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RESEARCH ARTICLE

PRODUCTION OF PULSES IN INDIA: AN ECONOMETRIC ANALYSIS

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ABSTRACT

The present study is an attempt to undertake the task of verifying the various factors influencing the production of pulses but especially it focuses on Area due to the availability of the data. Hence Production relation revealed that the production of pulses mainly depends on area since from many decades. Though India is a major pulses growing country in the world, it has faced the problem of supply and demand gap in pulses since mid seventies. Depending on the domestic short fall in pulses production stagnant production and ever increasing population has lead to declining per capita availability of pulses over the years. Growth trends in production of pulses suggest that area under cultivation has not been able to bring desired increase in production of pulses so as to meet increasing demand. The Government has focused on improving pulse production through various programmes and prices support policies but no significant progress has so far been observed since from the above analysis growth rate of production of pulses is found to be negative. Some of the factors discouraging pulses sector are stagnation in production, poor area expansion, low yield and relative low profitability, decrease in per capita land availability, increase in demand-supply gap, heavy dependence on imports, inefficient marketing, etc.

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. Pulses for being environment friendly, major source of protein and complementing cereals both in production and consumption will have a vital role to play under the circumstances. In the production process, pulses improve soil fertility, requires less water than cereals. On the consumption side, pulses are relatively cheaper source of protein. (Joshi and Saxena 2002). Pulses will 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 (Reddy, 2004). India is the largest producer and consumer of pulses in the world economy of pulses farming. The major pulse crops grown in India are chickpea, pigenopea, urdbean, mungbean, lathyrus, mothbean, horsegram, lentil and peas. The common pulses grown in Rabi season are chickpea, lentil, field pea, lathyrus (Khesari) and rajmash. The major pulses cultivated during Kharif season are arhar, moong and urd (black gram). Pulses accounted for 14.33 percent of gross cropped area of the country during 1952-53 and with fluctuations in between the years; it remained to around 12 percent during 2007-08. The area under pulses cultivation decreased by 3.95 percent and production increased by 17.67 percent during 1962-63 and 2007-08. This reflects more or less stagnant conditions of pulses production. There is a demand and supply gap in pulses, and depending on the domestic short fall in pulses production, India's net imports of pulses have ranged from 1 to 3 million tonnes during 2001-02 to 2008-09. The per capita availability of pulses declined from 61 grams in 1951 to 36 grams in 2007. To enhance adoption of improved technology in pulses farming, various programmes of government like National Pulses Development Project (NPDP), Technology Mission for Oilseeds and Pulses (TMOP), Integrated Scheme of Oilseeds, Pulses, Oil palm and Maize (ISOPOM) are in operation from time to time. Considering the importance of pulses in food security, the National Food Security Mission (NFSM) was launched during the eleventh Five year plan targeting important food grain crops rice, wheat and pulses. In recent reports it has been found that India has achieved a record pulses production of 18.45 million tonnes (MT) in the 2012-13 as compared with 17.09 MT in 2011-12.

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Area and Production of Pulses in India

The status of area and production of pulses in India over the years is presented in Table 1. The total production of pulses in India was 15.77 million tonnes in 2010-11 from an area of 23.88 million hectares. The area and production of pulses have been hovering in the same range over the years but have shown some sign of progress during the last decade. The production has registered an increase of 2.63 million tonnes (MT) from

13.14 MT in 2000-01 to 15.77 MT in 2010-11. The area under pulses has increased from 21.66 MH in 2000-01 to 23.88 MH in 2010-11 , registering an increase of 2.22 million hectares (MH). The yield has also increased by about 9 percent during the last decade. This has resulted mainly due to focused efforts of the Government through various initiatives like (NFSM) National Food Security Mission.

Table 1. All India Area and production of Pulses

Year	Area	Production
	(Million Hectares)	(Million Tonnes)
1950-51	19.09	8.41
1960-61	24.23	12.55
1970-71	21.94	11.31
1980-81	22.79	10.46
1990-91	23.74	13.66
2000-01	21.66	13.14
2010-11	23.88	15.77

Source: Directorate of Economics and Statistics, DAD, MOA

Constraints in Pulses Production

Looking into the importance of pulses in diet, in soil fertility and stagnation in its production, it becomes necessary to find out constraints and outline the prospects for pulses production in the country. This is due to the persistent problems of biotic factors (insect and diseases), abiotic factors (climate, uncertainties of rainfall, excessive temperature, etc.), institutional and infrastructural constraints, technology related constraints etc.

Socio economic institutional constraints

Non availability of good HYV seeds of pulses, lack of knowledge about HYVS, Poor technical guidance and untimely availability of inputs (agro-chemical, fertilizers, etc) are socio economic institutional constraints. Poor seed storage facilities, poor marketing facilities, poor transportation for marketing etc are the socio economic infrastructural constraints in pulses production in states of India.

Others constraints are as follows:

i. Terminal Drought
ii. Temperature
iii. Soil acidity
iv. Uncertainty in Rainfall

Supply of Pulses

The total supply of pulses in India has increased from 14.22 MT to 17.43 MT during the 1999-2000 and 2009-10. Though, the production during the same period has increased by 0.87 MT only i.e. from 13.77 MT in 1999-2000 to 14.64 MT in 2009-10. Hence, the imports have played a vital role in the total supply of pulses in the country. It is assumed that the production, imports and exports of the pulses contribute to its total supply. The import have increased from 0.61 MT in 1999-2000 to 2.92 MT in 2009-10 and are responsible for increase in total supply of pulses which increased from 4.27 percent to 16.75 percent of total supply during the same period.

Brief survey of existing literature

Reddy and Reddy (2010) Their study has found that there is a scope of increasing area under lentil during the *rabi* season, as its cost per hectare is less with higher net returns than the competing crops like wheat, gram and mustard in water-deficit and resource-poor conditions. The study has found that lentil-based cropping systems are profitable and also have high water productivity, hence are suitable for mostly un-exploited rice-fallows under water-deficit conditions. There is a case for larger institutional and policy support for pulse crops, keeping visible effects of pulse crops in increasing yield of subsequent crops in crop rotations. Even though pulses are very important for India in terms of share of production and consumption, in term of importance, both farmers and government have ignored them. In India, the irrigated area under pulses was only 12 per cent, while under wheat and paddy, it was more than 60 per cent of the total area. Another critical input, credit was Rs 85 /ha for pulses, whereas it was Rs 458/ha for paddy and Rs 90/ha for wheat in 2001 (Materne and Reddy 2007).

Traditionally pulses have been considered important elements of cropping systems in the Indo- Gangatic Plains. They were popular because of their importance as a source of protein and ability to fix atmospheric nitrogen (N) and thus improve soil fertility [Joshi 1998]. There has been a high degree of risk in pulses production. More than 87% of the area under pulses is presently rain fed [Reddy 2009]. The mean rainfall of major pulse growing states of India is 1,000 mm and the coefficient of variation of the rainfall is 20-25%. Moisture stress is the oft-cited reason for crop failures. Terminal drought and heat stress results in forced maturity with low yields. Drought stress alone may reduce seed yields by 50% in the tropics. Soil acidity was a serious constraint to legume introduction into rabi season as soil of some parts of India have pH value below 6.0.Legumes are more sensitive to soil acidity as compared to cereals and other non-legumes crops [Choudhary and Pande 1986, Chong *et al.*, 1987].

Objectives of the study

- To find out the trend of production of pulses over a period of time in India.
- To analyze the constraints in pulses production in India.
- To analyze the status of area and production of pulses in India over the years.
- To examine the relation between area and production of pulses in India over the decades.

Data source and methodology

Data source

The present study is based on the secondary data. The secondary data was collected from the official publications and Centre for Monitoring Indian Economy (CMIE) report from 1986-87 to 2010-11. The data collected includes Area and production of pulses in India.

Table 2. Production and area of pulses during 1986-2010

Year	PROD	AREA
1986-87	16,320.50	35,137.80
1987-88	15,730.20	32,292.80
1988-89	19,481.00	35,000.20
1989-90	18,353.60	35,699.40
1990-91	20,368.10	37,254.80
1991-92	17,518.50	34,948.00
1992-93	18,500.50	33,796.90
1993-94	18,463.70	33,747.50
1994-95	18,999.20	33,587.10
1995-96	17,009.60	33,176.50
1996-97	14,243.70	22,446.90
1997-98	12,979.30	22,871.00
1998-99	14,907.10	23,500.50
1999-00	13,418.10	21,116.00
2000-01	11,075.40	20,348.10
2001-02	13,368.10	22,008.40
2002-03	11,125.00	20,496.20
2003-04	14,905.20	23,458.10
2004-05	13,129.50	22,763.00
2005-06	13,384.40	22,391.30
2006-07	14,197.50	23,191.70
2007-08	14,761.50	23,633.00
2008-09	14,566.40	22,094.20
2009-10	14,661.80	23,282.40
2010-11	18,240.90	26,407.50

Source: Centre for Monitoring Indian Economy (CMIE) report

Methods of Analysis

For the proposed objectives the present study has applied the methods such as:

1) Descriptive statistics analysis
2) Compound Annual Growth Rate (CAGR)
3) Regression analysis

RESULTS AND ANALYSIS

1) Compound annual growth rate (CAGR)

The Compound annual growth rates have been calculated by fitting a growth rate formula using available data for the period 1986-87 to 2010-11.
The growth in the area and production of pulses is estimated using the compound growth function of the form:
$Y_t = ae^{rt}$
(Formula taken from veena, V.M., 1996)
Where, Y_t = Dependent variable in period t (Area/Production)
a = Intercept
r= Regression coefficient
t = Years which takes values, 1, 2, …,n

	Area	Production
CAGR (%)	-0.023015*	-0.011953*
	(0.0000)	(0.0075)

Figures in the parenthesis are the significance level of growth rate

From the above table we can observe that during the period of 1986-87 to 2010-2011the area of pulses has registered a negative growth and also has been found to be highly significant. On the other side, Production of pulses has also been found to growing at a negative rate. The result from the above analysis clearly signifies the decline in trend of pulses production due to decline in area of production, indicating the positive or direct relationship between the area and production of pulses. Hence, the decreasing return is operating in production of pulses for the study period.

2) Descriptive statistics analysis

Refer to above table, the average production of pulses during the period of 1986-2011 was 15588.35 million tonnes and average area cultivated for production of pulses during same period was 27385.97 million hectares. It is interesting to observe that area had larger variation compared with production of pulses, since std.dev of area is greater than that of production and we know that higher the value of std dev, higher will be the variation. Again the value of C.V of production is less than the C.V of area and hence production is found to be more consistent during the period of 1986-2011.

	PRODUCTION	AREA
Mean	15588.35	27385.97
Std. Dev.	2600.186	6068.084
C.V	16.7	22.2

3) Unit root test

From above table, it can be seen that the value of Augmented Dickey Fuller test statistic for production and area are less than Test Critical values for all 1%, 5%, 10% level. Also the probability value are more than 0.05. This means that the null hypothesis may be accepted. Thus it can be said that production and area has a unit root. Therefore it can be said to be non-stationary as it contains unit root problem. Now, when the 1st differences of both the series are taken, then $\tau_{calculated} > \tau_{critical}$ for all 1, 5 & 10% level, indicating that the null hypotheses are rejected. Thus both the variables are stationary after 1st differencing, as the probability value for both is also less than 0.05. In other words, both variables are integrated of order (1). Hence production and area are Co-integrated.

4) Regression analysis

By using Ordinary Least Squares (OLS) method, following result have been estimated:

From the above regression result it is found that there is a positive relation between production of pulses and area cultivated for production of pulses since coefficient of area is 0.381169 which is a positive value. If total area increases by 1 unit on an average, production of pulses increases by 38 percent. The estimated t-value is 9.337791 and the p-value is 0.0000 which is highly significant at 99% 0f significance level. Again, value of F-statistic is 87.19434 and prob (F-statistic) is 0.000000 which is highly significant, suggesting that the Area have a significant impact on production of pulses. As area increases, production of pulses also increases and if it decreases than there will be a decline in production too. The value of R^2 is 0.791278 which implies that about 79% of the variation of production is explained by area. Also the value of

Table: The Augmented Dickey Fuller (ADF) Test

	LEVEL		1st Difference			
Variables	ADF Test Statistic	Probability	ADF Test Statistic	Probability	Critical Values	Result
Production	-1.833756	0.3561	-6.751543	0.0000	1% -3.752946 5% -2.998064 10% -2.638752	I(1)
Area	-1.475494	0.5285	-4.996981	0.0006	1% -3.752946 5% -2.998064 10% -2.638752	I(1)

Dependent Variable: PRODUCTION
Method: Least Squares
Date: 06/13/14 Time: 02:53
Sample: 1 - 25
Included observations: 25

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AREA	0.381169	0.040820	9.337791	0.0000
C	5149.675	1143.937	4.501712	0.0002

R-squared	0.791278	Durbin-Watson stat	1.588260
F-statistic	87.19434		
Prob(F-statistic)	0.000000		

Durbin Watson is 1.588260 which is very close to 2 and which means that there is low auto correlation.

Findings of the study and conclusion

The present study is an attempt to undertake the task of verifying the various factors influencing the production of pulses but especially it focuses on Area due to the availability of the data. Hence Production relation revealed that the production of pulses mainly depends on area since from many decades.

- Though India is a major pulses growing country in the world, it has faced the problem of supply and demand gap in pulses since mid seventies. Depending on the domestic short fall in pulses production stagnant production and ever increasing population has lead to declining per capita availability of pulses over the years.
- Growth trends in production of pulses suggest that area under cultivation has not been able to bring desired increase in production of pulses so as to meet increasing demand.
- The Government has focused on improving pulse production through various programmes and prices support policies but no significant progress has so far been observed since from the above analysis growth rate of production of pulses is found to be negative.
- Some of the factors discouraging pulses sector are stagnation in production, poor area expansion, low yield and relative low profitability, decrease in per capita land availability, increase in demand-supply gap, heavy dependence on imports, inefficient marketing, etc.

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