

Impact of Doubling Farmers' Income on Area, Production and Productivity of Pulses in India

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Authors' contributions

This work was carried out in collaboration among all the authors. Author SBRL ha tabulated the data, performed the statistical analysis and wrote the first draft of the manuscript. Author PP collected and tabulated the data and author KCG has designed the study and has given necessary suggestions for finalizing the study. All authors read and approved the final manuscript.

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ABSTRACT

India is the largest producer and consumer of pulses in the world contributing around 25-28% of the total global production. The increasing demand and supply gap of pulses has led to an increasing trend in their import by India. In view of this gap, one of the strategies for "Doubling Farmers' Income by 2022" was to enhance area, production and productivity of pulses in India by incentivizing the farmers with right price. Hence an attempt has been made in this study to analyze the growth of pulses over a period of time i.e. from 1980-81 to 2017-18 in India using secondary data. The average annual growth rates and percentages were used as tools to carry out analysis. The results revealed that area, production and productivity of total pulses was positive but indicating a slow growth of 1.36 per cent, 3.29 per cent and 2.04 per cent respectively per annum. Due to steep hike in Minimum Support Price (MSP) during 2015-16, it was noticed that area, production and yield have recorded higher growth than previous years. The percentage change in area, production and productivity for major pulses during three periods indicated that there was a marginal increase in area and production of gram in major producing states and the same trend was noticed in red gram and black gram. It was also observed that in some of the states the growth in period- III for major pulses was higher compared to period-II. Policy implications or lessons learned are missing!

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1. INTRODUCTION

The growth of Indian agriculture over last few decades has helped the country in achieving food security at National level. The next big challenge faced by the country in general and Indian agriculture in particular is to sustain this growth and achieve nutritional security as well. On the consumption side, pulses will continue to form a major source of protein for a huge section of India, particularly for the poor, backward classes and most of the traditionally vegetarian population [1]. India, a country with high concentrations of poor and malnourished people, has for long promoted a cereal-centric diet, composed of subsidized staples such as rice and wheat. Today, however, dietary patterns are changing. Policy makers, researchers, and health activists are looking for ways to fight malnutrition in the country and not just hunger. As attention is shifted from calorie intake to nutrition, neglected foods such as pulses (the dried, edible seeds of legumes) and minor pulses are gaining popularity.

The Food Security Act-2013 mandatorily envisages the right to nutritional security as well. To ensure access to adequate quantity of quality food at affordable prices to each individual is government's top priority, as per FSA-2013. Pulses are an important group of food crops that can play a vital role to address national food and nutritional security and also tackle environmental challenges due to their high nutritional value (20-30 % protein) [2]. Pulses are considered as the climate-smart crops which helps the small farmers in arid and semi-arid regions of the world, withstand weather variability, require less water, enrich the soil and are packed with nutrition. However, due to inherent problems, growth performance of pulses in terms of area, production and yield has been slow. The recent policy initiative as a part of "Doubling Farmers Income by 2022" has emphasized on increasing area and production of pulses by raising their minimum support price (MSP). Hence, there is a substantial increase in area and production of pulses for the past three years. Keeping in view of the facts, an attempt has been made to analyze the growth of pulses over a period of time in India. The paper also aims to analyze the impact of recent policy of MSP as a part of "Doubling Farmers Income by 2022".

1.1 Background

India is the largest producer and consumer of pulses in the world contributing around 25-28% of the total global production [3-6]. Irony is, India is also a largest importing country of pulses as well in the world. In India pulses are cultivated in both kharif and rabi seasons, while rabi season accounts for higher share of total pulses produced in the country. The important pulses grown in India are gram (chickpea), red gram (tur), urad (black gram), moong (green gram), masoor (lentils) and peas. India constitutes about 90% of the global pigeon pea, 75% of chickpea and 37% of lentil. In India the major pulses producing states are Madhya Pradesh (25%), Uttar Pradesh (13%), Maharashtra (12%), Rajasthan (11%), and Andhra Pradesh (9%). Bengal gram and red gram constitute 44.77 and 16.88 per cent respectively of total pulse production in India (2017-18).

2. MATERIALS AND METHODS

2.1 Sources of Data

For the purpose of present study, time series secondary data with respect to area, production and productivity of total pulse crops in India during 1980-81 to 2017-18 was collected from various reports of Directorate of Economics and Statistics (DES). Minimum support Prices (MSP) from 2010-11 to 2019-20 were collected from the website of Commission on Agricultural Costs and Prices (CACP) in order to analyze the trend and their impact on change in the acreage under pulses.

2.2 Data Analysis

To analyse the growth in area, production and productivity of total pulses from 1980-81 to 2017-18, Average Annual Growth Rates (AAGR) were worked out as follows

$$AAGR = (GR_A + GR_B + \dots + GR_n) / N$$

Where, GR_A = Growth rate in period A, GR_B = Growth rate in period B, GR_n = Growth rate in period n, N= No. of years.

The growth of major pulse crops was analysed using percentages for three different periods, viz.

Period-I (1980-81), Period-II (1990-91), and Period-III (2017-18).

Percentages were calculated for the years from 2014-15 to 2017-18 to identify the proportionate change in terms of area, production and yield of major pulses over previous years. This particular analysis is done to know the impact of policy intervention on "Doubling Farmers' Income by 2022."

3. RESULTS AND DISCUSSION

The results of the analysis of the data on pulses are presented under the following sections.

3.1 Scenario of Pulses in India

Pulses were cultivated in an area of 29.99 million hectares during 2017-18 with an overall production of 25.23 MMT (Table 1). However, as compared to 2015-16, area, production and productivity increased by 20.39 per cent, 54.31 per cent and 28.20 per cent, respectively. The share of different states in area and production of pulses for 2017-18 indicates that Madhya Pradesh, Rajasthan, Maharashtra, Uttar Pradesh, Karnataka and Andhra Pradesh accounted for more than 70% of total area under pulses, contributing nearly 80 percent of total production. Thus, production of pulses is concentrated in a few states, and similarly few states dominated the production pattern of individual pulse crops (Srivastava et al., 2010). Higher yields were recorded in the case of Madhya Pradesh, Jharkhand, Gujarat, Uttar Pradesh and West Bengal (approximately 1000 Kgs per ha).

The state-wise analysis (Table 1) revealed that in the case of almost all the states, the proportion of total area, production and yield increased during 2017-18 as compared to 2015-16. While, in the case of Maharashtra, though the proportion of area under total pulses more or less remained same, due to improvement in yields, the proportion of production in total pulses has declined. However, better performance in other minor pulse producing states has led to a marginal increase in total production of pulses in 2017-18 (1.33 MMT) compared to 2015-16 (0.27 MMT).

3.2 Growth Performance of Pulses in India

From the Table 2 it is evident that the area under total pulses recorded a slow growth of 22.05 per

cent i.e. from 23.04 million hectares during T.E 1982-83 to 28.12 million hectares in T.E 2017-18. Whereas, production increased by 90.29 per cent i.e from 11.33 MMT to 21.56 MMT during the same period, which can be attributed to the increase in productivity by 54.71 per cent (i.e. from 491.67 Kg/ha to 760.67 Kg/ha).

The average annual growth rates in area, production and productivity of total pulses was positive but indicating a slow growth of 1.36 per cent, 3.29 per cent and 2.04 per cent respectively per annum (Table 3). Even with the best efforts, pulses production has been slow, mainly due to slow growth in expansion of their area. However, due to increase in yield, especially during recent years, it has resulted in increase in production. In addition to this, these crops are mainly cultivated in rainfed conditions, leaving less scope for expansion of area under irrigated condition. Keeping in view of these factors, as a part of strategies for "Doubling farmer's income, by 2022" an unprecedented hike in MSP was announced by Government. Hence, there has been an increase in area, production and productivity of pulses during the last three years.

3.3 Growth Performance of Bengal Gram in India

Bengal gram is grown in an area of 10.56 million hectares constituting 41.25 percent of area under total pulses in India during 2017-18. Production of gram is also the highest among all pulses produced in the country constituting 11.38 MMT accounting for nearly 44.91 percent of the total pulse production in India.

3.4 Major Contributing States in Terms of Area and Production of Bengal Gram

More than 90 per cent of gram production of the country has been realized by ten states of Madhya Pradesh, Maharashtra, Rajasthan, Karnataka, Uttar Pradesh, Andhra Pradesh, Gujarat, Jharkhand, Chhattisgarh and Telangana. From Table 4, it is observed that Madhya Pradesh contributed 33.99 per cent of the total gram area and 40.92 % of total gram production in the country, thereby ranking first both in area and production followed by Maharashtra (18.94 per cent, 15.89 per cent) and Rajasthan (14.89 per cent, 14.87 per cent) during 2017-18. As compared with 2015-16, the area during 2017-18 in all the states has increased except Karnataka.

Table 1. Area, production and yield of total pulses in major producing states of India during 2017-18 in Comparison with 2015-16 (Area – Million Ha, Production - Million Metric Tons, Productivity – Kg/Ha)

State	2017-18			2015-16						
	Area	% to All India	Production	% to All India	Yield	Area	% to All India	Production	% to All India	Yield
Madhya Pradesh	7.48	24.94	8.11	32.14	1084	5.88	23.58	5.30	32.43	902
Rajasthan	5.33	17.77	3.39	13.42	635	3.87	15.52	1.99	12.17	515
Maharashtra	4.35	14.51	3.3	13.09	759	3.54	14.23	1.54	9.45	436
Uttar Pradesh	2.27	7.56	2.21	8.75	974	1.88	7.55	1.14	6.97	403
Karnataka	3.02	10.07	1.86	7.35	614	2.82	11.33	1.14	6.97	403
Andhra Pradesh	1.41	4.69	1.22	4.85	870	1.45	5.82	1.23	7.52	848
Gujarat	0.91	3.03	0.93	3.67	1018	0.58	2.34	0.54	3.33	931
Jharkhand	0.79	2.64	0.85	3.35	1065	0.60	2.39	0.53	3.22	886
Tamil Nadu	0.87	2.88	0.55	2.18	635	0.88	3.53	0.55	3.39	631
Chhattisgarh	0.78	2.61	0.54	2.15	693	0.84	3.38	0.51	3.13	609
Telangana	0.57	1.91	0.51	2.01	885	0.47	1.89	0.24	1.47	508
West Bengal	0.46	1.53	0.44	1.76	969	0.35	1.39	0.36	2.19	1039
Others	1.75	5.85	1.33	5.28	-	0.28	1.11	0.27	1.68	-
All India	29.99	100	25.23	100	841	24.91	100	16.35	100.00	656

Source : Directorate of Economics and Statistics, DAC&FW,GoI

Table 2. All India area, production & productivity of pulses (Area - Million Ha, Production - Million Metric Tons, Productivity – Kg/Ha)

Year /Crop		T E -1982-83	T E -1992-93	T E -2017-18	% change over T.E 1982-83
Red Gram	A	2.92	3.6	4.57	56.51
	P	2.06	2.29	3.89	88.83
	Y	704.67	637.67	839.66	19.16
Bengal Gram	A	7.28	6.52	9.53	30.91
	P	4.75	4.63	9.22	94.11
	Y	654	711.67	959	46.64
Lentil /Masoor	A	0.96	1.19	1.43	48.96
	P	0.49	0.81	1.27	159.18
	Y	504.67	682.67	879	74.17
Green Gram	A	27.73	32.8	41.32	49.01
	P	10.33	13.57	19.27	86.54
	Y	240.1	417.33	464.5	93.46
Black Gram	A	2.83	3.31	4.46	57.60
	P	0.98	1.56	2.76	181.63
	Y	352.67	472.33	610.25	73.04
Total Pulses	A	23.04	23.19	28.12	22.05
	P	11.33	13.03	21.56	90.29
	Y	491.67	561.33	760.67	54.71

Table 3. Average Annual Growth Rates (AAGR) of pulses during 1980-81 to 2017-18

Sl.No	Crop	A	P	Y
1.	Bengal Gram	2.195	4.551	1.893
2.	Red Gram	1.545	4.069	2.042
3.	Black Gram	2.013	4.461	2.244
4.	Green Gram	1.700	6.848	3.94
5.	Lentil	1.588	4.158	2.572
6.	Total Pulses	1.360	3.291	2.040

The percentage change in area, production and productivity of gram for three periods under study (Table 5) indicates that all the major producing states recorded a marginal increase in area and production from Period-I to Period- III except Rajasthan and Uttar Pradesh which have shown a declining trend. However, w.r.t production and productivity Karnataka recorded the highest change i.e 928.57 and 91.28 per cent respectively.

Area under chickpea started increasing in Andhra Pradesh and Karnataka mainly on account of higher adoption of improved short-duration and wilt resistant varieties [7].

The productivity of pulses also recorded a positive growth in all the states. The improvement in productivity of pulses in India was mainly on account of higher adoption of improved varieties by farmers, supply of more breeder seeds, demonstration of pulses production technology and policy support [7].

3.5 Growth Performance of Red Gram in India

Red gram is the second largest pulse crop after gram in India with a production of 4.25 MMT from an area of 4.43 million hectares during 2017-18 (Table 6). Even though it is the major pulse crop, the share of red gram in total pulse production has declined from 21.1 per cent during 2016-17 to 16.93 per cent in 2017-18.

3.6 Major Contributing States in Terms of Area and Production of Red Gram

Maharashtra is the highest red gram producing state with a major share of 27.73 per cent and 25.21 per cent of the total area and total production respectively in the country during 2017-18 (Table 6). Next to Maharashtra are Madhya Pradesh (19.72 per cent), Karnataka (18.06 per cent) and Gujarat (7.92 per cent) in terms of production. Leading states after

Table 4. Area, production and yield of bengal gram in major producing states of India during 2017-18 in Comparison with 2015-16 (Area – Million Ha, Production - Million Metric Tons, Productivity – Kg/Ha)

State	2017-18			2015-16						
	Area	% to All India	Production	% to All India	Yield	Area	% to All India	Production	% to All India	Yield
Madhya Pradesh	3.59	33.99	4.60	40.92	1280.00	3.02	35.92	3.36	47.66	1115
Maharashtra	2.00	18.94	1.78	15.89	892.00	1.44	17.17	0.78	11.01	539
Rajasthan	1.57	14.89	1.67	14.87	1062.00	0.94	11.22	0.84	11.91	892
Karnataka	1.27	11.98	0.72	6.42	570.00	1.42	16.91	0.66	9.38	466
Andhra Pradesh	0.52	4.92	0.59	5.21	1125.00	0.47	5.61	0.50	7.08	1062
Uttar Pradesh	0.50	4.74	0.58	5.16	1156.00	0.27	3.19	0.16	2.32	612
Gujarat	0.29	2.77	0.37	3.27	1253.00	0.12	1.37	0.15	2.17	1330
Chattisgarh	0.32	3.01	0.32	2.82	995.00	0.30	3.61	0.22	3.10	722
Jharkhand	0.23	2.20	0.29	2.61	1258.00	0.16	1.90	0.16	2.27	995
Others	0.27	2.54	0.32	2.84	-	0.06	0.70	0.05	0.66	-
All India	10.56	100.00	11.23	100.00	1063.00	8.40	100	7.06	100	840

Source: Directorate of Economics and Statistics, DAC&FW, GoI

Table 5. Percentage change in area, production and productivity of bengal gram in major producing states of India (Area – Million Ha, Production - Million Metric Tons, Productivity – Kg/Ha)

State	Area			Production					Productivity						
	1980-81	1990-91	% change	2017-18	% change	1980-81	1990-91	% change	2017-18	% change	1980-81	1990-91	% change	2017-18	% change
Madhya Pradesh	1.81	2.46	35.91	3.59	45.93	1.06	1.89	78.30	4.60	143.39	588.00	768.00	30.61	1280.00	66.67
Maharashtra	0.43	0.67	55.81	2.00	198.51	0.15	0.36	140.00	1.78	394.44	349.00	532.00	52.44	892.00	67.67
Rajasthan	1.23	1.65	34.15	1.57	-4.85	0.85	1.01	18.82	1.67	65.35	697.00	612.00	-12.20	1062.00	73.53
Karnataka	0.14	0.23	64.29	1.27	452.17	0.06	0.07	16.67	0.72	928.57	401.00	298.00	-25.69	570.00	91.28
Andhra Pradesh	0.05	0.09	80.00	0.52	477.78	0.01	0.06	500.00	0.59	883.33	298.00	644.00	116.11	1125.00	74.69
Uttar Pradesh	1.50	1.28	-14.67	0.50	-60.94	1.29	1.12	-13.18	0.58	-48.21	861.00	879.00	2.09	1156.00	31.51
Gujarat	0.06	0.17	183.33	0.29	70.59	0.05	0.12	140.00	0.37	208.33	740.00	680.00	-8.11	1253.00	84.26
Chattisgarh	-	-	-	0.32	-	-	-	-	0.32	-	-	-	-	995.00	-
Jharkhand	-	-	-	0.23	-	-	-	-	0.29	-	-	-	-	1258.00	-
Telangana	-	-	-	0.27	-	-	-	-	0.32	-	-	-	-	-	-
All India	6.59	7.52	14.11	10.56	40.43	4.33	5.36	23.79	11.23	109.51	657.00	712.00	8.37	1063.00	49.30

Table 6. Area, production and yield of red gram in major producing states during 2017-18 in Comparison with 2015-16 (Area – Million Ha, Production - Million Metric Tons, Productivity – Kg/Ha)

State	2017-18					2015-16				
	Area	% to All India	Production	% to All India	Yield	Area	% to All India	Production	% to All India	Yield
Maharashtra	1.23	27.73	1.07	25.21	873	1.24	31.21	0.56	21.74	450
Madhya Pradesh	0.65	14.6	0.84	19.72	1297	0.58	14.61	0.62	24.40	1079
Karnataka	0.89	19.97	0.77	18.06	868	0.66	16.58	0.24	9.45	368
Gujarat	0.27	6.12	0.34	7.92	1244	0.23	5.78	0.26	10.06	1125
Uttar Pradesh	0.28	6.36	0.33	7.8	1177	0.27	6.69	0.18	7.15	691
Telangana	0.33	7.45	0.26	6.18	797	0.25	6.26	0.10	4.06	419
Jharkhand	0.19	4.37	0.22	5.22	1147	0.20	4.98	0.18	6.95	903
Odisha	0.14	3.11	0.12	2.91	897	0.14	3.49	0.12	4.78	886
Andhra Pradesh	0.28	6.3	0.12	2.8	427	0.22	5.55	0.13	5.15	600
Tamil Nadu	0.05	1.19	0.06	1.44	1162	0.06	1.49	0.05	2.09	908
Others	0.12	2.79	0.12	2.74		0.05	1.16	0.04	1.57	
All-India	4.43	100	4.25	100	960	3.96	100.00	2.56	100	646

Source: Directorate of Economics and Statistics, DAC&FW,GoI

Table 7. Percentage change in area, production and productivity of red gram in major producing states of India (Area – Million Ha, Production - Million Metric Tons, Productivity – Kg/Ha)

State	Area			Production					Productivity						
	1980-81	1990-91	% change	2017-18	% change	1980-81	1990-91	% change	2017-18	% change	1980-81	1990-91	% change	2017-18	% change
Maharashtra	0.71	1.01	42.78	1.23	22.02	0.36	0.42	16.94	1.07	154.16	510.00	418.00	-18.04	873.00	108.85
Madhya Pradesh	0.52	0.44	-15.49	0.65	47.06	0.30	0.44	43.75	0.84	92.22	581.00	989.00	70.22	1297.00	31.14
Karnataka	0.34	0.46	37.80	0.89	92.22	0.13	0.18	40.00	0.77	340.00	370.00	379.00	2.43	868.00	129.02
Gujarat	0.19	0.40	113.83	0.27	-32.84	0.14	0.35	147.89	0.34	-3.41	754.00	877.00	16.31	1244.00	41.85
Uttar Pradesh	0.52	0.47	-10.52	0.28	-40.17	0.76	0.58	-23.65	0.33	-42.91	1448.00	1234.00	-14.78	1177.00	-4.62
Jharkand	-	-	-	0.19	-	-	-	-	0.22	-	-	-	-	1147.00	-
Odisha	0.08	0.17	101.22	0.14	-15.15	0.04	0.13	202.33	0.12	-7.69	521.00	791.00	51.82	897.00	13.40
Andhra Pradesh	0.23	0.35	52.42	0.28	-19.08	0.04	0.07	68.18	0.12	62.16	194.00	213.00	9.79	427.00	100.47
Tamil Nadu	0.07	0.11	69.70	0.05	-55.36	0.03	0.07	137.93	0.06	-13.04	434.00	612.00	41.01	1162.00	89.87
India	2.84	3.59	26.43	4.43	23.30	1.96	2.42	23.51	4.25	75.84	689.00	673.00	-2.32	960.00	42.64

Table 8. Area, production and yield of black gram in major producing states of India during 2017-18 in Comparison with 2015-16 (Area – Million Ha, Production - Million Metric Tons, Productivity – Kg/Ha)

State	2017-18			2015-16						
	Area	% to All India	Production	% to All India	Yield	Area	% to All India	Production	% to All India	Yield
Madhya Pradesh	1.82	34.47	1.35	38.68	739.00	0.94	25.80	0.52	26.53	553
Rajasthan	0.84	15.91	0.52	14.90	624.00	0.30	8.24	0.11	5.89	384
Uttar Pradesh	0.61	11.55	0.31	8.88	511.00	0.57	15.73	0.22	11.13	380
Maharashtra	0.35	6.63	0.12	3.44	346.00	0.29	7.89	0.06	3.14	213
Tamil Nadu	0.43	8.14	0.30	8.60	707.00	0.40	10.91	0.26	13.58	668
Andhra Pradesh	0.40	7.58	0.37	10.60	920.00	0.46	12.58	0.41	21.13	901
Jharkhand	0.15	2.84	0.13	3.72	874.00	0.09	2.62	0.07	3.71	760
Karnataka	0.14	2.65	0.07	2.01	506.00	0.09	2.51	0.03	1.29	275
Gujarat	0.14	2.65	0.09	2.58	636.00	0.06	1.77	0.04	1.95	594
West Bengal	0.08	1.52	0.06	1.72	764.00	0.07	2.04	0.05	2.80	735
All India	5.28	100.00	3.49	100.00	662.00	3.62	100.00	1.95	100.00	537

Source: Directorate of Economics and Statistics, DAC&FW, GoI

Table 9. Percentage change in area, production and productivity of black gram in major producing states of India (Area – Million Ha, Production - Million Metric Tons, Productivity – Kg/Ha)

State	Area			Production					Productivity						
	1980-81	1990-91	% change	2017-18	% change	1980-81	1990-91	% change	2017-18	% change	1980-81	1990-91	% change	2017-18	% change
Madhya Pradesh	0.75	0.65	-13.33	1.82	180.00	0.18	0.19	5.56	1.35	610.53	233.00	285.00	22.32	739.00	159.30
Uttar Pradesh	0.20	0.29	45.00	0.61	110.34	0.06	0.11	83.33	0.31	181.82	275.00	364.00	32.36	511.00	40.38
Rajasthan	0.16	0.15	-6.25	0.84	460.00	0.06	0.06	0.00	0.52	766.67	398.00	359.00	-9.80	624.00	73.82
Maharashtra	0.48	0.40	-16.67	0.35	-12.50	0.11	0.20	81.82	0.12	-40.00	223.00	494.00	121.52	346.00	-29.96
Tamil Nadu	0.17	0.36	111.76	0.43	19.44	0.05	0.15	200.00	0.30	100.00	268.00	411.00	53.36	707.00	72.02
Andhra Pradesh	0.23	0.54	134.78	0.40	-25.93	0.11	0.36	227.27	0.41	13.89	461.00	678.00	47.07	920.00	35.69
Jharkhand	0.00	0.00	-	0.15	-	-	-	-	0.13	-	-	-	-	874.00	-
Karnataka	0.06	0.10	66.67	0.14	40.00	0.02	0.03	50.00	0.07	133.33	309.00	260.00	-15.86	506.00	94.62
Gujarat	0.00	0.13	-	0.14	7.69	0.00	0.06	-	0.09	50.00		500.00	-	636.00	27.20
West Bengal	0.13	0.13	0.00	0.08	-38.46	0.07	0.08	14.29	0.06	-25.00	485.00	591.00	21.86	764.00	29.27
India	2.83	3.48	22.97	5.28	51.72	0.96	1.65	71.88	3.49	111.52	339.00	473.00	39.53	662.00	39.96

Table 10. Percentage change in area, production and yield of major pulses in India from 2014-15 to 2017-18

Crop	Year	Area	% change over previous years	Production	% change over previous years	Yield	% change over previous years
Bengal Gram	2014-15	8.25	-	7.33	-	888.65	-
	2015-16	8.40	1.82	7.06	-3.68	840.30	-5.44
	2016-17	9.63	14.64	9.38	32.86	974.17	15.93
	2017-18	10.56	9.66	11.38	21.32	1078.00	10.66
Black Gram	2014-15	3.25		1.96		604.00	
	2015-16	3.62	11.38	1.95	-0.51	537.00	-11.09
	2016-17	4.48	23.76	2.83	45.13	632.00	17.69
	2017-18	5.03	12.28	3.28	15.90	653.00	3.32
Green Gram	2014-15	3.02		1.50		497.91	
	2015-16	3.83	26.82	1.59	6.00	416.15	-16.42
	2016-17	4.33	13.05	2.17	36.48	500.45	20.26
	2017-18	4.24	-2.08	2.02	-6.91	476.91	-4.70
Red Gram	2014-15	3.85		2.81		646.16	
	2015-16	3.96	2.86	2.56	-8.90	912.95	41.29
	2016-17	5.34	34.85	4.87	90.23	913.00	0.01
	2017-18	4.44	-16.85	4.29	-11.91	967.00	5.91

Maharashtra in terms of area are Karnataka (19.97 per cent), Madhya Pradesh (14.6 per cent), Telangana (7.45 per cent) and Andhra Pradesh (6.3 per cent).

An analysis of growth of red gram in India indicates that (Table 7) there was a slow growth in terms of area, production and productivity during three periods under study. The growth in production was slow because of factors like weather variations at critical crop growth stages which adversely affect the yield, higher price risk, low preference of the crop by farmers due to its long duration, non-availability of short duration varieties etc. [8]. With reference to the state wise performance in terms of change in area, Maharashtra though the major producer of red

gram, the percentage increase in area was low in period –III (22.02 %) over Period-II (42.78 per cent). Karnataka recorded the highest growth by 92.22 per cent over previous years. Whereas, proportion of area under red gram has declined substantially in the case of Tamil Nadu (55.36 per cent) followed by Uttar Pradesh (40.17 per cent) and Gujarat (32.84 per cent) which had a great impact on production leading to a decline at National level.

As far as production and productivity are concerned, Karnataka exhibited similar trend as that of area i.e. production increased by 340.00 per cent and productivity by 129.02 per cent respectively over previous years which might be due to increase in area during the same periods.

It was reported that in major producing districts of Karnataka, a cultivation technique with higher spacing has resulted in increase in yield. A peculiar situation can be observed with respect to the productivity where in, almost all the states exhibited a drastic increase in Period-III over previous years.

3.7 Growth Performance of Black Gram in India

Black gram also known as urd bean is one of the important pulse crops grown throughout India and is grown in all the three seasons such as kharif, rabi and summer. India is the major producer and consumer country of black gram. Urad bean crop is gaining momentum since 2015-16 and there has been phenomenal increase in its coverage. During 2017-18 the crop was cultivated over an area of more than 5 million ha. The success of this crop was released with a harvest of about 3.5 MMT at an ever highest yield level of 352 kg/ha [9].

3.8 Major Contributing States in Terms of Area and Production of Black Gram

More than 90 per cent of urd bean production comes from nine states of Madhya Pradesh, Rajasthan, Uttar Pradesh, Andhra Pradesh, Tamil Nadu, Maharashtra, Jharkhand, Gujarat and West Bengal.

As can be observed from Table 8, Madhya Pradesh was the leading producer with a contribution of 38.68 per cent of total black gram production in India. Also it accounts for 34.47 per cent of total area under black gram in India during 2017-18 followed by Rajasthan (15.91 per cent) and Uttar Pradesh (11.55 per cent). During 2015-16, Uttar Pradesh was the second leading state in terms of area, production and productivity. However, this position was replaced by Rajasthan during 2017-18 becoming the second leading state.

From the Table 9, it can be inferred that the area under black gram in Madhya Pradesh recorded a negative growth in Period II i.e the area declined by 13.33 per cent as compared to Period I. Later on during Period- III a drastic change was observed wherein the area increased by 180.00 per cent and production by 610.53 per cent over Period-II. However, the area under black gram decreased from Period- I to Period II in the states like Rajasthan (6.25 per cent), Maharashtra

(16.67 per cent). On the contrary, during period-III there was a prominent increase in area for Rajasthan (460.00 per cent), but Maharashtra recorded a continuous decline in area by 12.50 per cent which also had a negative impact on the production as well which made it to decline by 40 per cent during the same period. On the other hand, Andhra Pradesh which has shown an increase in area by 134.78 per cent in Period-II over Period-I, recorded a decline during period-III by 25.93 per cent.

3.9 Growth Performance of Pulses from 2014-15 to 2017-18

An analysis of percentage changes in area, production and productivity of major pulses from 2014-15 to 2017-18 (Table 10) indicates that the area under bengal gram and black gram has increased during the period whereas that of red gram and green gram increased up to 2016-17 and then decreased during 2017-18. Production of bengal gram and black gram declined by 3.68 per cent and 0.51 per cent respectively during 2015-16 as compared to 2014-15. But in the next years it started increasing. With respect to green gram, the production has declined by 6.91 per cent in 2017-18 over the previous years and that of red gram declined by 8.90 per cent in 2015-16 and 11.91 per cent in 2017-18 over previous years.

4. CONCLUSION

Pulse crops play an important role in improving the nutritional status of rural populations in the semi-arid tropics of India. Improvement in the availability and access to diverse and nutrient-dense foods like pulses is key to ending malnutrition in poverty-stricken areas of eastern India. However, off late, due to policy intervention of Govt. of India to enhance MSP for pulses has resulted in increase in area and production of pulses. The lower productivity of pulses crops is due to lack of sufficient irrigation, below normal monsoon and pulses crops are grown in rain-fed conditions. More than 92 per cent of the area under pulses is confined to unirrigated areas, and in future the bulk of pulse production will continue to be under rainfed areas. Therefore any plan for increasing pulse production in the country should be based on long term approach for improved productivity of these crops under rainfed farming conditions rather than on the use of high inputs. Efforts may be made to promote cultivation of pulses in semi- arid regions and also area expansion under irrigated conditions

should be promoted. However, the increased production of pulses should not lead to decline in their prices. Probably, the unprecedented hike in MSP is one such measure which has overcome the problem of prices. While the same policy should be sustainable in the long way with some modifications from time to time. There is also a need for developing value chain of pulse crops and emphasis should be laid on scientific price discovery.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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