International Journal of Agriculture Sciences
ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 12, Issue 11, 2020, pp.-9944-9947.
Available online at https://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Research Article

IMPACT OF NFSM ON GROWTH PERFORMANCE OF PULSES PRODUCTION IN TAMIL NADU

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Received: June 01, 2020; Revised: June 12, 2020; Accepted: June 13, 2020; Published: June 15, 2020

Abstract: The present study was carried out to estimate the growth and instability of area, production and productivity, to measure the relative contribution of area effect, yield effect and interaction effect of major pulses in Tamil Nadu for the period from 1997 to 2016. To examine the overall performances of total pulses were found to have positive growth in area (1.13 %), production (2.92 %) and productivity (1.77 %) for the study period (1997-2016) and it was positive in post NFSM period. The instability in the production of all the pulse crops has increased in the post NFSM as compared to pre NFSM, which indicates there was a significant positive change in area, production and productivity of pulses in Tamil Nadu which may be due to NFSM intervention. The relative contribution of total production of pulses was shared by yield effect (84.32 %) and interaction effect (139.11%) for the overall period. To further increase the area under pulse cultivation and yield of pulses, research and policy support in terms of output price support and procurement should be promoted which will help to increase per capita availability of pulses, reducing import dependence and to achieve self-sufficiency on pulses production.

Keywords: *Pulses, Compound growth rate, Instability index and Decomposition analysis*

Citation: R. Nagarethinam and M. Anjugam (2020) Impact of NFSM on Growth Performance of Pulses Production in Tamil Nadu. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 12, Issue 11, pp.- 9944-9947.

Academic Editor / Reviewer: Dr Dipak Nath, Dr S. G. Savalia

Introduction

In India most of the vegetarian populations depend on pulses for their protein requirement. Pulse have been cultivated using less amount of resource and characterized by poor soil fertility and moisture stress environment. Pulses mostly grown in rainfed condition and do not require intensive irrigation facility, can be cultivated both intercrop and mixed crop also. India is the world largest producer of pulses (25 % of world production), and play a significant role in both consumption (27 % of world consumption) and imports (14% of world importer). The share of pulses is around 7 to 10 % to total food grain production in India. UN government had declared 2016 as International Year of Pulses in the context of "addressing future global food and nutritional security as a part of environment sustainability of food production". In Indian economy, half of the country populations are working in agriculture for their livelihood. The food grain production has increased from 90 million tonnes to 275.68 million tonnes during 1967 to 2017 shows a remarkable increase in food grain production. However, nearly 1/3rd of the populations is facing extreme poverty and half of the Indian children were malnourished [1,2]. By increasing the investments and technological breakthrough, the availability of pulses has been improved. However, it may not necessarily translate into increased accessibility and absorption of food [3]. There exists a shortage of pulse production for about 6 million tonnes as against the estimated demand of 29-30 million tonnes in India during 2016-17. The per capita availability of pulses dwindled down from 60 to 37.2 gram/day during 1951 to 2010 however, it has been increased by 47.2 gram/ day in 2016 [4]. Hence, recognizing the stagnation of food grain production and steady rise in the consumption of food grains by the growing population, GOI has launched a massive program "National Food Security Mission" in 2007- 08 to increase the food grain production in the country [5]. The NFSM Programme targeted to escalate production of paddy, wheat and pulses by 10, 8, and 2 million tonnes, respectively by the end of Eleventh Five Year Plan. The NFSM scheme is one of the flagship schemes for improve the livelihood of farmers.

The main goal is to achieve self-sufficiency in food grain production, especially in pulses, rice and wheat. In Tamil Nadu, the NFSM scheme has been successfully implemented from 2007-08 and also it covered all most all the districts. Around 50 percent of pulses area was coved by Thoothukudi, Villupuram, Namakkal, Thiruvannamalai and Virudhunagar during 2018 under NFSM. The major components for pulses production under NFSM include provision of 20 kg of seed, *Trichoderma* Viridi 2.5 kg, MN mixture 5 kg, liquid bio fertilizer (*Phosphobacteria +Rhizobium*) 1000 ml, pusa hydrogel 250 grams, foliar spray of nutrient 25 kg and also Rs. 1500 cash for hiring charge in sowing and plant protection chemical per ha of land. In this context, the present study on analysis of growth and instability in pulses production in Tamil Nadu is of great importance for a comprehensive understanding of the food security at the state level.

Material and Methods

The study was based on the secondary data collected from Season and Crop Report, Department of Economics and Statistics, Government of Tamil Nadu. The crop wise time series data on area, production and yield of major pulses has been collected for 14 years period from 1997 to 2016. Based on NFSM implementation in Tamil Nadu the period was divided into three categories for analysis *viz*., Pre NFSM (1997 to 2006), Post NFSM (2007 to 2016) and Overall period (1997-2016) [6-13].

Compound growth rate analysis

Compound Growth Rate (CGR) analysis was used to measure the past performance of the economic variables such as area, production and productivity of major pulses in Tamil Nadu.

The growth rate was estimated using exponential trend model

$Y = ab^t$

Where, Y= area/ production / yield of major pulses

a =intercept, b= regression coefficient, t=time in years

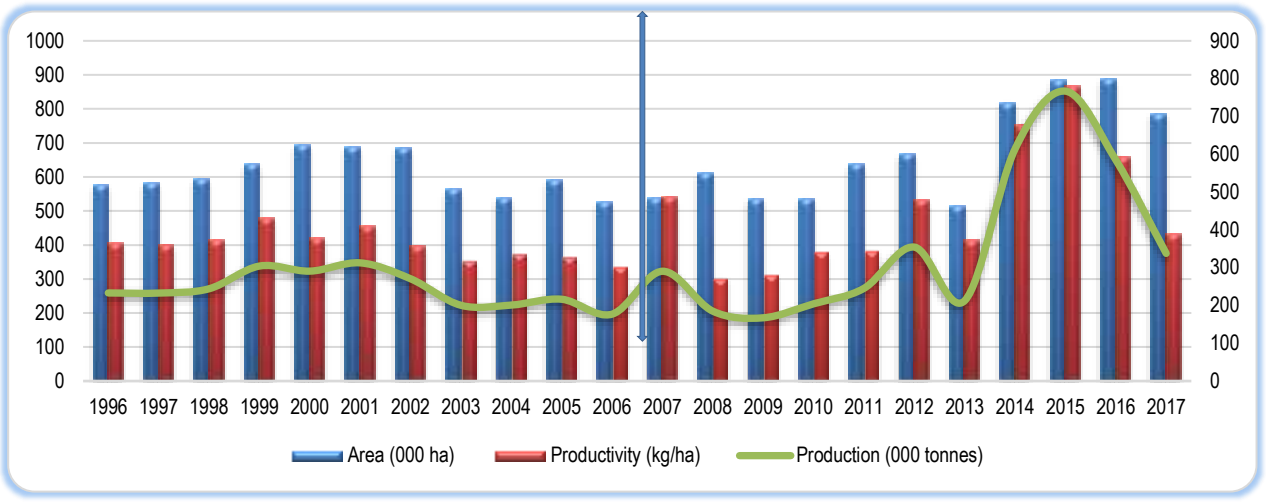

Fig-1 Trend in area, production and productivity of total pulses in Tamil Nadu [*Note: Straight line indicated the year of NFSM implementation in Tamil Nadu*]

From the estimated function, the compound growth rate percentage (r %) can be expressed as

CGR (r) = (Antilog of b - 1)* 100

Where, r= Compound Growth Rate (in %)

Instability Index

The instability indices of area, production, productivity was estimated using Coppock's Instability Index (CII) for three periods *viz*., Pre NFSM period (1997 to 2006), Post NFSM period (2007 to 2016) and Overall period (1997-2016).

The CII can be estimated by using the formula

The instability index = [Antilog ($\sqrt{V\ log}$) -1]* 100

$$V\ log = \frac{\left[\sum \log \frac{X_t+1}{X_t} - M\right]^2}{N}$$

Where,

X_t = Area/production/yield of major pulses in year t

N = number of years minus one (*i.e*. N= n-1)

M= Arithmetic mean of the difference between the log of X_t and X_{t-1}, X_{t-2}, *etc*. The CII analysis was used to measure percentage variation from year to year.

Decomposition analysis

Decomposition analysis was used to measure the relative contribution of area and yield towards the total production changes of major pulses.

This method is explained below

$P_0 = A_0 \times Y_0$, and

$P_t = A_t \times Y_t$ (1)

Where, A_0 and A_t represent the area and Y_0 and Y_t represent the yield in the base year and nth year, respectively.

$P_t - P_0 = \Delta P$,

$A_t - A_0 = \Delta A$

$Y_t - Y_0 = \Delta Y$ (2)

Upon simplification of equation (1) and (2), it could be written as:

$P_0 + \Delta P = (A_0 + \Delta A)(Y0 + \Delta Y)$

Hence,

$P = A_0\Delta Y/\Delta P \times 100 + Y0\Delta A/\Delta P \times 100 + \Delta Y\Delta A/\Delta P \times 100$

Production = Yield effect + Area effect + Interaction effect

Thus, the total change in production can be decomposed into three components *viz*., yield effect, area effect and the interaction effect due to change in yield and area.

Results and Discussion

Pulses occupied around 15 percent of gross cropped area in India and plays a vital role in the national food grain production. According to Food and Agricultural Organization (FAO, 2017), the area and production of pulses in India were 35 million hectares and 23.24 million tonnes, respectively. The average pulses productivity in India was found to be 664.2 kg per hectare during 2017. Tamil Nadu stood ninth position in Indian pulses production. The area under total pulses has increased from 5.44 lakhs ha in 1980 to 7.85 lakhs ha during 2017. Similarly, the production has increased from 1.76 to 3.37 lakhs tonnes for the same period (Season and Crop Report of Tamil Nadu, 2016-17).

Major pulses cultivating districts in Tamil Nadu are Thiruvarur, Thoothukudi, Nagapatinam, Villupuram and Cuddalore. The major pulses produced in Tamil Nadu are Black gram, Green gram, Cowpea, Red gram and Begal gram. Fig.1 represents trend in area, production and productivity of total pulses during 1996 to 2017. The figure indicated that after NFSM implementation, the area and productivity show increasing trend. The production of pulses decreased marginally due to lack of rainfall.

Compound Growth Rate

The growth rate of area, production and productivity of pulses in Tamil Nadu for three periods *viz*., Pre NFSM (1997 to 2006), Post NFSM (2007 to 2016) and Overall period (1997 to 2016) were estimated and presented in [Table-1].

Black gram is one of the most important pulse crops in Tamil Nadu which occupied an area about 4.3 lakh ha during 2016-17. It constitutes nearly 55 % of the area of total pulses. The result of CGR revealed that the growth rate of area, production and productivity of black gram were positive and significant during post NFSM period and overall period whereas in pre NFSM it showed a decreased growth rate. Green gram is also an important pulse crop in Tamil Nadu as it contributes 21 % and 17 % in area and production of total pulses at the state level. The result of CGR of green gram area were positively significant in all period whereas production and productivity were positive but non-significant, it may be due to development of high yielding varieties and development of yellow mosaic virus resistant varieties (Rijoy and Bhat,2017). The area, production and productivity of red gram in Tamil Nadu during 2016-17 were 57933 ha, 37053 tonnes and 655 (kg/ha), respectively. The growth rate of area and production of red gram possessed positive and significant growth rate in post NFSM, which may be due to development of improved varieties, increasing demand for domestic consumption and also export market (Usha, 2009). The compound growth rate of area, production and productivity of bengal gram was negative during overall period. Horse gram productivity was positively significant in the overall period whereas area and production had negative growth. The poor growth rate of area, production and productivity of major pulses are posing an alarm for the future since it could affect the food and nutritional security of the nation significantly. The overall performance of total pulses for the period 1996 to 2017 was found to have positive growth in terms of area (1.13 %), production (2.92 %) and productivity (1.77 %). The same pattern was also observed in case of post NFSM period. The initiatives taken by the Government through NFSM- Pulses had fruitful results in increasing the area under pulses and thereby boosting total pulses production.

Table-1 *Compound Growth Rate of Area, Production and Productivity of major Pulse Crops in Tamil Nadu, (Percent)*

Crops	Particulars	Pre NFSM (1997 to 2006)	Post NFSM (2007 to 2016)	Overall (1997 to 2016)
Black gram	Area	-0.09	4.69**	2.77***
	Production	-1.79	12.13**	4.82***
	Productivity	-1.7	7.11*	1.99*
Green gram	Area	3.37**	4.21**	3.05***
	Production	2.61	9.2	3.62**
	Productivity	-0.72	4.8	0.55
Red gram	Area	-7.85***	10.22***	-2.34**
	Production	-9.11***	14.04***	-0.48
	Productivity	-1.38	3.46	1.17
Bengal gram	Area	-2.94*	-1.49	-1.03
	Production	-3.14**	-1.62	-1.15**
	Productivity	-0.2	0.004	-0.07
Horse gram	Area	-2.99*	3.41	-2.22**
	Production	-6.32*	3.43	-0.92
	Productivity	-3.43	0.03	1.48
Total Pulses	Area	-0.87	5.16**	1.13**
	Production	-2.83	11.51**	2.92**
	Productivity	-1.98**	6.04*	1.77**

*Note: * Significant at 1% level, ** Significant at 5% level, *** Significant at 10% level Source: Source: Season and Crop Report, Department of Economics and Statistics, Government of India.*

Table-2 *The Coppack's Instability Index for Area, Production and Productivity of major Pulses in Tamil Nadu (Percent)*

Crops	Particulars	Pre NFSM (1997 to 2006)	Post NFSM (2007 to 2016)	Overall (1997 to 2016)
Black gram	Area	14.12	26.10	20.63
	Production	20.73	70.80	52.10
	Productivity	17.72	51.85	39.51
Green gram	Area	11.48	27.90	20.46
	Production	26.10	99.52	67.52
	Productivity	18.04	66.77	47.87
Red gram	Area	12.35	18.29	18.19
	Production	29.33	39.06	35.01
	Productivity	17.91	63.08	43.75
Bengal gram	Area	25.52	22.30	23.22
	Production	23.89	24.02	23.36
	Productivity	5.67	4.67	5.18
Horse gram	Area	13.01	32.01	23.32
	Production	31.49	69.56	52.65
	Productivity	23.68	33.34	31.10
Total Pulses	Area	9.08	20.79	15.65
	Production	15.49	60.38	43.01
	Productivity	9.50	40.76	30.46

Source: Season and Crop Report- 2016-17

Table-3 *Decomposition Analysis in Area, Production and Productivity of major Pulses in Tamil Nadu, (Percent)*

Crops	Particulars	Pre NFSM (1997 to 2006)	Post NFSM (2007 to 2016)	Overall (1997 to 2016)
Black gram	Area Effect	154.81	-257.28	-69.23
	Yield Effect	-94.57	238.03	117.08
	Interaction Effect	41.17	119.66	52.29
Green gram	Area Effect	-101.92	399.3	-304.14
	Yield Effect	171.4	-39.25	122.94
	Interaction Effect	30.9	-260.31	281.2
Red gram	Area Effect	36.3	-72.55	76.97
	Yield Effect	76.66	89.08	90.33
	Interaction Effect	-12.89	83.52	-67.18
Bengal gram	Area Effect	-14.09	-2.16	-1.99
	Yield Effect	101.36	121.77	96.49
	Interaction Effect	12.72	-18.84	5.46
Horse gram	Area Effect	34.64	114.65	73.86
	Yield Effect	103.53	95.62	170.11
	Interaction Effect	-38.77	-110.28	-144.05
Total Pulses	Area Effect	85.87	-399.36	-123.54
	Yield Effect	24.19	207.58	84.32
	Interaction Effect	-10.06	291.52	139.11

Source: Season and Crop Report- 2016-17

Higher minimum support price and higher procurement price could be the important factor for increased growth rate. But to meet growing demand and to reduce the import of pulses, more such initiatives are needed, so that the country can attain self- sufficiency in pulses production [10]

Instability Index

The instability analysis was worked out by generating Coppock's Instability Index (CII). The estimated results of instability in area, production and productivity of major pulses during the three periods *viz*., Pre NFSM (1997- 2006), Post NFSM (2007- 2016) and Overall period (1997 - 2016) are presented in [Table-2].

An analysis of changes in crop production, aside from growth, is significant, as large fluctuation in crop output not only influence price and achieve sharp fluctuation, in addition brings about wide variations in disposable income of the farmers. The size of fluctuations relies upon the idea of harvest generation innovation, its sensitivity to climate, monetary condition, availability of material sources of inputs and numerous different components. The results revealed that instability in the area and productivity of all the crops except bengal gram has increased in the post NFSM period as compared to pre NFSM period. This may be due to the intervention of NFSM pulses in Tamil Nadu. The instability in the production of major pulse crops has increased in the post NFSM as compared to pre NFSM and in overall period, it shows increasing trend. Thus, the instability of area, production and productivity of total pulses shows that it has increased in post NFSM and overall period which implies increasing trend on area, production and productivity of total pulses during study period.

Decomposition Analysis

The total change in pulses production was decomposed in to three effects *i.e*., area effect, yield effect and interaction effect and the results are represented in [Table-3] for three periods *viz*., Pre NFSM (1997 to 2006), Post NFSM (2007 to 2016) and Overall period (1997 to 2016).

[Table-3] revealed that an increase in black gram production was observed during the post NFSM period (2007 to 2016) and overall period (1997 to 2016) mainly due to increase in yield effect by 238.03 and 117.08 percent respectively. For green gram production the relative contribution of yield and interaction effect was positive during overall period (1996 to 2016) whereas area effect was positive with (399.3 percent) during post NFSM period. The yield effect was the major driving force for red gram production in 1997 to 2016. About 90.33 percent growth in red gram was due to yield effect which more than offset the area effect (76.97 percent). The similar results are found in post NFSM period. The increased production of Bengal gram was mainly influenced by yield effect (96.49) rather than area effect during over all period. The similar results are found in post NFSM period. Overall contributions of area and yield effect of horse gram production were positive for all the period.

In Tamil Nadu, the main source of output growth in total pulses was due to only the yield during post NFSM (207.58 percent) and overall period (84.32 percent). However, the area effect was negative for the same period. Finally, it is concluded that the pulses production in Tamil Nadu is mainly influenced by yield effect rather than area effect. To further increase the area under pulses cultivation and yield of pulses, research and policy support should be promoted which will help to increase per capita availability of pulses, reducing import dependence and to some extent it will stabilize the pulse prices.

Summary and Conclusion

The growth rate of area, production and productivity of total pulses in the Post NFSM period and overall period was positive and significantly contributed for the growth of pulses sector. The instability of area, production and productivity of total pulses has increased in post NFSM and overall period and it implies increasing trend on area, production and productivity of total pulses during the study period. The results of decomposition analysis revealed that yield and interaction effects were positively contributed to the production of pulses. Based on the results of the study, it is concluded that, NFSM pulses programme has positively contributed for the increasing pulses production Tamil Nadu.

Application of research: The growth in area, production and productivity of pulses have been increased significantly. The pulses production in Tamil Nadu is mainly influenced by yield effect rather than area effect.

Research Category: Growth, instability and decomposition analysis

Abbreviations:

NFSM: National Food Security Mission

CGR: Compound Growth Rate, CII: Coppock's Instability Index

Acknowledgement / Funding: Authors are thankful to Department of Agricultural Economics, Tamil Nadu Agricultural University, Coimbatore, 641003, Tamil Nadu, India

****Research Guide or Chairperson of research: Dr M. Anjugam**
University: Tamil Nadu Agricultural University, Coimbatore, 641003, India
Research project name or number: PhD Thesis

Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: Tamil Nadu

Cultivar / Variety / Breed name: Pulses

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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