Article

Leveraging Policies for Self Sufficiency in Pulses in India

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Abstract

Although pulses are a major source of protein integral to the Indian diet, there has been a consistent demand–supply gap. Barring the last five years, total production of pulses remained stagnant at 12–14 million tonnes (mt) over the past five decades. Over the last 20 years, more than 550 improved varieties of different maturity periods and for different regions have been released by public research organisations, but the availability of quality seeds remained a serious concern, thereby resulting in yield uncertainty. The domestic supply fell short by 3–4 mt every year. Also, owing to increased consumption by the diet-conscious growing urban population in India, prices rose by 150 per cent to 200 per cent in recent years. The supportive trade policy has cooled down the pulses price during the deficit year, while encouraging price support policy and good monsoon helped in a big way to allocate 20 per cent more area to the crop, which resulted in record pulses production of 23 mt in 2016–2017. This article captures the influence of government policy on pulses production and suggests paradigm shift in strategy through short-, medium- and long-term plans to achieve self-sufficiency in pulses production and ensure nutritional security for population.

Keywords

Pulses, policy, NFSM, import of pulses, MSP

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Getting the Pulse of Pulses

India continues to face severe shortage of pulses owing to rising demand and volatility in domestic production. It produces a quarter of the world's total production, but consumes almost one-third, thus importing 2–6 million tonnes (mt) annually to meet the domestic demand (Singh, 2015a). Pulses are an integral part of the Indian diet and remains a very important crop group[1] from the perspective of nutrition as well as environmental sustainability (Alexandratos & Bruinsma, 2012; Inbasekar, Roy, & Joshi, 2015). They are rich in complex carbohydrates, micronutrients, protein and B vitamins; low in fat and rich in fibre, therefore excellent for managing cholesterol, digestive health and regulating energy levels (FAO, 2016; Jukanti, Gaur, Gowda, & Chibbar, 2012). This is important in the backdrop that 38.7 per cent of Indian children under the age of five are stunted, 19.8 per cent are wasted and 42.5 per cent are underweight.[2] Over decades, governments emphasised more on cereals production (may be attributed to looming food security concerns) and pulses remained neglected in the country, as nutritional security remained elusive in the policy agenda. Domestic demand has never been met through domestic production, and it perpetually depended on import. Since the 1950s till 2005–2006, cropped area under pulse crops ranged between 22 and 23 mha, while total production remained stagnant at 12–14 mt. Moreover, several improved and high-yielding varieties of different pulse crops have been developed by research institutions for different regions in India. Although there are several biotic and abiotic reasons constraining pulses production, it could not attract much attention from the policymakers for creation of an enabling environment in pulses as in the case of cereals or cash crops. Moreover, the extreme deficit condition in the recent past followed by galloping prices of all pulses led to several proactive policy measures. This has resulted in a significant increase in area allocation to pulses and overall record pulses production in the country in the year 2016–2017. No doubt, the good monsoon also helped in a big way in brining bumper production. Hence, this article focuses on policy gaps and impacts related to pulses in India, with special focus on selected states—Madhya Pradesh, Maharashtra, Rajasthan and Odisha—first three are top three pulses-growing states in India, while Odisha has embarked upon pulses production rapidly in the recent years. The article narrates the process of policymaking and the relevant policies related to pulses adopted by selected states and at the national level; also examines the shift in the pulses production region; and finally towards the end, identifies the policy shifts required to achieve self-sufficiency in pulses in India.

Policy Relevance

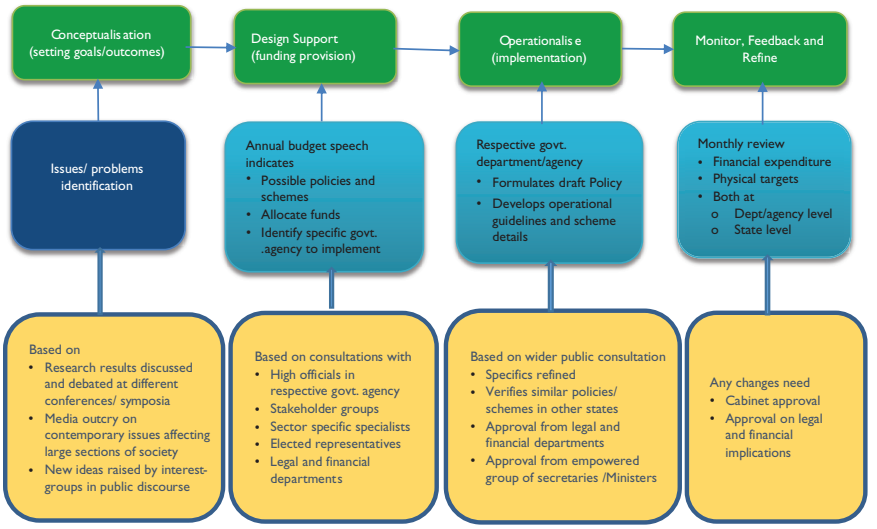
The agriculture sector provides employment as well as livelihood opportunities to the largest section of the society in developing countries such as India and

other Asian nations. Although investment in agricultural R&D yields higher returns on investment, the requirement for massive injection of investment simultaneously to other demanding sectors, such as health, education, infrastr ucture and so on, creates a strain on the agricultural investment pipeline in developing countries. In 2014, India invested 0.30 per cent of its AgGDP in agriculture research as compared to 0.62 per cent of AgGDP being spent by China (Stads, Sastry, Kumar, Kondisetty, & Gao, 2016). Furthermore, the investment decisions in agriculture are becoming increasingly complex. A well-designed implementable policy plays a decisive role in agricultural transformation with far-reaching consequences in any country. It is now obvious that by 2050, the global population will rise to 9.2 billion, which will require a 70 per cent increase in global food production. This appears to be a daunting task under the given scenario of shrinking arable land and depleting water resources due to demand from competing sectors and overhanging climate change effect. An enabling policy environment helps in mitigating these foreseeable as well as unforeseen challenges.

Process in Policy Formulation

The economic development of a country depends on the quality of its policy framework, especially the processes involved in formulating each decision. Policy formulation is part of the process by which proposed actions are articulated, debated and drafted into language for a law or policy, mostly in several iterations (Howlett, Ramesh, & Perl, 2003). It includes setting goals and outcomes of the policy. Once a problem requiring a policy solution is identified, the process of policy development includes how the problem is framed by various stakeholders, which problems make it onto the policymaking agenda and how the policy is formulated. Together, these steps, often not conducted in a linear fashion, determine whether a problem or policy proposal is acted upon. While issues framing, agenda setting and policy formulation are stages that policies go through, each of these stages can include a number of activities, namely, advocacy, policy dialogue and analysis of evidences related to the problem and policy responses (Corkery, Land, & Bossuyt, 1995). The way a problem is stated or an issue is framed influences the types of solutions that are proposed. The goals and objectives may be general or narrow but should articulate the relevant activities and indicators by which they will be achieved and measured (Isaacs & Irvin, 1991). Thus, policy formulation passes through different stages (Raju & Ravindra, 2015), as depicted in Figure 1 to bring out expected desirable changes in the society.

Figure 1. Targeted Policy Formulation Process at State Level



Source: Adapted from Raju and Ravindra (2015).

Policies at National Level

Indian policymakers are facing challenges to efficiently balance food security concerns and higher growth objectives. This requires not only pushing the production frontier upward, but also ensuring strategic management of foodgrain, including procurement and distribution. In India, although agriculture is a state subject, most of the agricultural policies are formulated at the federal/central level, which are implemented with the help of respective state governments. Major agricultural policies such as price policy, fertiliser policy, irrigation policy, agricultural market reforms, food policy, agricultural trade policy and so on are formulated by the central government. Over the years, several policies and schemes were initiated by the central government, which are applicable for all the relevant states, who implement it with little tweaking suiting to their conditions. Some of these policies related to pulses production are listed in Table 1.

The National Food Security Mission (NFSM) was launched in 2007. It is a set of policy packages involving field demonstrations of best farming practices, incentives for adoption of modern technologies, and resource conservation and management practices. It is a multipronged effort to boost the production of major foodgrains, namely, rice, wheat and pulses. These policies together have redefined the pulses economy at the state as well as national level. Over the past four decades, the area under major pulse crops has moved from eastern and northern region to central and southern region. Broadly, 80 per cent of production comes from 20 per cent of India's districts. Currently, only seven states together contribute about 85 per cent of total pulses production in the country (Figure 2). However, these states have different priority pulse crops with varying yield levels. Unfortunately, no state has

an average yield of even 1 tonne/ha. Moreover, in this season i.e. *kharif 2016,* acreage under pulses increased substantially in most of the states, because of the high prices that prevailed in the run-up to planting in June/July.

Table 1. Agricultural Policies and Schemes Driven by the Government of India

Policy available	Operational guidelines	Schemes/ Projects	Funding Support
Achieving higher foodgrain production	Enhance adoption of improved technology Implemented through the Directorate of Pulses Development	National Pulses Development Project in operation since 1985	100% centrally sponsored
	Special schemes implemented through districts and states by formulating District Agriculture Plan (DAP) and State Agriculture Plan (SAP)	*Rashtriya Krishi Vikas Yojana* (RKVY)	100% grant by the central government
	Launched under NFSM Bridge the yield gap of all pulses	*Accelerated Pulses Production Programme (2010)*	100% grant by the central government
Agriculture market reform	Single license to be valid across the state, Single point levy of market fee and Provision for electronic auction as a mode for price discovery.	*E-National Agricultural Market (2016)* *585 regulated wholesale markets are expected to come on this platform by March 2018*	Central government allocated ₹2 billion to support the initiative
Soil health, soil conservation and fertiliser	Assistance for soil improvement—supply of gypsum/pyrite/lime, plant protection chemicals, vermicompost unit, micronutrients, bio-fertilisers, soil testing laboratory (STLs), organic farming and so on Frontline demonstration (FLD) on soil testing	NFSM[1] NMSA[2] National Project on Management of Soil Health & Fertility	Central funding support of 50% of cost or on pro rata basis depending on the activities
Seed policy	Assistance for quality seed distribution Distribution of foundation/ certified seeds for production of quality seeds	NFSM NMAET[3], Sub-Mission on Seed Village Scheme	Central funding support up to 75% of cost of seeds
	Purchase of breeder seeds of pulses Targeted 4 mt increase in production of pulses in 12th FYP	NFSM	Full cost of breeder seeds as fixed by seeds division

(Table 1 continued)

(Table 1 continued)

Policy available	Operational guidelines	Schemes/ Projects	Funding Support
Irrigation policy	Assistance in sprinkler set, construction of water harvesting structure and farm ponds Water harvesting and management	NFSM NMSA	Central funding support up to 50% of cost or pro rata
Skilling of farmers	Training of farmers on plant protection measures Training of farmers for seed production Repair, maintenance and operation of various agricultural machinery and equipment Awareness programme on the storage and warehousing	NFSM NMSA Agricultural Marketing Infrastructure (AMI) sub-scheme of ISAM[4] SMAM[5]	Central assistance on pro rata basis
Farm mechanisation	Assistance in purchasing of all types of agricultural machinery and plant protection equipment Establishment of post-harvest unit for value addition Setting up farm machinery banks for custom hiring	SMAM	Central assistance on pro rata basis varying for different social category (25–50%) Project based, up to 40%
Institutional credit	Formal credit on subsidised interest KCC, investment loan, collateral-free loan	Through commercial banks, RRBs, PACS	Crop loan up to ₹0.3 million at 7% of interest, with provision of 3% subvention
Price policy	Procurement by central and/or state agencies at MSP	Price support scheme	Every year MSP declared for all pulses
Agricultural insurance	Actuarial premium-based crop insurance covering from sowing to harvesting	MNAIS[6] *Pradhan Mantri Fasal Bima Yojana*	Subsidy up to 75% of premium
Storage and warehousing of foodgrains	Financial assistance for construction and renovation of rural godowns and cold storage	ISAM	Subsidy on capital cost up to 33.33%

(Table 1 continued)

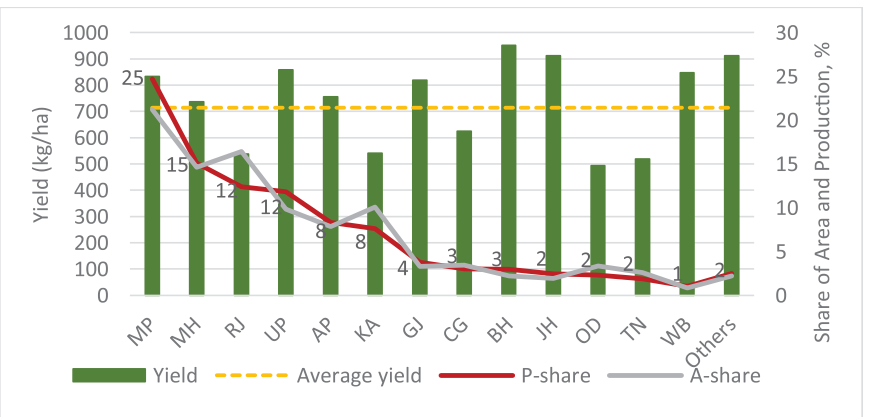
(Table 1 continued)

Policy available	Operational guidelines	Schemes/ Projects	Funding Support
Pulses promotion	Financial assistance for production and distribution of certified seeds, distribution of seed mini-kits, sprinkler sets, rhizobium culture and PSB, micronutrients and so on FLD by the ICAR	[7]ISOPOM	Central government Funded

Sources: Extracted from various government programme's documents (Feder, 1980; Gaur & Kumar, 2016; GoI, 2017; GoM; 2015; GoO, 2013, 2015).

Notes: [1]NFSM: National Food Security Mission; [2]NMSA: National Mission for Sustainable Agriculture; [3]NMAET: National Mission on Agricultural Extension and Technology; [4]ISAM: Integrated Scheme for Agricultural Marketing; [5]SMAM: Sub-Mission on Agricultural Mechanisation; [6]MNAIS: Modified National Agricultural Insurance Scheme; [7]ISOPOM: Integrated Scheme of Oilseeds, Pulses, Oil-palm and Maize.

Figure 2. States' Contribution in Pulses Production in India (average 2009/2010–2015/2016)



Source: Authors' own calculation.

Policies at State level

This article has focused on the policy push given to pulses in four select top pulses-growing states—Madhya Pradesh, Maharashtra, Rajasthan and Odisha. Odisha also has one of the largest rice fallow areas (1.2 mha), which holds significant potential in expanding the pulses production in the state (Subbarao et al., 2001). There has not been any specific policy support from state governments to increase the production or profitability of pulse growers in the respective states (refer Table 2). All these states depend on the support provided by the central government under various schemes to increase pulses production.

Table 2. State-specific Policies and Schemes Related to Promotion of Pulses Production

States	Policy available	Operational guidelines	Schemes/ Projects	Funding Support
Madhya Pradesh	Easy and cheaper credit to farmers	million farmers given KCCs	(*Budget 2015*)	NA
		Interest-free credit to 2.8 million farmers in 2014–2015		
	Farm mechanisation	Some of the farm machineries made tax exempted	(*Budget 2015*)	NA
Maharashtra	No special policy for pulses, *per se*	Implementation of all central government sponsored schemes		NA
	Micro-irrigation	Around 1.6 million ha under MI in 2013–2014	NMIM	Central fund
	Water for agriculture	Water conservation at village level	Jalyukt Shivar Abhiyan	₹1 billion (*Budget 2015*)
	Improving agricultural productivity	Convergence of various schemes	Krishi Samridhi Yojana	NA
Odisha	State Agriculture Policy 2013 (Comprehensive policy covering all aspects of agriculture)	Effective management of input supply and enhancing seed replacement, improving soil health, farm mechanisation, irrigation facilities and so on	Separate budget on agriculture started in 2013–2014	Corpus fund for seeds, fertilisers and irrigation
		Interest subvention for crop loan and term loan		Subsidy for micro-irrigation, community-based mega irrigation project and so on
		Deep bore well in clusters	Secha Karyakrama	₹5.2 billion
		Subsidy on purchase of farm machineries	Popularisation of agricultural implements, equipment and diesel pumpsets in 2014–2015	₹2.4billion in 2015–2016

(Table 2 continued)

(Table 2 continued)

States	Policy available	Operational guidelines	Schemes/ Projects	Funding Support
Rajasthan	State Agricultural Policy, 2013	Bridge the existing yield gap through adoption and upscaling of improved technologies	Seed village concept to enhance availability of quality seeds	10% plan expenditure in the Annual Plan 2014–2015 allocated for agriculture and allied activities
		Enhance productivity of core crops including pulses	District and village panchayat level soil health map	1% of cess on Mandi sales for strengthening agri R&D
		Promotion of watershed-based integrated farming system, with mixed/intercropping and diversification of crops	Promotion of water harvesting structure	
		Modernisation of agriculture (ICT, mechanisation, IPM and so on)		
	Rajasthan Agro-Processing and Agri-Marketing Promotion Scheme, 2015	Development of agro-food parks	Processing of pulses and oilseeds	No specific funding provision
		Model act provides provision for contract farming, direct purchase outside the market yards, unified license and so on	Ease in marketing of agricultural commodities including pulses	No specific funding provision

Sources: Extracted from various economic survey reports of respective states (GOI, 2017; GoM, 2015; GoO, 2015; GoR, 2016).

Demand–Supply Gap and Import of Pulses

The pulses production in India has been consistently inadequate in meeting the rising domestic demand. The estimated annual shortage of pulses on the basis of production and consumption data has been estimated to be 2–3 mt on continuous basis between 2000 and 2011 (Chandra & Roy, 2014). The high demand and deficit in local supply of pulses have increased India's dependence on imports from countries such as Canada, Myanmar, Australia and African nations. The current crisis can be attributed largely to decrease in acreage under pulses, getting these crops pushed to marginal, poorly irrigated and low-quality soils and poor availability of quality seed delivery system, resulting in lower yield. This has resulted in huge import of pulses, but also pushed the prices of pulses to a record level in the international market. Moreover, the true nature of the cooling effect of imports of pigeon pea and chick pea on domestic prices is not so much in terms of bringing prices down but in terms of moderating their rate of increase (Negi & Roy, 2015). Keeping this in view, in July 2016, India had signed a five-year agreement with Mozambique for import of pigeon pea and other pulses amounting to 100,000 tonnes in 2016–2017, with an option to scale it up to 200,000 tonnes by 2020–2021 (PIB, 2016). The overall import of pulses has been growing continuously; it reached 6.55 mt in 2016–2017 and is continuing in 2017–2018 (Table 3). This is despite a record 23 mt of pulses production in 2016–2017 (Table 4). The almost monophonic status of India in the pulses import market is also triggering stiff competition among major exporters. For instance, the rate for yellow pea corrected down from US$380 to US$300 especially after Russia and Ukraine began to offer lower rates, undercutting Canada. The share in total pulses export to India has dramatically changed in 2016–2017 as compared to the previous year. It is evident from Table 3 that some of the major pulses exporting countries like Myanmar for moong and pigeon pea exports, lost heavily to Tanzania and Mozambique. In case of peas, Canada and Russia lost to Lithuania and France, while in case of chickpea, Australia gained at the cost of Russia.

Table 3. Import of Major Pulses in India

		Import in million tonnes					Top 5 import sources (2016–2017 basis)
Pulses	**HS Code**	**2013–2014**	**2014–2015**	**2015–2016**	**2016–2017**	**2017–2018***	
Peas (*Pisum sativum*)	071310	1.33	1.95	2.25	3.17	2.45	Canada (55%)$^{-}$, Russia (10%)$^{-}$, Lithuania (9%)$^{+}$, France (7%)$^{+}$, USA (6%)$^{-}$

(Table 3 continued)

(Table 3 continued)

Pulses	HS Code	Import in million tonnes 2013–2014	2014–2015	2015–2016	2016–2017	2017–2018*	Top 5 import sources (2016–2017 basis)
Chickpeas	071320	0.28	0.42	1.03	1.08	0.75	Australia (85%)$^{+}$, Russia (5%)$^{-}$, Tanzania (4%)$^{+}$, Myanmar (1%), USA (1%)
Moong/ Urad	071331	0.62	0.62	0.58	0.57	0.33	Myanmar (66%)$^{-}$, Tanzania (10%)$^{+}$, Australia (10%)$^{+}$, Uzbekistan (4%)$^{+}$, Kenya (3%)$^{-}$, Mozambique (3%)$^{+}$
Lentil	071340	0.71	0.82	1.26	0.83	0.70	Canada (77%)$^{-}$, USA (12%)$^{+}$, Australia (11%)$^{+}$
Pigeon peas/Tur	071360	0.47	0.58	0.46	0.70	0.31	Tanzania (28%)$^{+}$, Myanmar (27%)$^{-}$, Mozambique (25%)$^{+}$, Malawi (7%)$^{-}$, Sudan (7%)$^{+}$
Total pulses		3.65	4.58	5.80	6.55	4.64	

Source: Department of Commerce, Government of India (various years).

Notes: '+' and '–' signs indicate the increase or decrease in share of total exports to India in comparison with previous year 2015–2016. No sign indicates that the country is maintaining same share. * April to November 2017.

Moreover, the bumper pulses production in 2016–2017 plummeted the domestic price of pulses, heavily compelling the government to place a restriction on import of pulses. A notification by Directorate General of Foreign Trade (DGFT) in August

2017 put an import quota of 0.2 to 0.3 million tonnes of pulses in any fiscal year (DGFT, 2017a, 2017b). However, it states that the restriction on imports does not apply to the Indian government's import commitments under any bilateral/regional agreement/MoU. Similarly, DGFT's notifications in September and November 2017 completely removed the prohibition on export of pulses. Thus, the import and export of pulses trade are heavily dependent on the government policy, which not only affects the international, but also the domestic market.

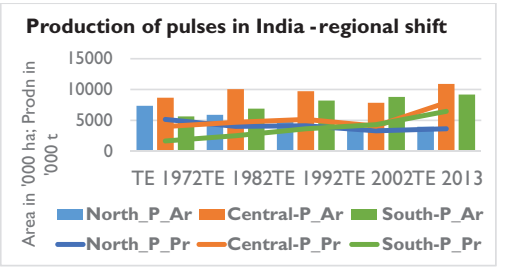
Pulses Production Environment and Technologies

Agricultural production *per se* and pulses production in particular is an inherently risky enterprise. Several studies have indicated that the production of pulses in India has moved away from irrigated area, and as irrigation becomes available, there is a switch away from pulses towards fine cereals (Inbasekar et al., 2015; Singh, 2015b). Pulses are mostly grown as rain-fed crops or with limited irrigation. But due to the availability of improved high yielding varieties, farmers are also cultivating it as an irrigated crop. Moreover, pulses are poor responsive to irrigation as compared to wheat, maize or rice (Goyne & McIntyre, 2002; Jalota, Sood, & Harman, 2006; Raul, 2001). On the other hand, when faced with uncertainty, producers base their crop decisions on both expected (average) income and income variance (Feder, 1980; Markowitz, 1952), though expected income can only be increased by taking on more risk (through increase in income variance). Farmers with smallholding and poor assets, being risk averse, are willing to accept lower expected income to reduce income variance. This is also one of the important reasons for largely widespread smallholders in northern and eastern India to shy away from pulses production. This raises serious concerns for regaining or raising the acreage under pulses in these regions.

During the green revolution period (1964–1972) in India, the focus was to achieve food self-sufficiency through modernising and intensifying agriculture to raise yields of major cereals, that is, rice and wheat, through the use of improved seeds, multi-cropping methods, modern fertilisers and pesticides, and so on. This has resulted in a significant boost in production of major cereals. Production of pulses in India increased only by about 47 per cent to about 18.5 mt in the triennium ending (TE) 2013–2014 from about 12.5 mt in TE 1960–1961 (Lingareddy, 2015). However, over the same period, production of rice and wheat has gone up by over 225 per cent and 808 per cent to 106 mt and 95 mt, respectively. Interestingly, over the last 40 years, there has been significant shift in the production of pulses in India. Area under pulses in northern states such as Punjab, Haryana, Uttar Pradesh, Bihar, Jharkhand, West Bengal and Assam has drastically decreased, though yield has consistently improved (Figure 3). The shift in pulses cultivation to the drylands of central and southern regions of the country (Bhalla & Singh, 2001; Sadasivan, 1989) makes 82 per cent of pulses cultivation still rain-fed. Among pulses, irrigated area of chickpea was 35 per cent, while that of pigeon pea was only 4 per cent in TE 2013–2014 (GoI, 2017). Concentrated production of pulses is one of the major challenges in the sector. Madhya Pradesh, Rajasthan, Maharashtra and Uttar Pradesh account for 80 per cent of chickpea production;

while Uttar Pradesh, Madhya Pradesh and Bihar together account for 80 per cent of lentil production; and four states, namely, Maharashtra, Karnataka, Madhya Pradesh and Andhra Pradesh, together account for over 70 per cent of pigeon pea production in India.

Figure 3. Regional Shift in Pulses Production in India Over Four Decades



During last 3 decades:

I. Area under pulses ↓ by 33%, though yield improved.

II. Area under pulses ↔, yield improved by 50%.

III. Area ↑ by 33%, yield ↑↑ by 94%.

Source: Authors' own calculation.

Consecutive drought-like situations in 2014/2015 and 2015/2016 resulted in about 20 per cent reduction in total pulses production, as compared to that in 2013/2014. However, farmers have shown resilience by allocating higher area (25.26 mha) to pulses in 2015/2016 after a blip during the previous year. While there was serious decline in production of pigeon pea and chickpea, the production

of moong and urad has not declined. Production of pulses in the 2015–2016 crop year was estimated to be around 20 per cent less than that in 2013–2014 which further declined to only 16.35 m because of drought in Maharashtra, Karnataka and Rajasthan, the three big states that lead in cultivation of pulses (Table 4).

Table 4. Trends in Pulses Production in India

Pulse Crops	Production (in million tonnes)						
	2010–2011	2011–2012	2012–2013	2013–2014	2014–2015	2015–2016	2016–2017*
Pigeon pea (Tur)	2.86	2.65	3.02	3.17	2.81	2.56	4.78
Chickpea (Gram)	8.22	7.70	8.83	9.53	7.33	7.06	9.33
Moong (Green gram)	1.80	1.63	1.19	1.61	1.50	1.59	2.16
Urad (Black gram)	1.76	1.77	1.90	1.70	1.96	1.95	2.80
Other pulses	3.60	3.33	3.35	3.24	3.54	3.19	3.88
Total pulses	18.24	17.09	18.34	19.25	17.15	16.35	22.95

Source: Directorate of Economics and Statistics, Government of India (various years).

Note: *Based on 4th Advance Estimates of Production.

The poor production of pulses in two consecutive years led to spiralling of prices of all the pulses. This led to several policy measures by the government such as increase in minimum support price (MSP), ensuring procurement of pulses at MSP, signing long-term agreements to import pulses from other countries and so on.

These positive signals and good monsoon in 2016–2017 led to almost 20 per cent increased area allocation to pulses (30.28 mha) in the year 2016–2017. Thereby, total pulses production in the year leapfrogged to about 23 mt up by 40 per cent compared to the previous year. According to the Ministry of Agriculture and Farmers Welfare (MoAFW), total area under pulses continues to be higher at 30.57 mha in the 2017–2018. Therefore, annual production of about 22–23 mt is likely to be sustained this year also, unless unseasonal rains or hailstorms damage the maturing crops.

According to a report of Department of Agricultural Co-operation, since 1991 till 2013, a number of improved varieties have been released by different research institutes/SAUs which includes 103 for chickpea, 49 for pigeon pea, 57 for green gram, 50 for black gram, 33 for lentil, 32 for field pea and 20–25 for rajma and horse gram each.[3] Thus, in the last 20 years, more than 550 improved varieties with all desirable features such as tolerance/resistance to different pests and diseases, of different maturity periods and for different regions have been released by public research institutions. But the farmers continue to cultivate old varieties as these are working well on the fields compared to the newly evolved/notified ones (Singh, 2014). Southern and western states were the major beneficiaries of technological changes in pulses. Many institutional and technological factors contributed to the expansion of pulses area into this region. The introduction of short duration and wilt-resistant varieties of chickpea such as JG-11 and later JG-14, a kabuli type KAK-2 with high market demand, revolutionised the pulses sector. Similarly, the stable yield received from the *maruti* variety of pigeon pea

was also widely accepted. The wider availability of highly subsidised cold storages and warehouses helped farmers overcome the lower market prices during harvest season (Reddy, Bantilan, & Mohan, 2013). However, over the years, the main drivers of agricultural growth have also been modern inputs and technology, institutions, and markets with the changing role of the public and private sectors, for example, spread of Bt cotton, assured procurement and farm mechanisation of rice and wheat from Punjab and Haryana, introduction of HYVs of chickpea and pigeon pea in SAT region and so on.

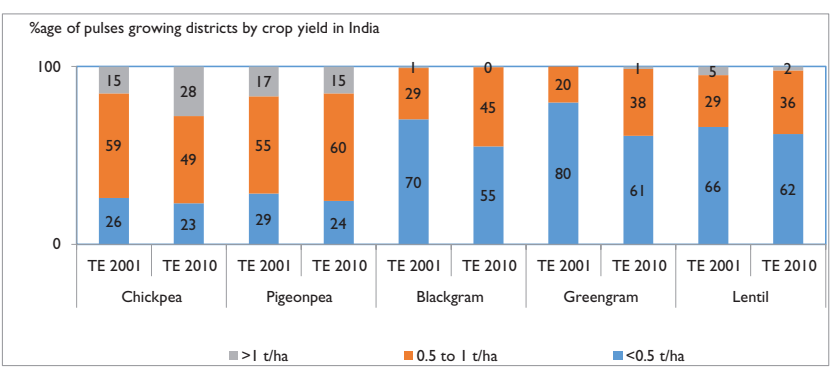
Crop Productivity and Profitability

In the last 10–15 years, there has been significant improvement in the yield of most pulse crops. However, very few proportion of pulses-growing districts are harvesting more than 1 t/ha of crop yield (Figure 4). In the case of chick pea, the situation is better, but still the existing crop yield with high uncertainty fails to trigger interests among farmers to allocate more area to these crops. Therefore, improving the crop productivity of pulse crops is the basic tenet of achieving self-sufficiency in pulses. There are four idioms of improvement in the pulses economy:

Area = f (profitability, risk);
Yield = f (improved variety, other inputs, package of practices)
Production = f (area, yield);
Profitability = f (yield, prices ^{X,Y})
x and y represent inputs and output, respectively.

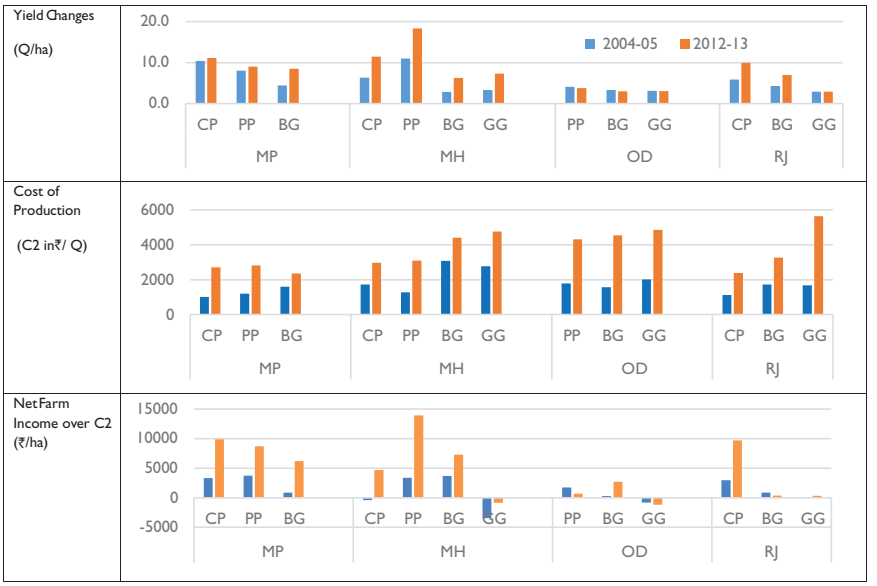
The main reason for stagnation in area under pulses has been poor availability of quality seeds and relative profitability vis-à-vis more remunerative crops. In other words, one of the prime reasons for the failure of the country's pulses production to keep pace with the rise in demand is the lack of adequate and consistent returns to the producers. The predominant smallholder farmers in India, being risk averse, shifted their cropping pattern away from risky pulse crops to less profitable but more stable profitable crops like cereals. Rising cost of labour further added their woes.

Figure 4. Spread of Pulses-growing Districts in India Across Varying Yield of Pulse Crops



Source: Authors' estimation.

Figure 5. Changes in Yield and Farm Profitability in Pulses in Four States



Source: Cost of Cultivation, Ministry of Agriculture, GoI.

Notes: CP—Chickpea, PP—pigeon pea, BG—black gram, GG—green gram, MP—Madhya Pradesh, MH—Maharashtra, OD—Odisha, RJ—Rajasthan.

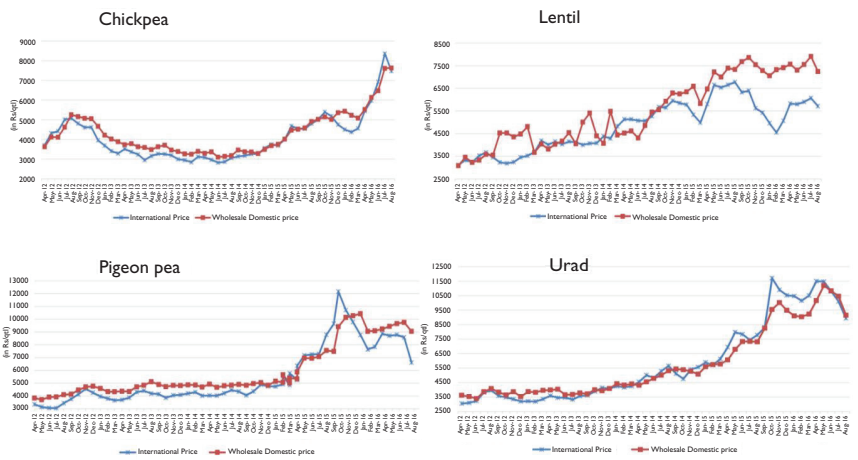
From 2004/2005 to 2012/2013, yield of all major pulse crops has improved in the states under study. However, the extent of change varied across these states (Figure 5). Among the selected four states, the improvement in yield has been significant in Maharashtra for all the four major pulse crops, that is, chickpea (CP), pigeon pea (PP), black gram (BG) and green gram (GG). However, it did not improve in Madhya Pradesh and Odisha, though in Rajasthan, yields of CP and BG have improved during this period. Moreover, the cost of production has jumped multiple times during the same period, mainly on the account of rising labour wages. It should be borne in mind that still many operations such as weeding and harvesting in pulses are done with manual labour. As a result, the net farm income from these pulses cultivation remained muted, except in Madhya Pradesh and Maharashtra states. In many cases, in fact, it remained negative, even when all the costs of cultivation (C2), that is, paid out cost + rent paid for leased− in land + interest on value of owned fixed capital + rental value of owned land + imputed value of family labour, were considered. Due to poor crop yield, crops are not profitable even now in Odisha and Rajasthan (except for chickpea). In Maharashtra and Madhya Pradesh particularly, pulse crops could provide good return in recent years.

Importance of Minimum Support Price for Pulses

The price spurt in pulses in 2015 and 2016 (as is evident from Figure 6) due to back-to-back monsoon failures and resultantly lower levels of production hit headlines across media outlets. The continuous price rise happened for all pulses, including moong and urad, which maintained the production level. There was a general perception that more than decline in production, some wholesalers and processors acted as cartels and hoarded huge quantities of all pulses in foresight of decline in production. On the other hand, growers of pulses felt betrayed due to crop failure and declining profitability from pulses. Responding to this situation, the government acted swiftly and banned export of pulses except kabuli chana and up to 10,000 metric tonnes in organic pulses and lentils. Imports of pulses were allowed at zero import duty. India imported around 5.80 mt of pulses in 2015–2016 from different countries. The MSP, including bonus, was substantially raised for all the pulses (kharif and rabi). The government also approved creation of buffer stock of 0.15 mt of pulses for effective market intervention.

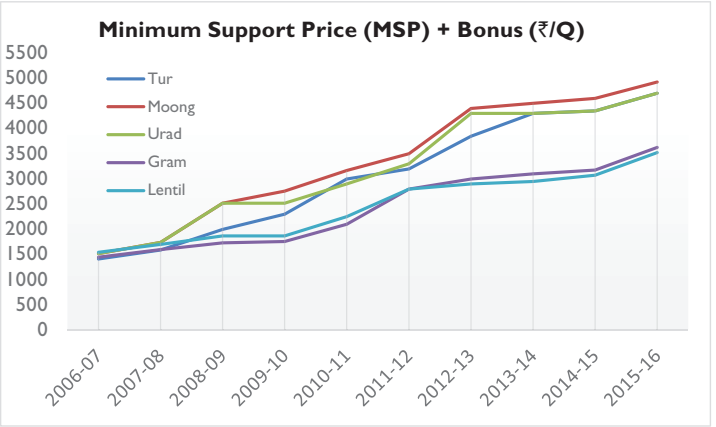
The government, as part of its output management policies, has been hiking the MSP of pulses regularly (Figure 7), but has not been able to intervene effectively due to lack of procurement operations in pulses. In the last 6 years, the government has continued to increase the MSP of kharif pulses by over 45 per cent, while it increased MSP for the rabi pulses by 50–60 per cent. Although there was no mechanism to support the prices, if the prices dipped below the MSP. 'Getting prices right' was a rallying call when developing countries started reorienting their economic policies in the early 1980s (Jensen, Robinson, & Tarp, 2010).

Figure 6. Domestic and International Prices of Major Pulses during 2012 to 2016



Sources: Department of Agriculture & Cooperation (DAC) and Agmarknet.

Figure 7. Effective Support Price for Pulses



Moong- ₹4,925
Urad- ₹4,700
Tur- ₹4,700
Gram- ₹3,625
Lentil- ₹3,525

Source: Department of Agriculture & Cooperation, Ministry of Agriculture.

Notes: Bonus of ₹200/q on tur, moong and urad, and ₹75/q on gram and lentil over and above MSP in 2015–2016.

Agricultural growth in India moved closely with agricultural prices relative to non-agricultural prices (Chand & Saxena, 2014). However, near-stagnating production with high year-to-year variability and ever-rising demand kept the market prices of all the pulses above MSP, thus making it irrelevant. In the past 10 years, MSP has increased by 10–15 per cent annually, but in the absence of any assured procurement, farmers face huge volatility in prices. The effective MSP, that is, including bonus price (per quintal) of pulses in recent years (2010/2011 versus 2017/2018) has almost doubled from ₹3,000 to ₹5,450 for tur, ₹2,100 to ₹4,400 for chickpea, ₹3,170 to ₹5,575 for moong, ₹2,900 to ₹5,400 for urad and ₹2,250 to ₹4,250 for lentil.

On the other hand, the almost oligopolistic market condition of split pulses in the hands of few market players concentrated on few locations aggravates the situation by adding to artificial scarcity. This reflects the inadequacy of policy implementation at different levels. Left to market forces alone, the major beneficiaries of the new high MSP will mostly be the larger farms, and farms that are well-connected to roads and markets.

Strategies for Achieving Self-sufficiency

Low genetic yield potential, high frequency of crop failure and yield instability due to biotic and abiotic stresses, and lack of institutional support (seed delivery system, guaranteed procurement, support price in congruence with yield

variability, risk mitigation, infrastructure for value addition near production) are major challenges in the pulses sector. Although the government has launched several schemes and programmes for promoting pulses production, besides continuously increasing the procurement prices of pulses, these initiatives have not been sufficient to trigger required interest among growers. Distress sales of produce immediately after the harvest at prices lower than MSP are quite common, particularly among smallholder growers who do not have easy access to regulated markets (due to geographical location or transportation problems). Dal mills and processing facilities should be encouraged within the vicinity of production areas, which will promote off-farm employment. Therefore, achieving self-sufficiency in pulses for India is now a compulsion and not a choice, keeping in view its rising demand and spiralling of domestic as well as international prices of pulses in case of crop failure in the country. For this, policy strategies need to be devised for short, medium and long terms, engaging different stakeholders.

Short-term Strategies

1. **Strengthening seed delivery system:** Strategic framework to improve seed replacement rate in pulses would play an important role in improving the productivity of pulses. Even though seed production in India has increased in recent years, there is a shortage of quality pulses seeds in the country as private companies are little interested in the production of seeds of pulse crops. ICRISAT and other NARS institutions should increase the quality seed production of different pulse crops by mobilising and skilling farmers. Availability of quality seeds of already-developed improved varieties would increase the pulses production by at least 15–20 per cent. Pigeon pea hybrids have been developed that offer huge potential for enhancing yield. Such commercial pigeon pea hybrids such as ICPH2671 and ICPH2740 are already available in the market. During the year 2016–2017, under the Ministry of Agriculture, Cooperation and Farmers Welfare and ICRISAT collaboration, pigeon pea hybrids were introduced in nine districts (100 ha each covering three districts each in three states of India); they are expected to provide 30 per cent to 40 per cent higher yield. Concerted efforts are needed by both government agencies and research organisations for the production of hybrid pigeon pea seeds and promotion of its cultivation in a phased manner across states growing pulses. Seed plans should be developed for each state, and nucleus/breeder seed of these varieties should be produced. In addition to public seed corporations, seed societies and private companies should be involved in seed production. Since seed storage for the next season is difficult in humid areas, good storage facilities similar to cold storage facilities available for potatoes in India may be explored.
2. **Ensuring remunerative prices:** Even the latest move to raise the MSPs of all the crops by a hefty margin and offering a bonus on top may fall flat, unless assured arrangements can be put in place to ensure that the farmers actually get these prices. The MSP for pulses should be fixed considering

not only the cost of its cultivation and parity with the competing crops, but also considering the yield variability in pulses and externalities it brings to the system in terms of nitrogen saving and subsidy saved on fertiliser and irrigation (Subramanian, 2016).

3. **Effective procurement:** The procurement of pulses after harvest needs to be strengthened immediately. Most of the pulse growers are currently unable to reach to regulated markets to sell their produce; instead, village traders are their main buyers. Therefore, to ensure the remunerative prices for these growers, it is very important to bring the procurement centres at the doorstep of the growers, particularly during harvest season. Standardisation of prices and procurement by using mobile vans or regulating the village traders to make public all the information related to the transactions may reduce the ambiguities and exploitation of the smallholders. In the medium term, it can be facilitated by forming farmer producer organisation (FPO) and linking it with National Agricultural Market though e-platforms.
4. **Skilling of pulse growers:** India has very strong network of 600+ *Krishi Vigyan Kendras* (KVKs) spread across all the districts, besides other extension agencies. Skilling pulse growers on modern production practices—from sowing to harvesting—by these agencies can be very useful in reducing production losses. Through different information and communication tools, crop production and protection technologies, improved varieties, risk mitigation (crop insurance) techniques and so on can be brought to the farmers' doorstep. The KVKs in potential pulses-growing districts may select few progressive farmers from each *taluka/ mandal*, who in turn can act as master trainers for other pulse growers.
5. **Efficient crop insurance mechanism:** Even after more than three decades of implementation of crop insurance schemes in India, only 20 per cent of farmers subscribe crop insurance. Although there is no information available about the pulse growers, it is essential to bring maximum number of pulse growers under insurance cover. This would give sufficient confidence to these farmers to combat the situation of crop failure. In January 2016, the new crop insurance scheme was launched by the Prime Minister of India; it aims to provide a more efficient insurance support to the farmers. Under this, the premium rate will be 2 per cent of the actual sum assured amount for kharif season crops and 1.5 per cent for the rabi crops. However, implementation of the scheme is a major challenge as technology for estimation of crop losses at individual farm levels is not in practice. Without that, even genuine farmers are unable to get compensation for crop losses.

Medium-term Strategies

1. **Expansion of area under pulses:** Fallow lands or reclaimed waste lands can be identified and targeted in each state to bring it under pulse crops. Bringing additional area under pulses in rice fallows of eastern India is another

potential area. Focus on both *kharif* (pigeon pea) and *rabi* (chickpea) pulses targeting low productive and high potential region would offer huge potential in jacking up the production of these crops. Several studies have shown that there is large tract of about 6–8 million hectares, which are rice fallow. Even if 10 per cent of this area is targeted every year, within 5 years, we may have an additional 1 million hectares of land under pulses.

2. **Farmers producer organisation (FPO) on pulses:** This can be a game changer in the pulses sector. Through this, the pulses value chain can be easily shortened; it can also add a lot of value in the hand of pulse growers. Identifying the pulses-growing clusters and bringing on a single platform to integrate with the backward and forward linkages will help the farmers in reducing the cost of production substantially. This will also help in capturing additional value by undertaking processing of pulse grains and delivering the product directly to the urban consumers through organised retailers. The shortening of value chain will help the consumers in accessing the produce at reasonable price, even if the support price of pulses is increased substantially. The by-products of processed pulses are also nutritious feed for livestock, which can also be additional benefits for the farmers, if the processing mills are set up near these farmers.
3. **Customisation and development of farm equipment:** Collaborative approach to develop small size multi-crop harvesting farm machines and other farm equipment for plant protection can be of great help for the producers in reducing labour cost. New age app-based custom hiring services for farm equipment can be quite useful particularly for smallholders in doing the basic farm operations timely and economically. Private tractor company, like Mahindra and Mahindra, has started on pilot basis 'on-demand farm equipment' rental start-up, *Trringo* in Karnataka state, through which farmers can book tractors by the hour via a phone call (Peermohamed, 2016). Such innovation in farm equipment services has a lot of potential in revolutionising the pulses production.
4. **Setting up of storage and warehousing in rural areas:** Developing the multipurpose storage and warehousing structures in the rural areas is essentially required to realise better prices by the farmers by timing the market for selling of the produce. This should also be seamlessly integrated with the financing provisions on collateral basis, so that the farmers who wish to sell the produce, when the price is right, can meet the financial obligations. Moreover, if FPOs are established, then setting up of such ecosystem becomes far easier to bring logistics, finance and insurance near to the producers.
5. **Foresight for international trade:** The government should also develop a predictive tool to determine the demand and supply of pulses in forthcoming seasons to plan in advance to import or export of pulses in international market. The current practice of approaching the international market after sufficient information of domestic deficit provides ample opportunity to the exporter to raise the price of pulses. Opposite to it, having long-term contract for importing pulses also harms the domestic market in case of good harvest.

Long-term Strategies

1. **Developing short duration and pest- and disease-resistant cultivars:** Infestation of pests and diseases such as podborer, wilt and so on and variation in rainfall and temperature bring huge risks to pulses cultivation. There are large tracts of pulses in India, where the crop variability is very high due to these biotic and abiotic stresses. Development of suitable cultivars specific to production regions will be very important to break the yield barrier, as has happened in southern region, particularly in case of chick pea. Several research institutes under NARS and ICRISAT are working on this line. Moreover, liberal research funding towards R&D on pulses needs to be allocated, as compared to other cereal crops.
2. **Integrating pulses into public distribution system:** Keeping in view the widespread under- and malnutrition among women and children in India, to achieve the target of zero hunger and good health and well-being prescribed in sustainable development goals (SDG), it is necessary to provide pulses to all the poor households at affordable price. Although this would further increase the demand of pulses, it can be managed if sufficient steps for enhancing the domestic production are already taken. Therefore, compulsory inclusion of pulses in the existing schemes such as mid-day meal scheme or public distribution system (PDS) shall be ensured, so that the minimum pulses consumption by poor households are maintained even during the scarcity in pulses production.

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Notes

1. Several pulse crops are grown in India, which include chickpea or Bengal gram, pigeon pea or red gram, lentil, urd or black gram, mung bean or green gram, matki or moth bean, horse gram or kulthi, pea, grass pea or khesari, cowpea, lablab bean and broad bean or faba bean. Some of them such as cowpea, lablab, broad bean and pea are mostly used for vegetable purposes, while most commonly used pulses are chickpea, pigeon pea, mung bean, urd bean and lentil.
2. Stunting is a measure of chronic undernutrition; wasting indicates acute undernutrition; and underweight is a composite of these two conditions. According to India Nutrition Report (2014), India's undernutrition problem is a serious threat to child development.
3. See http://dpd.dacnet.nic.in/VARIETIES-Web%20site.pdf

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