Social Science Journal for Advanced Research
ISSN (Online): 2583-0074
Volume-1 Issue-3 || November 2021 || PP. 51-56 DOI: 10.54741/ssjar.1.3.8

Instability of Total Pulses in India

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Received: 07-10-2021	Revised: 04-11-2021	Accepted: 23-11-2021

ABSTRACT
India's agricultural sector witness many reforms which had entirely changed the cropping pattern of agriculture. In terms of production and productivity reforms were complimentary for all the crops but when comes to stability it had adverse effect. Some of crops like wheat and rice are more stable whereas, pulses and wholegrain are having higher instability. This study examines the instability in area, yield and production for pulses at national level as well as main producing states. The paper used secondary data from 1961 to 2019, and instability measured through coefficient of variation. The results show that Maharashtra had highest instability in area, production and yield of total pulses although Uttar Pradesh had lowest.

Keywords**:** *instability, area, production, variability, and yield*

I. INTRODUCTION

Pulses are produced, consumed, and imported in significant quantities in India. In India, pulses are produced in quantities ranging from 18 to 19 million tons per year over an area of 24 to 26 million hectares. India covers further than a 3rd of the world's total territory and further than (20%) of its population. Red gram, Bengal gram, red gram, lentil (mash), black gram and green gram, are the most common grains produced in India (urad). For the majority of India's vegetarians, pulses constitute their primary source of protein. In India, pulses and pulse crop wastes are the primary sources of high-quality animal feed.

Pulses, along with staples like wheat and rice are an important element of the diet for both growers and consumers, and they are especially vital as food safety. More significantly nutrition safety, chiefly for low-income customers whose main protein sources are vegetables. Thus, crops pulse can potentially help improve nutrition, and health, moderate hunger and poverty, and increase resilience in the ecosystem. The core of life for approximately (60%) of the population is farming in India. The agricultural nations of India produce high quality other food products and food grains. India's farming industry continues to grow at a rapid pace and contribute to global trading. India's food and food market, with (70%) of its sales, is the 6th largest in the world.

Agriculture evolves at the same pace as the development of India. The way food is manufactured and consumed has changed. In India, there has been population growth, a growth in revenue, urban/rural migration and an increase in rural productivity per capita over a number of years. The requirement for food has also increased with the increase in all of these factors.

The most promising pulse production technologies are improved crop establishment and integrated soil fertility, management practices, and pesticide control practices, and so on, which increase not only profitability and productivity, but also promote social sustainability and environmental and nutrition security]. Pulses are an essential part of crop rotation, and they only need a minimal amount of fertilizer to be sustainable. In rotating crops, legumes are helpful for soil fertility.

It is the most appropriate drought-tolerant pulse for cultivation of 300–450 mm/year drought-taking areas with the lowest rainfall. Normal plants cannot produce and survive fruit in such harsh situations. The advantage of those dry beans is that deep-root systems survive in areas that are afraid of water and thus improve crop productivity in marginal areas that are suitable for these harsh environments. With pulses adapted locally, farmers can step up their manufacturing systems in a sustainable manner in a dry environment, where food safety is a great task. In addition, opposite policies and programs must be stimulated for pulses to enhance the accessibility, consumption and supply of drought-resistant- pulses in commercial systems in support of marginal farmers.

In many countries, malnutrition is a major problem and pulses are cultivated in these areas to overcome the threat of hunger. With pulse production in these areas, food and nutrition safety can be achieved to some extent.

II. REVIEW OF RELATED LITERATURE

Bharathi (1992), in Andhra Pradesh, India, researchers investigated the causes of the instability of pulse production. The Cop-Pock volatility index is applied and used to figures from the 70s to 80s. For yield and planted area, results of black gram, green gram and all pulses in total were obtained. An increase in harvest contributes less to an increase in the level of production than an increase in the area under cultivation, and fluctuations in yield are the main cause of instability.

In Parmar (1994), pulses cultivated in South Gujarat, India, were studied for their growth and stability, output, yield, pricing, and profitability. In regions where jowar and cotton are produced, tur has emerged as one of the most effective crops. It was determined that tur production may significantly enhance this area's productivity and pulse processing businesses with a suitable expansion plan and better seed types.

Reddy and Mishra (2009), at the state government level, the growth pattern, diversity, and causes of growth and instability of chickpea release were estimated. To achieve the objectives, time series data on chickpea production, location, and products from 1971 to 2000 was used to calculate aggregate growth rates, Coppock's Instability Index (CII), coefficients of variation, and to perform analysis decomposition. Chickpea emissions increased (7%) from (4.8 MT in 1970/85) to (5.2 MT in 1986/2000), and the variation of coefficient increased from (14% to 17% simultaneously. As a result, most states' chickpea output falls into the low growth-high-risk group. Only Madhya Pradesh, Andhra Pradesh, and Orissa are classified as having strong growth and low risk.

Rao (2010), using native time series data, output, and productivity from 1986-87 to 2007-08, the researchers examined growth patterns and levels of instability, as well as evaluating the effects of explanatory factors on pulse production in Andhra Pradesh. Objectives were met using position collections and integration of K-Means, Coppock's Instability Index (CII), Compound growth rate (CGR), and decay analysis (production change in moderation). The production of pulses grew rapidly, but this was accompanied by a high degree of volatility. The area impact on the production difference was slightly larger than the productivity effect, according to decomposition analysis. As a result, area attributing variables such as guaranteed supply of agricultural inputs and availability of remunerative pricing should account for the majority of output increases.

Kakde and Gajbhiye (2011) Chickpea growth and stability were assessed. The Akola district in Maharashtra was selected for this research because the area under chickpeas was believed to be the greatest in the Akola district. Based on secondary data research from 1985-1986 through 2005-2006. The findings show that chickpeas are a major crop in the Akola region, with substantial growth rates in both area and output. Chickpea instability research shows that production is less variable in chickpeas. It implies that chickpea output has remained almost consistent throughout time.

Objective of the Study

- To examine the instability of main pulses at national level,
- To investigate instability of pulses at different states, and
- The analysis of total pulses instability of main producing states.

III. METHODOLOGY

3.1 Study Time

The aim is to estimate the main pulses and total pulses of lentils, pigeon peas grams, green grams, black grams, area, productivity and production of micro-production countries and macro national level. At the macro level, the time sequence data from 1961 to 2019 are used to estimate the area increase, productivity and production of the overall pulses, pigeon and gram, while the data from 1971 to 2019 are used for lens, green gram and black gram.

3.2 Data Sources and Nature

Secondary data were gathered from newspapers, magazines, journals, government websites, krishikosh, bulletins, shodhganga, research publications, SSRN, and other chosen websites to complement primary data and provide a solid foundation for the study.

3.3 Procedure

An indicator of instability is used as a quantity of variability to investigate the changeability in the area output and productivity of pulses. The departure from the trend is known as instability. The coefficient of variation may be used to calculate it. The coefficient of difference is the standard deviation expressed as a (%) of the means (Prashant and Bala 2000).

$CV = \sigma/\bar{X}*100$

where

CV = Variation coefficient

σ = The standard deviation of the variables in question, such as area, production, and productivity,

$\overline{X}$ = The average value of the variable in question.

The index of instability was calculated using the method proposed by Kanley and Yella (2000).

Instability of the Index (CV*) = CV $_*$ (1- $R^{2)\ 0.5}$

In cases where R2 is sufficient, this variable coefficient is multiplied by the square of the difference between the coefficient of unity and the multiple coefficients (R2).

IV. RESULTS AND DISCUSSION

4.1 Analysis of Main Pulses' Variability

The changeability, as measured by the coefficient of the area of variation, production, and productivity, was investigated to see whether there was any instability.

4.2 Volatility of Main Pulses Analysis at the National Level

In 1961-2019 and 1971-2019, the greatest area variability was recorded in grams (13.9%), followed by black grams (11.2%) at the national level. Total pulses had the lowest area fluctuation (5.7%), indicating that the area under total pulse production has remained almost constant throughout time.

The green gram had the highest production variability (25.7%) in 1971-2019, followed by gram (21.8%) in 1961-2019 and black gram (17.5%) in 1971-2019, indicating that the respective crops' output is more unpredictable.

The green gram yield variation was the greatest (21.96%) from 1971 to 2019, followed by the pigeon pea yield variation (11.6%). The total pulse yield variation is the least (13.93%), suggesting that total pulse yield has stayed almost constant throughout.

Table 1: Volatility of main pulses analysis at the national level

Pulses / Year		(1961-70)		(1971-80)		(1981-90)		(1991-2000)		(2001-2010)		(2011-2019)		(1961-2019)		(1971-2019)	
		CV	CV#	CV	CV#	CV	CV#	CV	CV#	CV	CV#	CV	CV#	CV	CV#	CV	CV#
Total Pulses	A	4.8	2.53*	5.48	4.28	4.2	4.3	4.13	1.8	6.6	4.8	5.2	6.2	5.9	5.7	-	-
	P	11.57	11.57	12.13	12.14	8.68	7.40	8.65	8.67	16.1	7.7	8.2	9.45	18.2	12.4*	-	-
	Y	11.16	10.46	9.40	9.38	6.40	4.77	6.78	6.5	10.9	5.32	6.12	7.12	15.4	9.5*	-	-
Gram	A	9.7	4.69 *	7.67	7.28	10	8.08	14.70	14.67	16	5.3	5.6	6.25	15.2	13.9*	-	-
	P	16.07	15.98	18.54	17.46	14	12.95	18.87	18.64	23.2	8.5	7.5	8.2	24	21.8*	-	-
	Y	15.34	13.97	14.12	14.11	7.8	7.36	7.39	6.78	9.8	6.3	8.1	9.6	19	10.7*	-	-
Pigeon pea	A	3.4	1.10 *	6.52	3.82	7.2	2.7 *	4.12	3.05	8.5	5.6	7.6	7.8	17.10	7*	-	-
	P	15.98	13.93	10.56	9.96	9.52	8.25	12.40	1.8	13.6	9.4	8.4	9.6	21.4	13.5*	-	-
	Y	14.4	13.29	10.78	10.96	6.98	4.80	12.60	12.31	9.6	8.7	7.3	7.8	11.6	11.6	-	-
Lentil	A	-	-	11.89	10.09	7.63	3.68	8.28	4.12	5.9	5.4	6.6	8.6	-	-	24.4	10.5
	P	-	-	14.56	13.78	18.4	6	14.6	9.77	8.8	8.1	9.25	10.3	-	-	39	15.9
	Y	-	-	8.82	7.58	11.49	4.03	7.30	7.29	9.1	8.6	10.36	11.12	-	-	17.5	15
Black gram	A	-	-	14.32	7.78	8.20	3.20	5.80	5.56	7.3	6.7	7.3	8.9	-	-	15.8	11.2
	P	-	-	16.62	8.70	18.96	5.89	9	7.8	16.5	14.8	15.8	16.2	-	-	29.4	17.5
	Y	-	-	7.6	7.26	11.18	4.68	7.60	7.48	14.3	9.2	10.5	11	-	-	19.2	15
Green gram	A	-	-	12.5	5.65	7.89	4.16	7.59	6.39	10	10	11	12	-	-	17	12.7
	P	-	-	20.36	13.56	13.26	12.4	16.92	15.2	30	28.5	30.6	31.2	-	-	27.6	25.7
	Y	-	-	14.28	12.48	7.36	8.12	14.76	13.6	24.4	22.2	24.56	26.45	-	-	20.56	21.96**

Source: Researcher's own calculation

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4.3 Analysis Instability Main Producing Nations

In the period 1971-2019, output variability was lowest in Andhra Pradesh (11.9%) and highest in Maharashtra (32%).

In the period 1971-2019, area variability of grams was lowest in Uttar Pradesh (9.2%) and highest in Andhra Pradesh (47.3%).

In the period 1971-2019, yield changeability was lowest in Andhra Pradesh (7.8%) and highest in Maharashtra (17.7%).

According to the results, Maharashtra had the most insecurity in grain production between 1971 and 2019, owing to a significant increase in area and yield, which resulted in output volatility.

Table 2: Analysis instability main producing nations

Year / Gram		(1971-80)		(1981-90)		(1991-2000)		(2001-10)		(2011-19)		(1971-2019)	
		CV	CV#	CV	CV#	CV	CV#	CV	CV#	CV	CV#	CV	CV#
Andhra Pradesh	A	0.7	0.6	2.1	19.1	38.4	20.1*	26.6	15.6*	32.64	48.97	113.31	47.3*
	P	40.1	42.6	48.9	53.7	63.2	27.5*	40.7	90.4*	52.01	28.26	131.8	11.9*
	Y	16.3	29.7	30	27.9	32	2.8	18.2	56	32.48	21.7	56.8	7.8*
Madhya Pradesh	A	9.8	8.7	7.2	6.5	11.9	11	11	7.3*	9.1	13.18	18.8	8.9*
	P	10.3	8.7	12	10.6	17.9	16.8	23.9	17.4*	25.11	30.16	39.9	16.8*
	Y	14.9	11.4**	6.5	6	5	4.3	15.1	13.3**	19.54	22.01	23.7	14.2*
Maharashtra	A	16.9	14.7	16.7	7.5*	21	14.6**	28.4	17.3**	19.57	20.10	47.5	17.7*
	P	28.6	25.2	41.4	28.5**	32.2	28.2	44.7	24.9*	35.16	17.25	82.2	32*
	Y	21	18.9	26.3	21.8	18.1	18.3	19.6	11.2*	24.30	12.36	36.31	18.2*
Rajasthan	A	17.9	17.9	27.4	23.5	41.9	41.8	33	23.9*	35.80	41.36	32.4	30.9**
	P	34.6	33.3	34.2	29.54	50.3	50.8	47.8	31.9*	34.23	39.14	42.4	42
	Y	21.9	19.7	13.9	13.6	15.7	15.6	23.7	22.5	29.74	23.50	19.7	19.2
Uttar Pradesh	A	10.9	3.8*	8.4	6**	11.7	3.7*	18.6	11.3	13.19	22.47	39.1	9.2*
	P	21.6	19.6	12.1	11	13	8.2*	23.3	20.5	17.54	26.13	33.2	17.7*
	Y	20.5	20.5	11.2	11.2	9.7	9.7	16.6	16.6	27.2	27.2	17.9	14.9*

Source: Researcher's own calculation

4.4 Main Generating States Analysis of Total Pulses Instability

In the period 1971-2019, the area changeability of total pulses was lowest in Uttar Pradesh (7.5%) and highest in Maharashtra (12.7%).

In the period 1971-2019, the variability of yield variability was lowest in Uttar Pradesh (12%) and highest in Maharashtra (16%).

In the period 1971-2019, output variability was lowest in Uttar Pradesh (14%) and highest in Maharashtra (22%).

It is clear from the results that the overall pulse output in Uttar Pradesh has been constant throughout time. Maharashtra, on the other hand, had the most insecurity in total pulse output due to a significant yield increase in the corresponding time, resulting in production volatility.

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Table 3: Main generating states analysis of total pulses instability

	Year	(1971-80)		(1981-90)		(1991-2000)		(2001-10)		(2011-19)		(1971-2019)	
Total Pulses		CV	CV#	CV	CV#	CV	CV#	CV	CV#	CV	CV#	CV	CV#
Andhra Pradesh	A	5.16	5	6.2	4.9	6.2	5.6	8.2	7.8	8.6	10.2	16.5	7.5*
	P	12.63	12.52	13.9	6.6	19.2	18	16.4	10.10	11.65	13.75	50.96	15.44*
	Y	8.8	8.9	10.69	7.5	13.6	13.7	18.9	11.10	13.62	12.86	40.35	15.3*
Madhya Pradesh	A	4.5	3.6	5	3.7	11.04	9.7	10.8	6.2	8.36	7.96	10.24	9.45
	P	13.1	10.5	9	7.5	15.6	15.7	22.36	16.7*	12.11	14.75	30.21	18.5*
	Y	15.6	11.7**	8	6**	8.5	8	15.2	13.1			24.5	12.96*
Maharashtra	A	14.9	11.6**	9.6	5.3*	6.4	5.3	10.3	0	11.13	13.26	17.62	12.7
	P	24.6	21.4	23.5	15.3*	26.3	24.6	23.9	19.4**	22.04	25.63	48	22
	Y	16	14.2	15.35	11.6	22.8	22.7	16.6	9.9	12.09	16.74	32.01	16
Rajasthan	A	14.2	14	20	18.5	22.5	21.6	20.8	17.6	19.14	21.78	22.14	22.96
	P	34.8	33.7	30.8	30	44.2	44.3	45.6	40.1	42.63	46.22	48.51	48.69
	Y	25	24	20.4	20.6	24.8	24.04	32.5	31	28.45	29.85	30.41	28.63
Uttar Pradesh	A	7.9	2.4	3.8	3.9	2.9	1.3	8.6	6.5	7.12	8.25	13.8	7.5
	P	18.1	17.9	8	7.5	8	6.5	10.8	9.9	11.25	12.16	15.25	14
	Y	17.5	17.6	7.4	7.3	6.7	6.8	11	11	12	13.8	14.4	12**

Source: Researcher's own calculation

V. CONCLUSION

Instability is one of the causes that enhanced the volatility of pulse generation in the state by changes in area variance. The national level, the largest area of variability was found at (14.5%) from 1971 to 2019. The Green gram (moong) had the most production (25.7%) and yield (21.96%) instability at the national level between 1971 and 2019.

In total pulses, changes in minimum area (5.7%), production (12.4%) and yield (9.5%) were observed from 1971 to 2019, revealing stagnation in yield and area, leading to stagnation in production.

Between 1971 & 2019, among other major producing states, the variability in production, area, and yield of total pulses was highest in Maharashtra & lowest in Uttar Pradesh.

It is clear from the statistics that the overall pulse output in Uttar Pradesh has been constant throughout time. Maharashtra, on the other hand, experienced the greatest variability in total pulse production during the same period due to a strong increase in yields, leading to fluctuations in production.

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