	806			
	1986-89	804	-2	-0.24	1119
	1996-99	1180	376	46.76	(138.83 %)
	2006-09	1559	379	32.11	
	2016-19	1925	366	23.47	
Bajra	1976-79	272			
	1986-89	265	-7	-2.57	659
	1996-99	485	220	83.01	(242.27 %)
	2006-09	785	300	61.85	
	2016-19	931	146	18.59	
Urad	1976-79	379			
	1986-89	244	-135	-35.62	210
	1996-99	380	136	55.73	(55.40 %)
	2006-09	372	-8	-2.10	
	2016-19	589	217	58.33	
Moong	1976-79	280			
	1986-89	194	-86	-30.71	194
	1996-99	260	66	34.02	(69.25 %)
	2006-09	390	130	50.00	
	2016-19	474	84	21.53	
Total Food grain crops	1976-79	15556			
	1986-89	16783	1227	7.88	7785
	1996-99	22774	5991	35.69	(50.04 %)
	2006-09	27868	5094	22.36	
	2016-19	23341	-4527	-16.24	

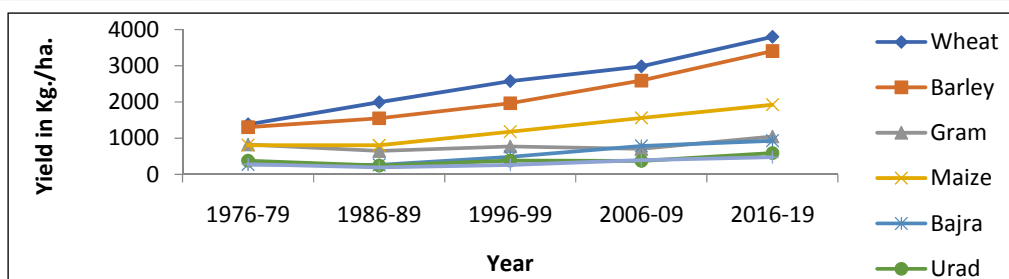


Fig. 3: Trend in productivity of food grains during the study period (1976-2018) in Rajasthan State

food grain crops was increased significantly by 50.04 per cent during all decades under study in Rajasthan. Among the food grains highest increase in yield was shown in bajra by 242.27 per cent and lowest was recorded in gram by 26.78 per cent during the study period. A sizable increase of yield in wheat (174.96 per cent), barley (161.39 %), maize (138.83 per cent), urad (55.40 per cent) and moong (69.25 per cent) were recorded during the study period. Similar results were also reported by (Patil *et al.* 2010) in their study which was conducted for Growth and instability in area, production and productivity of different crops in Bengaluru Division.

Temporal Changes in Area, Production and Productivity of oil seeds and cash crops

The changes in area of oil seeds and cash crops were analyzed for the period from 1976-77 to 2018-19. The results are showed in Table 4 and Fig. 4. The average area under rapeseed & mustard was started increasing continuously till 2006-09 (triennium average), and after that in 2016-19 it was decreased. In general, there was an increase in area of rapeseed & mustard by 729.27 per cent during the overall decades under study. The data shows continuous increase in average acreage under soybean crop in the entire trienniums. The overall

Table 4: Temporal Changes in Area under Oilseeds and Cash Crops in Rajasthan (1976-2018)

Crop	Year	Area (ha)	Change in area over previous decade (ha)	Per cent change in area over decade	Change in area overall decades (ha)
Rapeseed & Mustard	1976-79	299523			
	1986-89	1067101	767578	256.26	2184337 (729.27 %)
	1996-99	2582982	1515881	142.06	
	2006-09	2765255	182273	7.05	
	2016-19	2483860	-281395	-10.17	
Soybean	1976-79	30040			
	1986-89	80958	50918	169.50	927959 (3089.07 %)
	1996-99	548062	467104	576.97	
	2006-09	756074	208012	37.95	
	2016-19	957999	201925	26.70	
Sesamum	1976-79	387908			
	1986-89	291959	-95949	-24.73	-134215 (-34.59 %)
	1996-99	310165	18206	6.23	
	2006-09	369809	59644	19.22	
	2016-19	253693	-116116	-31.39	
Total Oilseed crops	1976-79	1870305			
	1986-89	4105166	2234861	119.49	9054863 (484.13 %)
	1996-99	10162113	6056947	147.54	
	2006-09	11325941	1163828	11.45	
	2016-19	10925168	-400773	-3.53	

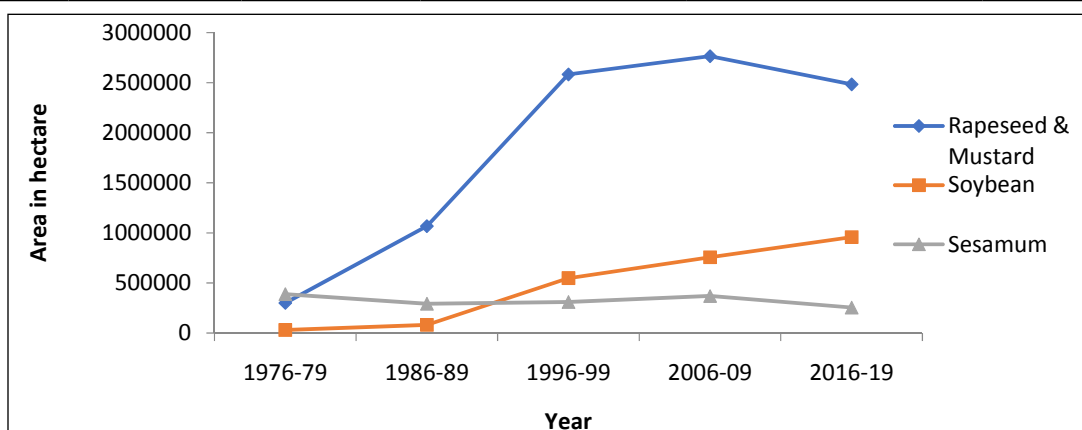


Fig. 4: Trend in area of oilseeds and cash crops during the study period (1976-2018) in Rajasthan

increase in average area of soybean was 3089.07 per cent during the study period. The area in first and last decade under sesamum crop decreased by -24.73 and -31.39 per cent, respectively (Pandey and Rai, 2018). The overall decrease in average area of sesamum was 34.59 per cent during the study period. The average area under total oilseed crops had increased by 484.13 per cent during the study period. The average area of oilseed crops had increased during all decades except last decade. In last decade the total area of oilseeds had reduced by -3.53 per cent.

The total production of oilseed crops enhanced from 6.57 lakh tonne in 1976-79 to 156.70 lakh tonne (2283.37 per cent) in 2016-19 (triennium average).

Rapeseed & mustard, soybean and sesamum recorded increase in production by 2487.47, 6019.05 and 32.73 per cent, respectively from 1976-79 to 2016-19 (triennium average) Table 5 and Fig. 5.

It was interesting to note that the yields per hectare of all the selected crops of Rajasthan showed sustainability over a period of time (Table 6 and Fig. 6). It showed the positive impact of research carried out by Agricultural Universities of Rajasthan in releasing many promising varieties of different crops and also the efforts of extension wings of SAUs and the state government.

The yield of all oilseed crops increased by 143.02 per cent from 1976-79 to 2016-19 (triennium average).

Table 5: Temporal Changes in Production under Oilseeds and Cash Crops in Rajasthan (1976-2018)

Crop	Year	Production (Tonne)	Change in production over previous decade (Tonne)	Per cent change in production over decade	Change in production overall decades (Tonne)
Rapeseed & Mustard	1976-79	156024			
	1986-89	978963	822939	527.44	3881039 (2487.47 %)
	1996-99	2298673	1319710	134.80	
	2006-09	3194941	896268	38.99	
	2016-19	4037063	842122	26.35	
Soybean	1976-79	18359			
	1986-89	74627	5626	306.48	1105039 (6019.05 %)
	1996-99	659651	585024	783.93	
	2006-09	883507	223856	33.93	
	2016-19	1123398	239891	27.15	
Sesamum	1976-79	61498			
	1986-89	25977	-35521	-57.75	20132 (32.73 %)
	1996-99	52804	26827	103.27	
	2006-09	104263	51459	97.45	
	2016-19	81630	-22633	-21.70	
Total Oilseed crops	1976-79	657474			
	1986-89	3197605	2540131	386.34	15012609 (2283.37 %)
	1996-99	9021524	5823919	182.13	
	2006-09	12483312	3461788	38.37	
	2016-19	15670083	3186771	25.52	

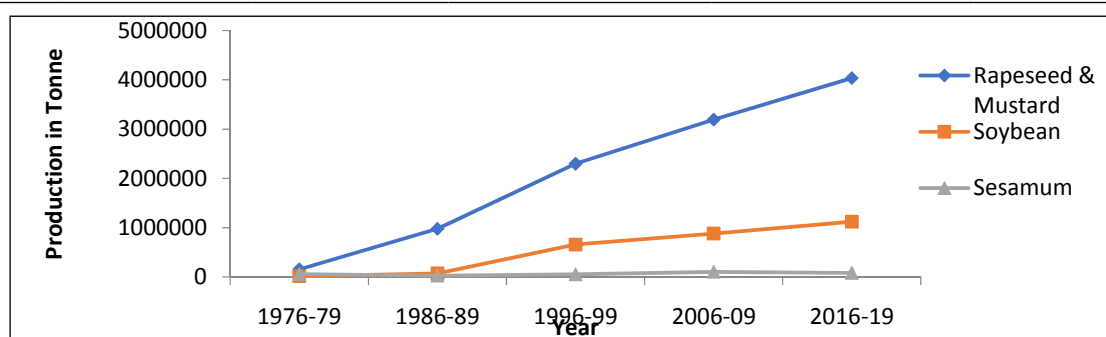
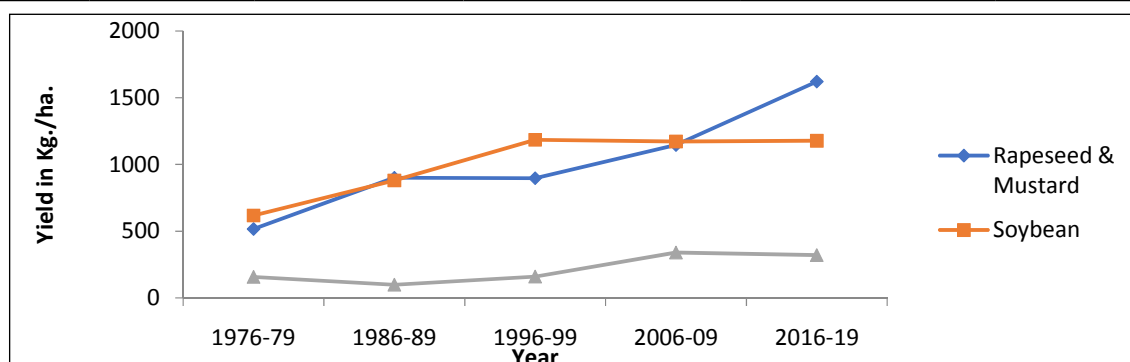


Fig. 5: Trend in production of oilseeds and cash crops during the study Period -(1976-2018) in Rajasthan

Table 6: Temporal Changes in Yield under Oilseeds and Cash Crops in Rajasthan (1976-2018)

Crop	Year	Productivity (Kg/ha.)	Change in Productivity over previous decade (Kg/ha.)	Per cent change in Productivity over decade	Change in Productivity overall decades (Kg/ha.)
Rapeseed & Mustard	1976-79	516			
	1986-89	900	384	74.41	1105
	1996-99	897	-3	-0.33	(214.14 %)
	2006-09	1146	249	27.75	
	2016-19	1621	475	41.44	
Soybean	1976-79	618			
	1986-89	881	263	42.55	560
	1996-99	1185	304	34.30	(90.61 %)
	2006-09	1173	-12	-1.01	
	2016-19	1178	5	0.42	
Sesamum	1976-79	158			
	1986-89	99	-59	-37.34	163
	1996-99	160	61	61.61	(103.16 %)
	2006-09	340	180	112.50	
	2016-19	321	-19	-5.58	
Total Oilseed crops	1976-79	3756			
	1986-89	5512	1756	46.75	5372
	1996-99	6675	1163	21.09	(143.02%)
	2006-09	7783	1108	16.59	
	2016-19	9128	1345	17.28	

**Fig. 6:** Trend in Productivity of oilseeds and cash crops during the study Period (1976-2018) in Rajasthan State

Amongst the three oilseed crops, namely rapeseed & mustard, soybean and sesamum, the increase in yields were found to be 214.44, 90.61 and 103.16 per cent, respectively from 1976-79 to 2016-19 (triennium average).

The study revealed that there was much more fluctuation in area, production and productivity of oil seed and cash crops in different trienniums. The main reasons for fluctuation in area, production and productivity of oilseed and cash crops were adoption of high yielding varieties, fluctuation in market price, inadequate and irregular irrigation, rainfall variation, widespread infestation of insect and pest and destruction of crops by wild animals (Ahmed *et al.* 2015).

In short, area, production and productivity of oilseeds during the last three decades had increased due to initiatives have taken on a technological mission on oilseeds and other oilseed development programmes in Rajasthan. The area expansion in oilseed during the last three decades was a major source of growth in oilseeds. The area increase was noticed where the total oilseed crops were superior options to traditional crops like coarse cereals and millets. Farmer always searched for technological options and practices which brought them higher returns and readily responded to various economic incentives.

CONCLUSION

The area under selected crops in Rajasthan state had changed remarkably during 1976-77 to 2018-19. The area under barley, gram and sesamum reduced and that area was shifted towards pulses, oil seeds and cereal crops like moong, urad, soybean, rapeseed & mustard and wheat. Production and productivity of all the selected crops of Rajasthan improved substantially during the last four decades. In foodgrain crops moong crop recorded highest growth in area, production and bajra noticed in yield. Soybean crop recorded highest growth rate of area and production, while sesamum crop reported the highest growth rate of yield in oilseed crops. The study revealed that there was much more fluctuation in area, production and productivity of food grain crops and oilseeds crops in different trienniums. The main reasons for fluctuation in area, production and productivity of food grains were adoption of high yielding varieties, fluctuation in market price, inadequate and irregular irrigation, rainfall variation, widespread infestation of insect and pest and destruction of crops by wild animal.

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