Economic Affairs 2014, 59(3) : 403-414

New Delhi Publishers

Economic Affairs

RESEARCH PAPER

59(3): 2014: DOI 10.5958/0976-4666.2014.00008.4

Pulses Production in India: Challenges and Strategies

K. Inbasekar

Scientist, Division of Agricultural Economics, IARI, New Delhi, India.

Corresponding author: economist.inba@gmail.com

Paper No. 148 Received: 20th May, 2014 Accepted: 24 September, 2014

Abstract

This study analyses the challenges and strategies to increase pulse production with special emphasis on chickpea and pigeon pea. The study is based on secondary data collected from published sources. Compound growth rate was estimated to study the yield performance in the major states. The study revealed that there is low yield growth in chick pea and pigeon pea in the majority of the states. The yield gap analysis in chickpea also reveals high exploitable potential yield in the western zone. Totally 3.2 million tonnes of additional pulses can be produced by extending pulses area to rainfed rice fallow lands, replacing low productive crops and summer fallows. Hence, the respective state governments may take necessary action to increase pulses production by providing technological and institutional support.

Keywords: Chickpea, Pigeonpea, Yield growth, Yield Gap

Introduction

The diversified agro-climatic condition in India positively supports variety of pulses in various regions. Pulses are grown in on area of 22-23 million hectares with an annual production of 13-18 million tonnes. However, there is always a gap between potential and actual yield. Bridging this gap would substantially increase country's pulses production. In addition to that the potential areas of pulses may be identified and supported technologically and institutionally to increase area under pulses.The total pulses production in the country is almost static although substantial productivity improvement in most of pulse crops has been made. The static pulses production mainly due to poor adoption of improved varieties and production technologies by farmers. The resource poor farmers in the marginal lands choose to grow pulses.

Kumar (1993) and Sawant (1981) attributed the slow growth in pulses production for low growth in yield. Very smaller area under irrigation and its variability contributed for instability in pulses production. Lack of knowledge on crop management and technological constraints such as the insufficient and untimely availability of HYVs of seeds affected pulses production (Ramasamy, 2002). The differential impact of technologies high yielding varieties and irrigation substantially affected area under pulses. Relative decrease in instability of paddy and wheat yield drastically affected pulses (Expert Committee on Pulses, 2012). Reddy (2006) studied instability in pulses and concluded that instability is more in production when compared to area and yield.

The adoption rate of pulses technologies is miserably low among the farmers mainly because of risky crops, low and unstable yields, poor infrastructure and non-availability of critical inputs like quality seeds in time (IIPR, 2007). Srivastava (2010) studied pulses in India and concluded that there was hidden potential of minor states in pulses production for long term sustainability. Hence, for different pulses, minor pulses producing states should be encouraged to identify the region specific constraints and efforts should be made for creation of necessary infrastructure and efficient execution of pulses development schemes to provide favourable condition for pulses cultivation. In this study, our first objective is to study the yield growth across various states and zones. The second objective is to identify and quantify the potential pulses production from niche pulses areas.

Data and Methodology

The study primarily based on the secondary data collected from published sources like Directorate of Economics and Statistics, various annual reports of All India Coordinated Research Projects of concerned crops and Expert committee on pulses. The yield performance studied by arriving Compound annual growth rate. The yield gap is measured by taking the differences between the demonstrated yield of improved varieties and state average yield. The potential attainable production is measured by multiplying potential extendable pulses area and average yield of particular state.

The evolution of pulses in India classified into 5 categories viz. pre-green revolution period (1960-1970), green revolution (1970-1980), post-green revolution period (1980-1990), post-liberalization period (1990-2000) and a period following the trade-spike from 2000-2010. During the green revolution period, the reduction in the variability of paddy and wheat yield coupled with unabated risks in pulses could have led to the substitution of area away from pulses. The post-liberalization period witnessed favourable terms of trade for agriculture over industry and this has potential to change and impact cropping pattern. Finally, the importance of post-trade spike period is indicated by the fact that during this period pulses import increased by as much as 36 per cent.

To study the yield of pulses over time, we group the states into five zones based on geographical location. The northern zone comprises Haryana, Punjab and Uttar Pradesh. The southern zone comprises Andhra Pradesh, Karnataka and Tamil Nadu. The eastern and western zones consist of Assam, Bihar, Odisha and West Bengal and Rajasthan, Gujarat and Maharashtra respectively. Only two states lie in the central zone viz.Chhattisgarh and Madhya Pradesh.

Results and Discussion

Pulses in India mostly grown in marginal rainfed lands show remarkable variability and diversity in terms of varieties and quantity of production. The percentage share of pulses in total cropped area (GCA) is declining in most of the states. Pulses constituted 11 per cent of GCA in 2000-01 which increased marginally by 2 percent to attain 13 per cent in 2010-11 (Table 1). This primarily may be attributed to various pulses developmental schemes during post-2000 period. The major pulses producing states like Madhya Pradesh, Karnataka, Orissa and Rajasthan show remarkable increase in share of pulses area in GCA. The other major states like Andhra Pradesh, Maharashtra, Gujarat, Haryana and Tamil Nadu almost maintained same position between 2000-01 to 2010-11. These states coming under status-quo position which are neither increasing nor decreasing the share of pulses area in GCA. Uttar Pradesh, Punjab and West Bengal show decreasing trend in share of pulses area in GCA of respective states. Broadly, the share of pulses area in GCA is declining in major pulses growing states.

Another important change is increase in area under rabi pulses. After 2000-01 there observed continuous and increasing difference between khariff and rabi and increase in area in favour of rabi season (Figure 1). The seasonal shift of pulses area was observed and now as much as 61.0 per cent of the total production comes from rabi. More emphasis should be given to rabi pulses as their production share is much higher and increasing in recent years (Reddy AA, 2013)

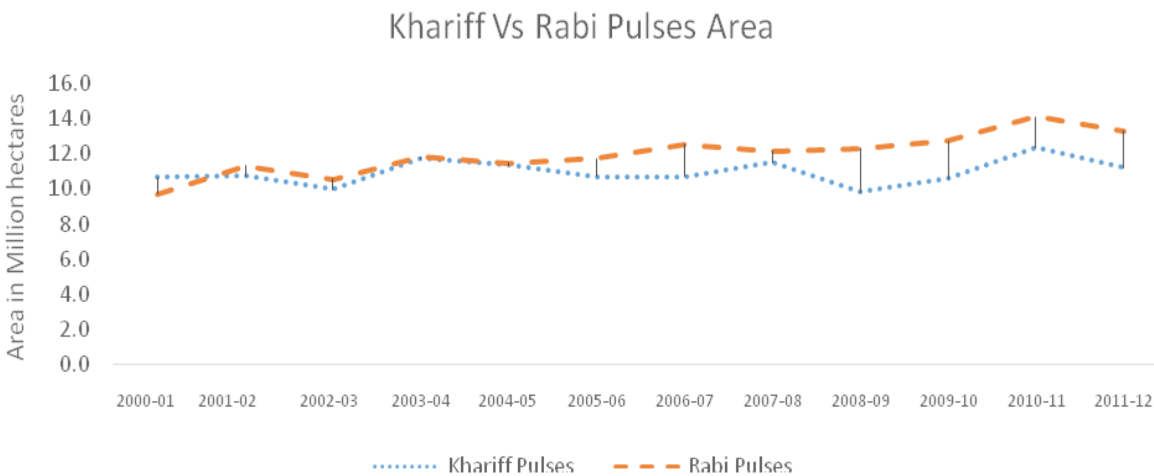

Fig. 1 : Increase in rabi pulses area

 Print ISSN: 0424-2513 Online ISSN: 0976-4666

Table.1 Percentage Share of pulses area in Gross Cropped Area

States	2000-01	2010-11
Andhra Pradesh	14.0	14.7
Assam	2.7	3.0
Bihar	9.0	8.5
Gujarat	6.1	7.3
Haryana	2.6	2.7
Karnataka	16.7	21.4
Madhya Pradesh	19.9	23.4
Maharashtra	16.5	16.8
Orissa	7.7	16.2
Punjab	0.8	0.3
Rajasthan	12.3	18.3
Tamil Nadu	10.9	11.1
Uttar Pradesh	10.6	9.6
West Bengal	3.0	2.1
All India	11.0	13.3

Source: Directorate of Economics and Statistics, GoI, 1992-2011

As far as concern about pulses production concerned in the northern zone all the states are showing decreasing trend in pulses production. The most prospective zones in the southern zone Andhra Pradesh and Karnataka show remarkable increase of 91 and 82 per cent respectively. In the eastern zone Odisha showed 46 percentage increase in pulses production between last two decades. In Maharashtra and Gujarat pulses production has increased to the tune of 37 and 22 per cent respectively. Madhya Pradesh, largest state for pulses production showed 49 per cent increase over last two decades. All over India pulses production increased by 30 per cent between 2000 and 2012 (Table 2)

Table 2. Zone wise pulses production (‘000 tonnes)

States	TE 2000	TE 2012	Percentage change
Northern Zone			
Haryana	268	129	-52
Jammu & Kashmir	17	15	-14
Punjab	52	17	-66
Uttar Pradesh	2403	2114	-12

Contd.

 Print ISSN: 0424-2513 Online ISSN: 0976-4666

Southern Zone			
Andhra Pradesh	714	1366	91
Karnataka	697	1272	82
Tamil Nadu	306	273	-11
Eastern Zone			
Assam	66	68	3
Bihar	735	507	-31
Orissa	267	390	46
West Bengal	163	152	-7
Western Zone			
Gujarat	551	673	22
Maharashtra	1883	2579	37
Rajasthan	1990	2135	7
Central Zone			
Madhya Pradesh	2645	3951	49
India	12853	16664	30

Source: Directorate of Economics and Statistics, GoI.

During the green revolution period chickpea yield in India grew negatively with the CAGR of -0.4 per cent. At all India level during all the period under study, chickpea yield grew at the rate of below 2 per cent. This indicates that there were no significant breakthroughs in chickpea yield and adoption of available improved technologies. During the green revolution period, the northern zone states like Punjab and Uttar Pradesh showed negative yield growth of -0.58 and -6.54 per cent respectively. In the eastern zone Bihar and Orissa, though exhibited negative yield growth during the post-liberalization period, it managed to increase positively with the yield growth rates 0.57 and 3.17 respectively during the post-trade spike period. In the western zone, Gujarat showed remarkable yield growth from 1.03 per cent in the post-liberalization period to 7.88 per cent during the post-trade spike period. The same situation holds to Maharashtra. Thus in the semi-arid western India though the chickpea yield (Table 3).

Pre-green revolution period (1960-70), Green revolution period (1970-80), Post-green revolution period (1980-90), Post-liberalization period (1990-2000), Post-trade spike period (2000 onwards)

Madhya Pradesh one of the major chickpea producing state in central India, showed continuous decrease in yield during the pre-green revolution (-1.53) and the green revolution (-2.77) periods.

All India level, Pigeonpea yield grew 2 per cent during the post-liberalization period. In the northern zone, pigeonpea yield showed decreasing trend in Punjab (-0.05) and Haryana (-2.41) during post-liberalization period. In the southern zone, Karnataka showed continuous increase in yield growth from post-liberalization period.

Table 3. Chickpea Yield - Compound Annual Growth Rate

Zone/State	Pre-Green Revolution Period	Green-Revolution period	Post-Green Revolution Period	Post-Liberalization period	Post-Trade Spike Period
Northern Zone					
Haryana	3.10	3.44	8.64	0.12	1.46
Punjab	0.77	-0.58	4.52	2.71	3.26
Uttar Pradesh	0.95	-6.54	-0.39	0.19	-0.59
Southern Zone					
Andhra Pradesh	-1.82	-0.51	3.33	1.23	2.06
Karnataka	5.01	2.83	-2.79	5.29	1.20
Tamil Nadu	-3.37	0.83	0.04	0.01	-0.55
Eastern Zone					
Assam	2.55	-1.16	-1.48	0.86	0.29
Bihar	1.82	-0.63	11.58	-0.17	0.57
Orissa	6.33	-2.00	1.25	-1.97	3.17
West Bengal	4.82	1.81	0.36	0.59	2.14
Western Zone					
Gujarat	1.89	-3.57	8.26	1.03	7.88
Rajasthan	1.04	2.18	-0.56	2.70	0.74
Maharashtra	-2.37	4.14	3.96	1.26	5.53
Central Zone					
Madhya Pradesh	-1.53	-2.77	1.00	2.75	1.22
India	0.8	-0.4	0.7	1.7	1.6

Source: Directorate of Economics and Statistics, Government of India, 1960-2010.

Table 4. Pigeon Pea Yield - Compound Annual Growth Rate

Zone/State	Pre-Green Revolution Period	Green-Revolution period	Post-Green Revolution Period	Post-Liberalization period	Post-Trade Spike Period
Northern Zone					
Haryana	-	8.52	3.11	-0.05	3.82
Punjab	-	5.41	-1.83	-2.41	1.16
Uttar Pradesh	1.78	0.71	-0.71	0.87	-5.25
Southern Zone					
Andhra Pradesh	3.64	-2.91	-0.58	3.02	2.26

Karnataka	3.57	4.76	-1.97	4.65	4.47
Tamil Nadu	-2.06	5.48	7.38	3.27	1.17
Eastern Zone					
Assam	5.05	-0.65	-0.45	0.55	-0.31
Bihar	3.71	-1.06	1.86	1.31	-0.03
Orissa	0.99	-2.72	2.52	-4.04	5.20
West Bengal	2.13	4.84	3.23	1.53	-0.22
Western Zone					
Gujarat	-0.73	2.11	-2.77	1.40	9.79
Rajasthan	-0.23	-8.24	2.33	9.50	4.41
Maharashtra	-4.56	2.47	2.40	5.87	1.82
Central Zone					
Madhya Pradesh	-2.77	-4.85	5.01	-1.16	1.09
India	-0.4	-0.3	0.5	2.0	1.5

Source: Directorate of Economics and Statistics, Government of India, 1960-2010.

Pre-green revolution period (1960-1970), Green revolution period (1970-1980), Post-green revolution period (1980-1990), Post-liberalization period (1990-2000), Post-trade spike period (2000 onwards)

In the eastern zone, Assam, Bihar and West Bengal show negative CAGR in Pigeon pea yield. Orissa showed 5.04 per cent increase in Pigeon pea yield during trade spike period. Almost all the states in the western zone performed well in terms of yield increment. While Gujarat showed 1.4 percent growth in the post-liberalization period, in the post-trade spike period the CAGR of yield shoot up to 9.79 per cent. Maharashtra, the top producer of Pigeon pea, shows continuous increase in yield in all the period from the green revolution. Madhya Pradesh show 1.09 per cent increase in Pigeon pea yield during post-trade spike period.

From our yield growth rate study it is evident that there is marginal increase in yield of major pulses like chickpea and Pigeon pea. This will remain a major constraint in increasing pulses production. Moreover, as it evident from Table 1, the share of pulses area in gross cropped area in declining in the major pulses producing states. This is the matter of serious concern in extending area of pulses. It was also observed that pulses area slowly shifting towards Rabi season. This increases the vulnerability of pulses to moisture stress as these are grown on limited residual moisture.

Two strategies are identified to increase pulses production in the country. First there always exists a gap between potential attainable yield and actual yield attained by farmers. Bridging this yield by exploiting the improved varieties and adoption of various technologies is the short term option to increase pulses production. Another option is to bring other potential cultivable areas under pulses cultivation. The expert committee on pulses (2012) has identified potential areas that can be brought under pulses cultivation. The rain-fed rice fallow lands, current fallow lands and area with low productivity crops can be potentially diverted to produce pulses. Here, we provide an estimated pulses production that can be produced additionally by bringing these areas under pulses cultivation.

Table 5. Estimated chickpea production by bridging yieldgap

States	Yield of improved varieties * (tons/ha)	State Average Yield (2007-12) (tons/ha)	Yield-Gap (tons/ha)	Average Chickpea Area (2007-12) (mha)	Estimated Additional Production (million tons)
Northern Zone					
Haryana	1.809	0.835	0.974	0.101	0.098
Uttar Pradesh	1.66	0.952	0.708	0.564	0.399
Southern Zone					
Andhra Pradesh	1.689	1.264	0.425	0.606	0.258
Karnataka	1.14	0.576	0.564	0.813	0.459
Tamil Nadu	0.714	0.638	0.076	0.007	0.001
Eastern Zone					
Assam	1.096	0.509	0.587	0.001	0.001
Bihar	1.389	1.046	0.343	0.059	0.020
West Bengal	1.61	1.063	0.547	0.022	0.012
Western Zone					
Rajasthan	1.589	0.687	0.902	1.318	1.189
Maharashtra	1.393	0.808	0.585	1.255	0.734
Gujarat	1.39	1.041	0.349	0.187	0.065
Central Zone					
Chattisgarh	1.418	0.907	0.511	0.244	0.125
Madhya Pradesh	1.395	0.941	0.454	2.904	1.318
Total					4.679

Source: Directorate of Economics and Statistics, Government of India, 1960-2010.

*All India coordinated research project on Chickpea, Annual Report 2011-12

There always existed a gap between the potential achievable yield and farmers yield. Here we arrived the estimated production by bridging this yield gap. The western and central zones may be exploited to increase chickpea production. These two zones have the potential to produce 2.00 and 1.5 million tons of chickpea respectively. The next comes the southern zone with the potential estimated production of 0.718 million tonnes.

Table 6. Estimated pigeonpea production by bridging yield gap

State	Yield of improved varieties (tonnes/ha)*	State Average Yield (2007-12) (tonnes/ha)	Yield Gap (kg/ha)	Average Pigeonpea Area (mha)	Estimated Additional Production (tons)
Uttar Pradesh	1.597	0.882	0.715	0.330	0.236
Madhya Pradesh	0.964	0.657	0.307	0.406	0.124
Maharashtra	0.898	0.764	0.134	1.162	0.156
Gujarat	1.107	1.009	0.098	0.264	0.026
Karnataka	0.694	0.552	0.142	0.708	0.100
Tamil Nadu	0.769	0.726	0.043	0.032	0.001
Andhra Pradesh	0.721	0.453	0.268	0.498	0.134
Assam	1.169	0.704	0.465	0.006	0.003
Total					0.781

Source: Directorate of Economics and Statistics, Government of India, 1960-2010.

* National Food Security Mission Report, 2010-11

With respect to the eastern zone, even though the yield gap is quite high the total potential production is very low because less area under chickpea cultivation. To increase pulses production in eastern India, it is advocated to increase area under chickpea. Cumulatively, if all the states adopt improved varieties and technologies India will be able to produce 4.7 million tonnes of chickpea additionally.

In case of pigeonpea very high yield gap observed in Uttar Pradesh and Karnataka. Bridging pigeonpea yield gap would add some 0.78 million tonnes to total pulse production (Table 6).

Joshi (2005) studied Chickpea in the non-traditional areas and proposed that significant chickpea area expansion possible on fallow lands. Most of the crop land in rain-fed areas is kept fallow during the post-rainy season due to the non-availability of irrigation water and other resources, and the low production potential of soil (marginal lands). RRFL (Rainfed Rice Fallow Lands) offers an enormous scope for pulse production and chickpea, because of its low water requirement, is the most suitable second crop (NFSM Progress Report, 2011-12). The RRFL offer some of the most productive environment for chickpeas; if suitably integrated into rainfed rice production systems, this can revolutionize chickpea production (Pande, 2012). With this background we estimated the potential pulses production from RRFL. The Scenario 1,which assumes that 25 per cent of RRFL are to be brought under rabi pulses will add 1.8 million tonnes of pulses with current productivity levels. The scenario 2 assumes 50 per cent of RRFL are to be brought under pulses cultivation which will add 3.7 million tonnes of pulses production (Table 7).

Table 7. Estimated Rabi pulses production from rain-fed rice fallows (RRFL) in India

State	RRFL area# (m.ha)	Average Yield of Rabi pulses * (tons/ha)	Potential area available (m.ha)		Estimated Production (mt)	
			Scenario 1 (25%)	Scenario 2 (50%)	Scenario 1	Scenario 2
Assam	0.54	0.55	0.14	0.27	0.07	0.15
Chhattisgarh	2.94	0.69	0.74	1.47	0.51	1.02
Jharkhand	1.75	0.92	0.44	0.88	0.40	0.81
Madhya Pradesh	1.75	0.83	0.44	0.88	0.36	0.72
Orissa	1.22	0.47	0.31	0.61	0.14	0.28
West Bengal	1.72	0.82	0.43	0.86	0.35	0.70
Total	-	-	2.5	5.0	1.8	3.7

Source :* Average yield for the period 2007-2011, Directorate of Economics and Statistics,GoI.

Expert committee on pulses, 2012

Table 8. Estimated pulses production from replacing low productive crops

Low Productivity Crops	Area (million ha)#	Replacing crops	National Average Yield (tons/ha)*	Estimated Production (tones)
Upland Rice	0.5	Pigeon pea	0.705	0.35
Millets	0.45	Pigeon pea	0.705	0.32
Barley	0.3	Chick pea	0.878	0.26
Total	-	-	-	0.93

Source: *Average yield for the period 2007-2011, Directorate of Economics and Statistics, GoI.

Expert committee on pulses, 2012

The low productive crops may be substituted with pulses in order to increase pulses production. The low productive crops like upland rice and various millets add one million hectare land which can produce additional 0.67 million tonnes of pigeon pea at current productivity level.

The low productive Rabi crops like barley of 0.3 million hectare may produce 0.26 million tonnes of chick pea. Cumulatively replacing low productive crops have the potential to add 0.93 million tonnes of pulses in India (Table 8).

Extending pulses area in the current fallow lands by increasing substantial infrastructural facilities is one of the best option not only to increase pulses production but also to ensure inclusive agricultural growth. Green gram can be cultivated in the summer fallows in Uttar Pradesh, Bihar, Gujarat and West Bengal. This can add 0.44 million tonnes of green gram to total pulses production (Table 9).

Table 9. Estimated Greengrams production from current fallow lands

State	Current Fallow Land (mha)	Potential area (mha) (25 %)	Average Yield of Green gram (tons/ha) * (TE 2011)	Estimated Production (million tonnes)
Uttar Pradesh	1.22	0.303	0.596	0.18
Bihar	0.92	0.230	0.598	0.14
Gujarat	0.38	0.094	0.433	0.04
West Bengal	0.57	0.143	0.591	0.08
Total	-	-	-	0.44

Source: *Average yield for the period 2007-2011, Directorate of Economics and Statistics, GoI.

The strategy of increasing area under pulses by bringing rainfed rice fallows, low productive crops areas and current fallow lands India has the potential to achieve 3.2 million tonnes of pulses in the long term (Table 10). However, these areas characterized by water stress, soil salinity in case of rainfed rice fallows, low market linkage and credit availability. These problems may be addressed to bring these areas under pulses cultivation.

Table 10. Estimated potential Pulses production

S. No	Potential Areas	Estimated Production (m. tons)
1	Rainfed Rice Fallows	1.8
2	Replacing Low Productive Crops	0.93
3	Current Fallows	0.44
4	Total Production	3.2

Source : Computed by Author

The necessary varietal, agronomic and plant protection improvement measures may be taken in order to encourage the farmers to take up pulses in these areas. The assured prices and institutional procurement may enhance the farmer's choice to produce pulses.

Conclusion

The decreasing share of pulses area in gross cropped area in various states is of serious concern in increasing pulses production. The western region also noted for having high yield gap. By bridging the chickpea and pigeonpea yield gap India has the potential to produce 4.7 and 0.78 million tonnes of the same. Various studies pointed out the potential of rainfed rice fallow lands to produce chickpea. In our estimate it may produce 1.8 million tonnes of chickpea if 25 per cent of rainfed rice fallow lands are brought under chickpea cultivation. The replacement of low productive crops like upland rice, millets and barley may add 0.93 million tonnes of pulses. The green gram cultivation in the summer fallows expected to add 0.47 million tonnes. The technological adoption to bridge the yield gap and extending area under pulses to various crops will likely to add about 8 million tonnes of pulses to total pulses production of our country. Hence, the concerned state governments may take necessary actions to exploit the domestic potential to produce pulses by technological adoption and institutional support to farmers.

References

Innovative approach to achieve self-sufficiency in production of pulses, National Food Security Mission, 2010-11.

Joshi, P.K., M. Asokan, and M.C.S. Bantilan, (2005). "Chickpea in nontraditional area: evidence from Andhra Pradesh". Pages 115-129 in "Impact of Agricultural Research: Post-Green Revolution Evidence from India" New Delhi, India: National Centre for Agricultural Economics and Policy Research and Patancheru-502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

NFSM-Progress Report No: 5, (2011-12). Enhancing chickpea production in Rainfed Rice Fallow Lands (RRFL) of Chhattisgarh (CG) and Madhya Pradesh (MP) states of India following Improved Pulse Production and Protection Technologies (IPPPT).

Pande Suresh (2012). Farmers participatory introduction and expansion of chickpea in the rainfed rice fallow lands in India, ICRISAT, Extended summaries: 3rd International Agronomy Congress, Nov. 26-30, 2012, New Delhi, India.

Ramasamy.C, K.N.Selvaraj. (2002), "Pulses, Oilseeds and coarse cereals: Why they are slow growth crops?", Indian *Journal of Agricultural Economics*, **57**(3).

Reddy A. A, MCS Bantilan and Geetha Mohan (2013). "Pulses Production Scenario: Policy and Technological options", Policy Brief 26, International crop Research Institute for the Semi-Arid Tropics.

Reddy. A.A., (2009). Growth and Instability in Chickpea Production in India: A State Level Analysis (November 4, 2009). *Agricultural Situation in India*, 230-145.

Report on Expert c on Pulses, (2012). Department of Agriculture & Co-operation, Government of India, Ministry of Agriculture, New Delhi -110 001.

Srivastava S.K., N. Sivaramane, and V.C. Mathur (2010). "Diagnosis of Pulses Performance of India", *Agricultural Economics Research Review*, 23: 137-148.