POLICY BRIEF 53

Technology and Policy Options for Sustaining Pulses Revolution

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INDIA although is the largest producer of pulses but their production has always fallen short of domestic demand, compelling their imports, and many a times in huge quantities. In the past two decades, pulses imports increased significantly. During 2016-18, an average 6 million tons of pulses, equivalent to 22% of the demand, were imported.

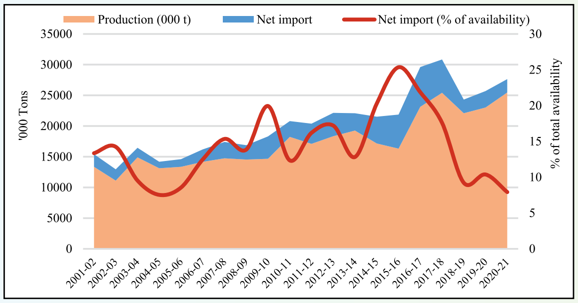
Chickpea, pigeon pea, lentil, green gram, and black gram are the main pulses produced and consumed in India; and therefore these also comprise bulk of the imports. Their imports, however, are concentrated on a few countries. Approximately 90% of the pigeon pea imports are sourced from Mozambique, Tanzania and Myanmar; 80% of the chickpea imports from Tanzania, Sudan and Russia; and 90% of the lentil imports from Canada and Australia.

Until 2015-16, India's pulses production grew slowly, mainly because of a lack of comparative advantage vis-a-vis their competing crops. Crops' relative yields and prices are the main factors determining their competitiveness. In case of pulses, neither their yields nor prices saw any significant increase until 2015-16. For instance, between 2000-01 and 2015-16, the yield of chickpea and pigeon pea, which together account for two-third of the total pulses production, increased at an annual rate of 1.42 and 0.68%, respectively. Likewise, their respective minimum support prices (at 2011-12 prices) increased by 2.4 and 4.7% per annum. Further, pulses are generally grown in marginal environments characterized by low and erratic rainfall and poor soils; hence are highly prone to production risks.

Until recently, pulses production did not respond much to prices[1], possibly because of the greater emphasis of agricultural price policy on rice and wheat. Nevertheless, recognizing the contribution of prices and technologies in increasing the production of rice and wheat, the Government of India in 2016-17 adopted a similar approach for pulses. Minimum support prices (MSP) of different pulses were raised from 8 to 16% in 2016-17, and since then the production of pulses has remained upwardly mobile (Figure 1). The significant change in MSP of pulses during 2008-09 to 2012-13 (Figure 2) could not translate into higher production due to non-availability of quality seed and procurement. To ensure the supply of seeds of high-yielding, climate-, and pest-resilient varieties, seed production hubs were established. Alongside, the central government started procuring pulses at their MSP in order to incentivize farmers to produce more of these and for maintaining their stocks for price stabilization. This change in policy stance provided an unprecedented push to pulses production – a 42% increase in 2016-17 over 2015-16. This reduced the dependence on imports, from an average of 6 million tons during 2015-16 to 2017-18 to 2.6 million tons during 2018-19 to 2020-21.

However, the area and production of pulses have been hovering around 29 million hectares and 24 million tons, respectively since 2016-17. On the other hand, by 2033-34, demand for pulses is projected to increase to at least 38 million tons[2]. Thus, the possibility of the demand outstripping production cannot be discounted in the times to come. The question is: How to sustain the recent trends in pulses production? In this brief, we explore technological and policy options for sustaining pulses production and reducing imports.

Figure 1. Domestic production, net import and availability of pulses



Source: Authors' compilation using data from Directorate of Economics and Statistics, MoA&FW, Govt. of India and Ministry of Commerce, Govt. of India.

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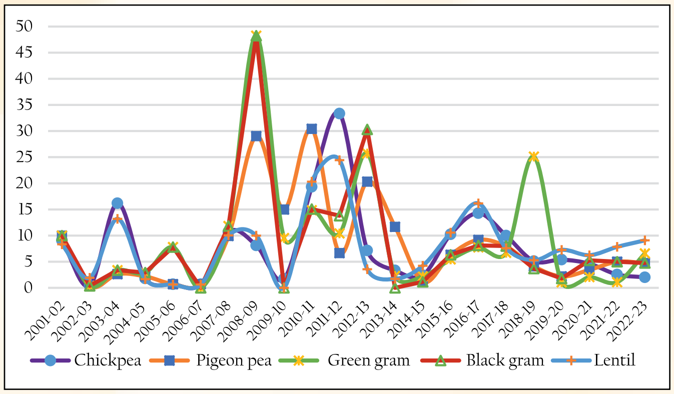
[1] Tuteja, U. (2006). Growth performance and acreage response of pulse crops: a state-level analysis. *Indian Journal of Agricultural Economics*, 61(2): 218-237.

[2] NITI Aayog. (2018). *Demand and supply projections towards 2033: crops, livestock, fisheries and agricultural inputs*. Working Group Report, Niti Aayog, Government of India.

Figure 2. Change in minimum support prices of pulses (%,y-o-y)



Source: Authors' compilation using data from Commission for Agricultural Costs and Prices, MoA&FW, Govt. of India.

Technological change

Growth in pulses production can occur from (i) area expansion bringing fallow lands under cultivation or replacing less remunerative crops, and (ii) sustained improvements in yields. The scope for area expansion is limited. Acreage allocation is guided by crops' comparative advantage, i.e., their relative yields and prices. Price increase can incentivize production in the short-run, but cannot provide a long-term solution. The recourse, therefore, has to be with technological change.

Total factor productivity (TFP), an indicator of technical progress, has grown slowly in case of pulses than in staple food crops. Since 2000-01, TFP growth in pulses has been estimated in the range of 1.2 to 1.4% (Table 1).

Table 1. TFP change in major pulses in India (%)

Crops	2000-01 to 2009-10	2010-11 to 2019-20
Chickpea	1.28	1.35
Pigeon pea	1.24	1.35
Green gram	1.32	1.35
Black gram	1.30	1.34
Lentil	1.29	1.36

Source: Calculated by authors using data from Commission for Agricultural Costs and Prices, MoA&FW, Govt. of India.

Trade policy

India's pulses trade policy is anchored to providing affordable access of pulses to consumers, and protecting farmers from cheap imports. India has been chronically deficit in pulses, and most of the times import tariff on pulses has been kept low.[3] However, after a significant jump in their production in 2016-17, pulses imports were restricted and tariffs were raised. Restrictions on their exports were also withdrawn in November 2017. From 2016-17 onwards, import tariffs on pulses are given in Table 2.

Table 2. Pulses import policy

Year	Pulses trade policy changes
2006-2017	No import duty (June 2006 to February 2017)
2016-17	10% import duty on lentils and pigeon pea in March 2017
2017-18	August 2017: 200,000 tons import quota for pigeon pea, 300,000 tons for black gram and green gram (150,000 tons each) November 2017: import duty on peas increased to 50% December 2017: import duty on lentils and chickpea increased to 30% February 2018: import duty on chickpea further increased to 40% March 2018: import duty on desi chickpea increased to 60%, 40% on Kabuli chickpea
2018-19	Quota restriction (QR) on: Black gram and green gram: 150,000 tons each Pigeon pea: 200,000 tons Peas: 100,000 tons June 2018: Import duty on Kabuli and desi chickpea increased to 60%, and on lentil to 30%
2019-20	QR on peas: 150,000 tons QR on black gram and green gram: 150,000 tons each, increased to 400,000 tons on black gram in December 2019 QR on pigeon pea: 200,000 tons, and increased to 400,000 tons in July 2019 June 2019: Basic import duty on lentils increased to 50%.
2020-21	QR on peas and green gram: 150,000 tons each QR on pigeon pea and black gram: 400,000 tons each June 2020: Basic import duty on lentils reduced to 10% (June to August 2020) February 2021: imposed-AIDC: chickpea 50%, bengal gram 30%, kabuli Chana 50%, Yellow peas 40%, lentils 20%.
2021-22	QR on green gram: 150,000 tons QR on pigeon pea: 400,000 tons QR on black gram: 400,000 tons Import policy: QR removed on green gram, black gram and pigeon pea) upto 31.10.2021, but import duty remained July 2021: Basic import duty on lentils reduced to zero, AIDC lowered from 20% to 10%, Social Welfare surcharge of 10% remained unchanged
2022-23	March 2022: No QR on black gram and pigeon pea upto 31.03.2023, subject to existing import duties, and further extended upto 31.03.2024.

Note: AIDC: Agriculture Infrastructure Development Cess; Quantitative restrictions do not apply to Governments' import commitments under any Bilateral or Regional Agreement or Memorandum of Understanding.

Source: Updated by authors using data from DGFT, Ministry of Commerce, GOI from Roy et al. (2022).

Impact of technology versus import tariff

Impacts of changes in TFP and import tariffs on pulses production, farm income, and trade were assessed in the framework of the standard Computable General Equilibrium (CGE) model[4], calibrated by the International Food Policy Research Institute's (IFPRI) to India's Social Accounting Matrix (SAM) 2017-18.[5] This model assumes consumer prices to

[3] Roy, D., Boss, R., Pradhan, M. & Ajmani, M. (2022). *India's pulses policy landscape and its implications for trade*. IFPRI Discussion Paper 02113, South Asia Regional Office, International Food Policy Research Institute, New Delhi.

[4] Lofgren, H., Harris, R. L., & Robinson, S. (2002). *A standard computable general equilibrium (CGE) model in GAMS*. International Food Policy Research Institute, Washington DC, USA.

[5] Pal, B. D., Pradesha, A., & Thurlow, J. (2020). *2017/18 Social Accounting Matrix for India*. International Food Policy Research Institute, Washington DC, USA.

remain constant, investment to drive savings, and government savings and foreign exchange to be flexible. Following scenarios of TFP growth and import tariffs have been developed to assess their impacts (Table 3).

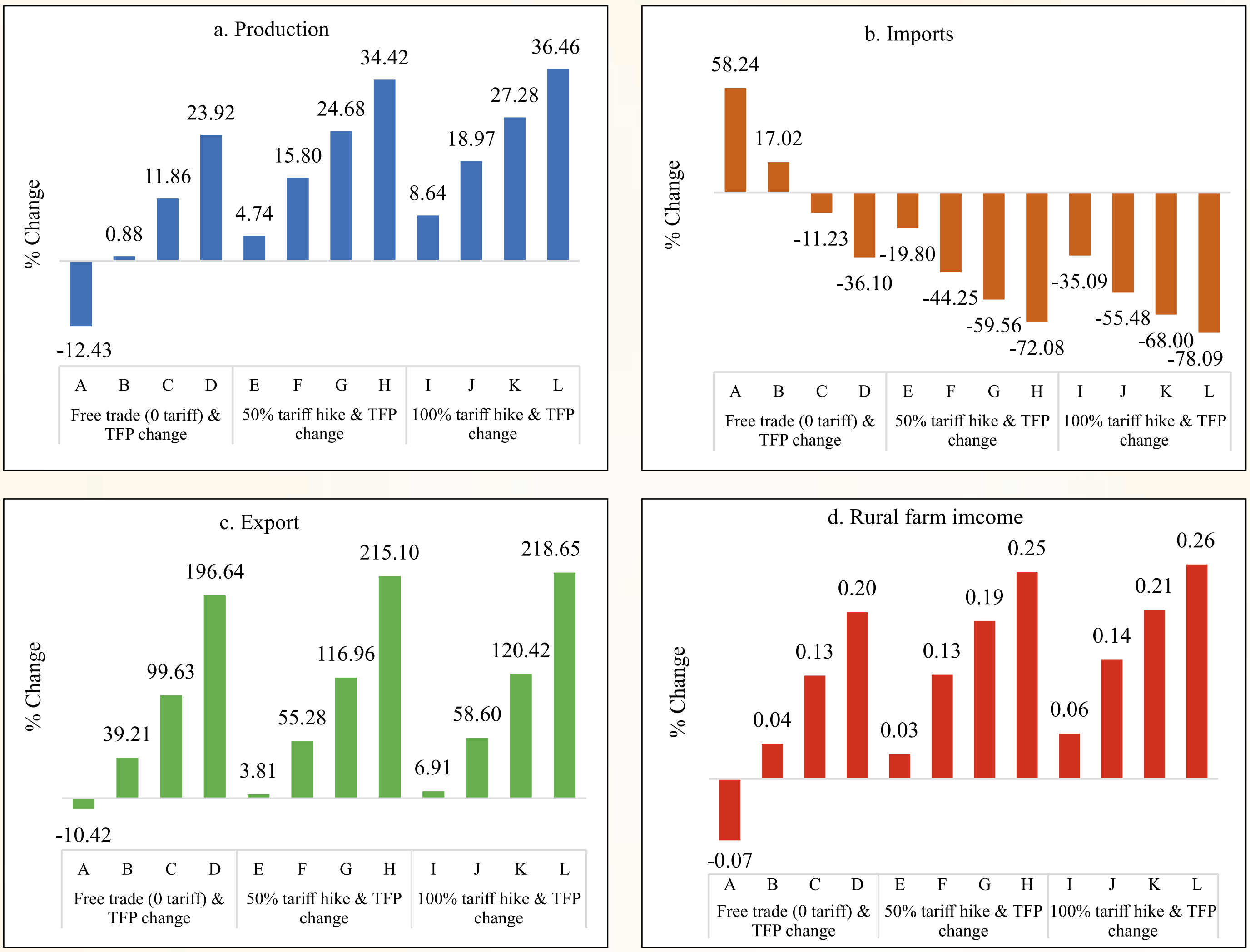
Table 3. Assumed TFP growth and import tariff over next 15 years

Scenarios		TFP change (%)[6]			
		No change	15% (1%/yr)	30% (2%/yr)	50% (3.3%/yr)
Tariff change (% over 2017-18)	0% tariff	A	B	C	D
	50%	E	F	G	H
	100%	I	J	K	L

- Scenario A assumes free trade and no technical progress. Scenarios B, C and D, respectively, assume annual TFP growth of 1, 2, and 3.3% in a free trade regime over the next 15 years.
- Scenario E assumes no technical progress and a 50% hike in import tariff over the next 15 years; and scenarios F, G and H are built up on TFP growth of 1, 2 and 3.3%, respectively with tariff remaining unchanged.
- Scenario I assumes no technical progress and a hike of 100% in import tariff. In scenarios J, K and L, tariff hike remains at 100% and TFP grows at an annual rate of 1, 2 and 3.3% respectively over the next 15 years.

The estimated impacts of changes in TFP and import tariff are shown in Figure 3. In a free trade regime, with no TFP growth, pulses production falls by over 12%, leading to a surge in imports to the extent of 58%. However, if TFP grows at an accelerated rate, production increases and imports decline. A one-percent annual growth in TFP results in a marginal increase in production (<1%) but a 17% increase in imports, substantially less had there been no technical progress. However, if TFP were to grow at an annual rate of 3.3%, production increases by 24% and imports decline by 36%.

Figure 3. Impact of technology and import tariffs



Source: Authors estimate using IFPRI's standard CGE model

[6] TFP shock applied to the constant shift parameter of constant elasticity of substitution (CES) production function. The shift parameter of CES production function is estimated through calibration (see details in Lofgren et al., 2002) for India SAM 2017-18.

If technical progress is accompanied by a hike in import tariff, pulse production increases, and imports fall significantly. For instance, a 50% hike in import tariff accompanied by a 2% growth in TFP, causes a 25% increase in production, and 60% decline in imports. If TFP continues to grow at an accelerated rate, a further hike in import tariff does not yield much additional gains. It means that gains from hike in import tariff beyond a limit may remain muted in the absence of a technological breakthrough in production.

At present, India has an insignificant presence in the export market for pulses due to the ubiquitous constraint of high domestic demand. Nevertheless, pulses exports are likely to increase in case there is a technological breakthrough in their production. For instance, with a TFP growth of 2%, pulses exports almost double over their existing level even in free trade regime. Raising import tariffs, however, does not lead to significant gains in exports.

In free trade regime, producer prices are not much affected even if there is technical progress in production. However, producer prices fall when import tariff is raised simultaneously. Putting it differently, the imposition of tariffs benefits consumers and not the producers. Technical progress leads to an increase in rural farm income, and the benefits are enhanced if the import tariff is raised simultaneously.

Finally, technical progress in pulses production positively impacts gross domestic product (in real terms). Its gains are more pronounced in free trade regime. Higher import tariffs in the absence of technical progress reduce gross domestic product.

Policy Implications

Tariff can be an instrument to regulate imports, but it cannot cause any significant increase in production. The recourse, therefore, has to be with technological change, which has considerable potential to enhance pulses production, and reduce imports. Technical progress can lead to a reduction in producer prices, but farmers benefit from enhanced yields.

The strategy for accelerating pulses production should be built around bridging the yield gap and effecting a technological breakthrough. There exist huge yield gaps in pulses. The realized yield of different pulses is 10 to 37% less than what can be attained on farmers' fields with the adoption of appropriate production practices. One of the reasons for the high yield gap is the repeated use of seeds or the low seed replacement rate[7,8]. Recent experience has shown that farmers' access to good quality seeds can significantly enhance pulses production. Besides improving the supply of quality seeds, alleviating farmers' financial and market constraints can significantly bridge the yield gaps. Reducing the yield gap by 25% can enhance pulses production by 1.4 million tons[9].

Pulses have low water-footprint, but are vulnerable to terminal drought and heat-stress. Irrigation can help improve yields and reduce the impact of drought and heat-stress. However, only 23% of the total pulses area receives irrigation.

Prices incentivize production. Hence, there is a need for a crop-neutral price policy which can aid optimization of cropping pattern while taking cognizance of demand and supply of different commodities, and the positive and negative externalities associated with their production. Price-led growth, however, may not sustain in the long-run because of its potential to fuel inflation.

In the long-run, increase in pulses production shall have to come from a technological breakthrough. Spending on pulses research however remains low, with approximately 0.5% of the total spending on agricultural research and development. Enhancing spending on pulses research is beneficial for human nutrition and health of natural resources.

[7] Ali, M. & Gupta, S. (2012). Carrying capacity of Indian agriculture: Pulses crops. *Current Science*, 102: 874-881.
[8] Balaji, S.J., Kishore, P., Saxena, R., Singh, N.P. & Franco, D. (2017). Technology-Policy tradeoff in doubling farmers' income: A case study of pulses. *Agricultural Economics Research Review*, 30(Conf.): 117-126.
[9] GoI. (2022). *Price policy for Kharif crops: marketing season 2022-23, and Price policy for Rabi crops: marketing season 2023-24*, Commission for Agricultural Costs and Prices, MoA&FW, Government of India.

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