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Growth performance of pulses in India

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Abstract

The study is attempted to examine growth trend in percent major pulses in India. Over all period classified into three decades to know decadal growth over the years in area, production, yield and value of output decreased for major pulse. Compound growth rate of 1.27, 2.34, 1.08, and 8.94 for grams, 0.49, 1.13, 0.47 and 7.66 for arhar, 0.21, 0.51, 0.30 and 8.21 for moong, 0.93, 1.19, 0.26 and 8.97 for masoor, -4.90, -4.08, 0.83 and 4.69 for horse gram, 0.03, 0.83, 0.80 and 8.47 for uad, 0.28, 1.41, 1.05 and 8.40 per cent for total pulses in area, production, yield and value of output observed respectively for overall period (1990 to 2015). Decadal growth also followed the same trend for the all the pulses. Low productivity, low net return, pulses have been marginalized by highly remunerative competing crops.

Keywords: Growth, trend, pulses, value of output.

Introduction

India is a largest producer of pulses in world producing of pulses 19.98 million tonnes covering the area of 25.26 million hectare with the yield of 659 kg per hectare (GOI, 2016-17). Madhya Pradesh is largest contributor of pulses which contribute about 5.12 million tonnes with the area coverage 22.81 per cent of total pulses in India followed by Rajasthan and Maharashtra both in area and production respectively. India primarily produces gram, red gram, lentil, green gram and black gram are the major pluses along with other pulses. For majority vegetarian population in India pulses are the major source of protein. Pulses and pulse crop residues are also major sources of high quality livestock feed in India. In India pulses are cultivated on marginal lands under rain fed conditions. United Nations (UN) General Assembly, at its 68th session declared 2016 as the International Year of Pulses (IYP) to bring awareness in the production of pulses. Since the early 1960s, world production of pulses has increased by about one percent per annum, reaching 77.47 million tonnes area coverage of 85.19 million hectare with average production of 909 kg/ hectare in 2016. Myanmar, Canada and China also largest contribution to the world pulse production respectively (GOI, 2016-17). Principle pulses in world production are Beans, chickpea and peas. Among all the major pulses cultivated globally, lentil has been performing well at productivity level (1150 kg. per ha) but chick pea production has made it a leading crop among pulse crops in the world pulses are traditionally grown in developing countries, which contribute 70 per cent of pulse production globally (except for dry peas). Among developing economies, Asia played a significant role in pulse production. It accounted for 86.1 per cent in chick pea, 84.9 per cent in pigeon pea and 55.6 per cent in lentil production globally during 2001-13. India is top most pulse producing country in the world contributing about 24 percent to the world pulses followed by Canada and Myanmar in 2016 (FAO 2016). Among Asian countries India secured top position in chick pea and pigeon pea production whereas in case of productivity China and Philippines secured top rank in chick pea and pigeon pea respectively, in 2001-13. Production wise Canada has been leading in lentil followed by India whereas New Zealand has been leading in terms of productivity. Per capita consumption of pulses in the developing countries stagnated and registered drastic decline in some regions, especially in Asia and sub-Saharan Africa. These trends reflect changing dietary patterns and consumer preferences but, in several countries, also the failure of domestic production to keep pace with population growth. In developed countries, pulses represent a less important part of traditional diets and a fair share of the production is destined for export. However, per capita consumption of pulses has been increasing due to enrich health benefit and international migration.

Research Methodology

Primarily secondary data collected from various sources like central statistical organization

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(CSO), food and agriculture organization (FAO) and Agriculture statistics at a glance by ministry of agriculture and farmer welfare. For the whole country period from 1990-91 to 2014-15, for various pulses like gram, arhar, moong, masoor, uad, horse gram and total pulses data collected and compound growth rate (CGR) method applied annual growth rate calculated. Growth rate are worked out to examine the tendency of variable to increase, decrease or stagnant over a period of time. It also indicates the magnitude of the rate of change in the variable under consideration per unit of time. The rate of change of “Yt” per unit of time to express as a function of the magnitude of “Yt” itself is usually termed as the compound growth rate (CGR) which can be expressed mathematically as:

$$CGR = \left[\left(\frac{1}{Y_t} \right) \left(\frac{dY_t}{dt} \right) \right] = \left[\left(\frac{Y_{t+1} - Y_t}{Y_t} \right) \right] \dots\dots\dots (1)$$

The above expression if multiplied by 100 gives the compound growth rate of “Yt” in percentage term. There are many alternative forms of growth function viz., linear exponential, modified exponential, Cobb-Douglas etc. which have been developed and used by the researcher.

The mathematical form of log-linear function (also known as exponential function) is as follows:

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

Results and Discussion

Compound growth trend of Gram

Compound growth trend was fitted to assess the growth trend

Table 1: Compound growth trend in area, production, yield and value of output for Gram

Items	Particulars	Period I (1990-00)	Period II (2000-10)	Period III (2010-15)	Over all period (1990-15)
Area	F value	0.83	45.64	0.02	13.07
	R ²	0.094	0.851	0.005	0.362
	CGR	1.25	4.23***	-0.36	1.27***
Production	F value	3.55	24.15	0.00018	25.77
	R ²	0.307	0.751	0.001	0.528
	CGR	2.92*	5.82***	-0.16	2.34***
Yield	F value	5.75	4.87	0.00081	32.28
	R ²	0.418	0.378	0.003	0.584
	CGR	1.68**	1.59*	0.20	1.08***
Value of Output	F value	26.01	83.58	3.47	348.36
	R ²	0.765	0.913	0.536	0.938
	CGR	10.32***	11.62***	8.18	8.94***

CGR: Compound growth rate percent per annum ***: Significant at 1% level of significance, **: Significant at 5% level of significance *: Significant at 10% level of significance

Compound growth trend of Arhar

During overall period (1990-15), of study, area allocated by farmers for arhar cultivation was expanding with a compound growth rate of 0.49 per cent per annum. Growth trend analysis for production and yield of arhar suggests that it was growing with a compound growth rate of 1.13 and 0.47 per cent per annum respectively. The value of arhar output was expanding with a compound growth rate of 7.66 per cent per annum during overall period of study. Period I (1990-00), the area allocated by the farmers for arhar cultivation in the country was declining with a compound growth rate of -0.66 per cent per annum, whereas production and yield of arhar was growing with a compound growth rate of 1.36 and 1.58 per cent per annum respectively. The value of arhar output was expanding with a compound the area, production, productivity and value of arhar output in the country was expanding with

in area, production, productivity and value of output for all pulses.

To assess the trend in area, production, yield and value of output for the total period of 1990 to 2015 were consider for the calculation it has seen that increase in all the variables like area, production, yield and value of output were showing the increasing trend for the total pulses take into consideration.. Represent for compound growth rate for the gram area, production, yield and value of output during overall period of study viz., 1990 to 2015, during overall period area under gram is growing with a compound growth rate of 1.27 per cent per annum, whereas production was increasing with a compound growth rate of 2.34 per cent per annum. In case of gram yield, the growth trend analysis suggests that it was growing with a compound growth rate of 1.08 per cent per annum, whereas value of output was expanding with a compound growth rate of 8.94 per cent per annum.

Period I (1990-00), the growth trend analysis for gram area, production, productivity and value of output suggests that it was growing with a positive compound growth rate of 1.25, 2.92, 1.68 and 10.32 per cent per annum respectively. During the period II (2000-2010), of study, higher growth rate was observed for area, production, yield and value of output as compared to first period of study. During the period III (2010-15), of study, area and production showing decreasing trend and it was declining with a compound growth rate of -0.36 and -0.16 per cent per annum respectively. Whereas in case of yield and value of output, growth trend analysis suggests that it was growing with a compound growth rate of 3.47 and 8.18 per cent per annum respectively (Table1).

growth rate of 9.07 per cent per annum during first period of study. In case of period II (2000-10), compound growth rate of 0.16, 1.61, 1.46 and 11.97 per cent respectively During third period of study (2010-15), area allocated by the farmers in the country was declined and it was declining with a compound growth rate of -2.76 per cent. arhar’s production and yield was growing with a compound growth of 1.41, and 4.20 per cent per annum. The value of arhar output in the country was expanding with a compound growth rate of 10.72 per cent per annum during same period of time. It is clear from the discussion that over a period of time, farmers were shifting from traditional variety to improved varieties of arhar resulting enhancement of arhar production despite the declining in the area under arhar crop during third period of study (Table 2).

Table 2: Compound growth trend in area, production, yield and value of output for Arhar

Items	Particulars	Period I (1990-00)	Period II (2000-10)	Period III (2010-15)	Over all Period (1990-15)
Area	F value	6.61	0.14	8.16	10.13
	R ²	0.452	0.017	0.731	0.306
	CGR	-0.66**	0.16	-2.76*	0.49**
Production	F value	0.79	2.14	0.35	12.76
	R ²	0.090	0.211	0.104	0.357
	CGR	1.36	1.61	1.41	1.13**
Yield	F value	1.42	2.93	2.82	2.97
	R ²	0.151	0.268	0.484	0.114
	CGR	1.58	1.46	4.20*	0.47
Value of Output	F value	31.77	74.55	11.53	186.22
	R ²	0.799	0.903	0.793	0.890
	CGR	9.07***	11.97***	10.72**	7.66**

CGR: Compound growth rate percent per annum, ***: Significant at 1% level of significance, **: Significant at 5% level of significance, *: Significant at 10% level of significance

Compound growth trend of Moong

During overall period (1990-15) of study, area allocated by the Indian farmers for moong cultivation was expanding with a compound growth rate of 0.21 per cent per annum. The growth trend for production, yield and value of output for moong was found to be 0.51, 0.30 and 8.21 per cent respectively. Whole period of the study was divided into three sub-periods to find out the growth trends for area, production, productivity and value of output of moong. During the first period I (1990-00) of study, negative growth trend was observed for area, production, yield

and value of output. Period II (2000-10), positive growth was observed for area and value of output for moong crop in the country, whereas negative growth trend was observed for production and yield. During period (2010-15) of the study, negative growth was observed for area, production and productivity of moong crop and it was declining with a compound growth rate of -3.59, -4.46, -0.88 per cent per annum. In case of value of output, it was growing with a compound growth rate of 8.01 per cent per annum (Table 3).

Table 3: Compound growth trend in area, production, yield and value of output for Moong

Items	Particulars	Period I (1990-00)	Period II (2000-10)	Period III (2010-15)	Over all Period (1990-15)
Area	F value	3.21	0.05	1.02	0.78
	R ²	0.286	0.006	0.254	0.033
	CGR	-1.28	0.21	-3.59	0.21
Production	F value	6.29	0.25	0.66	0.62
	R ²	0.440	0.030	0.181	0.026
	CGR	-3.06**	-1.45	-4.46	0.51
Yield	F value	2.55	0.53	0.15	0.31
	R ²	0.242	0.062	0.048	0.013
	CGR	-1.78	-1.65	-0.88	0.30
Value of Output	F value	0.31	13.38	1.10	81.26
	R ²	0.037	0.626	0.267	0.779
	CGR	-1.33	7.03***	8.01	8.12***

CGR: Compound growth rate percent per annum, ***: Significant at 1% level of significance, **: Significant at 5% level of significance, *: Significant at 10% level of significance.

Compound growth trend of Masoor

Overall period (1990-2015) of study, compound growth trend analysis for in area, production, yield and value of output showed positive growth and it was growing with a compound growth rate of 0.93, 1.19, 0.26 and 8.97 per cent respectively. In case of first period (1990-2000) of study compound growth was 2.32, 2.41, 0.09 and 12.76 per cent for area, production, yield and value output respectively. During period II (2000-10), area was

shrinking with a compound growth rate of -0.31 per cent per annum, whereas production, yield and productivity were augmenting with compound growth rate of 0.08, 0.40 and 9.92 per cent respectively. In period III (2010-15) area was declining with compound growth rate of -3.20 per cent per annum, whereas production, yield and value of output were expanding with a compound growth rate of 1.44, 4.64 and 12.07 per cent respectively (Table 4).

Table 4: Compound growth trend in area, production, yield and value of output for Masoor

Items	Particulars	Period I (1990-00)	Period II (2000-10)	Period III (2010-15)	Over all period (1990-15)
Area	F value	23.65	0.36	3.14	27.27
	R ²	0.747	0.043	0.511	0.542
	CGR	2.32***	-0.31	-3.20	0.93***
Production	F value	3.92	0.00084	0.40	22.60
	R ²	0.329	0.001	0.117	0.496
	CGR	2.41**	0.08	1.44	1.19***
Yield	F value	0.01	0.31	2.07	1.36
	R ²	0.001	0.037	0.408	0.056
	CGR	0.09	0.40	4.64	0.26
Value of Output	F value	90.19	39.93	45.46	526.76
	R ²	0.919	0.833	0.938	0.958
	CGR	12.76***	9.92***	12.07***	8.97***

CGR: Compound growth rate percent per annum, ***: Significant at 1% level of significance, **: Significant at 5% level of significance, *: Significant at 10% level of significance

Compound growth trend of Horse gram

During overall period (1990-15) of horse gram, area and production was declining with a compound growth rate of -4.90 and -4.08 per cent per annum respectively, whereas, yield and value of output was growing with a compound growth rate of 0.83 and 4.69 per cent respectively. In period I (1990-00), area, production and yield was registered negative growth trend and it was declining with a compound growth was -5.11, -5.59, and -0.49 per cent per annum respectively, whereas value of output was growing with a compound

growth rate of 4.64 per cent per annum. In period II (2000-10) compound growth of -5.01, -3.42 and -1.56 per cent per annum respectively, whereas yield was augmented with a compound growth rate of 5.48 per cent per annum. In period III (2010-15), area allocated by Indian farmers under horse gram was declining and it was declining with a compound growth rate of -0.40 per cent per annum, whereas production, yield and value of output was expanding with a compound growth rate of 1.03, 0.41 and 15.25 per cent respectively (Table 5).

Table 5: Compound growth trend in area, production, yield and value of output for Horse gram

Items	Particulars	Period I (1990-00)	Period II (2000-10)	Period III (2010-15)	Over all period (1990-15)
Area	F value	35.22	49.39	0.03	592.08
	R ²	0.815	.861	0.009	0.963
	CGR	-5.11***	-5.01***	-0.40	-4.90***
Production	F value	24.41	4.74	0.04	106.20
	R ²	0.753	0.372	0.014	0.822
	CGR	-5.59***	-3.42*	1.03	-4.08***
Yield	F value	0.67	3.99	0.15	6.49
	R ²	0.077	0.333	.047	0.220
	CGR	-0.49	5.48**	0.41	0.83**
Value of Output	F value	19.41	2.32	13.35	61.04
	R ²	0.708	0.225	.817	0.726
	CGR	4.64***	-1.56*	15.25**	4.69***

CGR: Compound growth rate percent per annum, ***: Significant at 1% level of significance, **: Significant at 5% level of significance, *: Significant at 10% level of significance

Compound growth trend of Urd

During overall period (1990-15) positive growth trend was observed for urd area, production, yield and value of output in the country and it was growing with a compound growth rate of 0.03, 0.83, 0.80 and 8.47 per cent per annum respectively. During period I (1990-00), area, production and yield or urd crop in the country was declining with the compound growth of -1.59, -1.90 and -0.32 per cent per annum respectively, whereas in case of value of output, it was expanding with a compound growth rate of 8.13 per cent per annum. In period

II (2000-10) of the study, suggests that area under crop was declining with a compound growth rate of -1.40 per cent per annum, whereas production, yield and value of output was augmenting with a compound growth rate of 0.15, 1.12 and 7.12 per cent respectively. In period III (2010-15), again area under urd was declining trend and it was declining with a compound growth rate of -0.68 per cent per annum, while production, yield and value of output was augmenting with a compound growth rate of 1.43, 2.11 and 9.62 per cent respectively (Table 6).

Table 6: Compound growth trend in area, production, yield and value of output for Urd

Items	Particulars	Period I (1990-00)	Period II (2000-10)	Period III (2010-15)	Overall (1990-15)
Area	F value	5.92	2.32	0.57	0.02
	R ²	0.425	0.225	0.159	0.001
	CGR	-1.59**	-1.40	-0.68	0.03
Production	F value	4.11	0.09	0.41	4.83
	R ²	0.339	0.011	0.121	0.174
	CGR	-1.90*	0.15	1.43	0.83**
Yield	F value	0.24	9.98	1.25	7.72
	R ²	0.029	0.555	0.294	0.251
	CGR	-0.32	1.12**	2.11	0.80**
Value of Output	F value	21.52	5.50	4.99	208.46
	R ²	0.729	0.407	0.625	0.901
	CGR	8.13***	7.12**	9.62	8.47***

CGR: Compound growth rate percent per annum, ***: Significant at 1% level of significance, **: Significant at 5% level of significance, *: Significant at 10% level of significance

Compound growth trend of Total pulses

During overall period (1990-15), in case of total pulses area, production, yield and value of output was growing with a compound growth rate of 0.28, 1.41, 1.05 and 8.40 per cent respectively. During period I (1990-00), area and production was registered negative growth trend and it was declining with a compound growth rate of -0.60 and -0.20 per cent per annum respectively, whereas, yield and value of output was growing with a compound growth rate of 1.27 and 7.38 per

cent per annum respectively. In period II (2000-10), area, production, yield and value of output was augmenting and it was growing with a compound growth rate of 1.09, 2.67, 1.53 and 10.22 per cent per annum respectively. In period III (2010-15), area and production in the country was declining and it was declining with a compound growth rate of -1.99 and -0.04 per cent per annum, whereas yield and value of output was expanding with a compound growth rate of 2.05 and 9.82 per cent respectively (Table 7).

Table 7: Compound growth trend in area, production, yield and value of output for Total pulses

Items	Particulars	Period I (1990-00)	Period II (2000-10)	Period III (2010-15)	Overall (1990-15)
Area	F value	2.07	5.50	1.75	3.30
	R ²	0.206	0.407	0.369	0.125
	CGR	-0.60	1.09**	-1.99	0.28**
Production	F value	0.07	9.20	0.000045	22.30
	R ²	0.009	0.535	0.00	0.492
	CGR	-0.20	2.67**	-0.04	1.41***
Yield	F value	4.88	8.42	1.27	29.69
	R ²	0.379	0.513	0.297	0.563
	CGR	1.27**	1.53**	2.05	1.05***
Value of Output	F value	69.39	77.69	72.09	429.96
	R ²	0.897	0.907	0.960	0.949
	CGR	7.38***	10.22***	9.82***	8.40***

CGR: Compound growth rate percent per annum, ***: Significant at 1% level of significance, **: Significant at 5% level of significance, *: Significant at 10% level of significance

Discussion

In India total pulse production was 25 million hectare producing 19 million tonnes, with the productivity of 764 kg per hectare. Out of total pulses area, about 19 per cent area was under irrigated (GOI, 2016). Secondary data collected from central satirical organization (CSO) for the purpose of find out the growth trend in the major pulses. Data was collected for the period of 1990 to 2015. The whole period of study was divided into three period viz., Period I (1990-00), Period II (2000-10) and Period III (2010-15). The compound growth analysis was carried out to find out the growth rate of area, production, yield and value of output were calculated for overall period and sub-period. Instability was estimated to find out the variability in area, production, yield and value of output. Data analyzed for the various pulses like gram, arhar, moong, masoor, horsegram, uad and total pulses. Significant increase in the value of output for the all the pulses over the period of time and decadal growth for arhar, gram and total pulses showed significant growth in Period II (2000-10) and all other pulses indicated significant growth in Period III (2010-15). Gram, arhar moong and total pulses showed growth for area in Period II (2000-2010), whereas masoor in Period I (1990-00) and horse gram and uad showed negative growth for all the periods. Among all pulses gram showed significant growth for area among pulses. Gram, arhar and total pulses showed growth trend for production in Period II (2000-10), horse gram and uad showed growth in Period III (2010-15), masoor in Period I (1990-00), whereas moong indicated negative growth for production of pulses. Gram showed the significant growth in production among all the pulses for overall period. Arhar, masoor, uad and total pulses indicated significant growth in Period III (2010-15) for yield, horse gram and total pulses showed growth in Period II(2000-2010), gram showed in Period I (1990-00) whereas moong showed negative growth for yield. Gram showed significant growth for yield among all pulses.

Conclusion

Pulses are important source of nutrients not only ensure nutrients but also increase the soil fertility. Majority of the pulses are showed growth in value of the output compare the area production and yield. All the pulses showed significant growth in case of area but horse gram and uad showed negative growth trend. Moong showed negative trend for production and yield. Gram indicated significant growth in area, production and yield among all the pulses. Availability of high yielding variety, higher minimum support prices,

improved management practices and other incentives must ensure for increase the pulse production in India.

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