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Demand: Supply gap in pulses in India: An analysis

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Abstract
The major pulse crops grown in India are gram, tur, moong and urd. They are widely grown in Madhya Pradesh followed by Rajasthan, Maharashtra, Karnataka and Uttar Pradesh. Though India is the largest producer (25 per cent of global production) of pulses, it imports around 10.6 per cent of its pulses. A study was conducted to find the growth in area, production and productivity of pulses over the last 20 years and to analyze the demand- supply gap of pulses in India. The demand for pulses was found to increase substantially over the years and its domestic supply had also increased thus making India self-sufficiency in pulses. Government subsidy and pulse supply under the system of public distribution and increase in minimum support price by government has led to an increase in the production and consumption of the pulses in our country. Consequently there is decrease in demand supply gap in pulses during the recent years and there is decline in import of pulses.

Keywords: Demand, pulses, import, supply, consumption

Introduction
India is the largest producer and consumer of pulses in the world, accounting for 25 per cent of total production and around 30 per cent of total world consumption. In 2018-19, India accounts for 29.4 mha of pulses, 23.4 MT of pulses production, 835 kg / ha productivity, 2.53 MT of imported pulses, 0.28 MT of export pulses (GOI, 2019) [5, 6, 7]. The main pulses produced and consumed in India are gram, tur, moong and urd. Gram (chickpeas) is the most dominant pulse with an average share of about 46 per cent over the past five years in total pulse production.
Global pulse production in 2017-18 was around 82.2 MT and productivity was 922 kg/ha. India is the largest pulse producing country with the share of about 6 per cent. In 2018, India was the major importing (14 per cent) country of pulses in world where as Canada was the major exporting country. (APEDA, 2018)

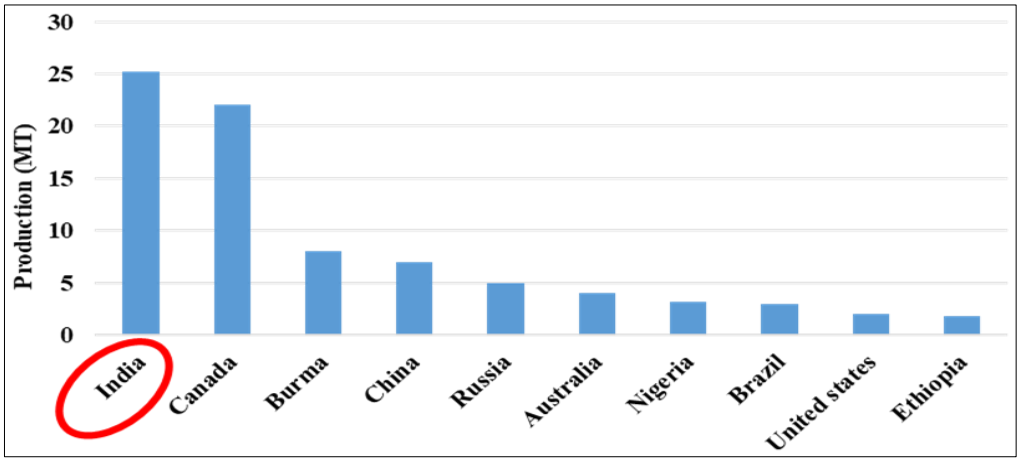


Fig 1: Top 10 pulse producing countries in World (2017-18)

In India, twelve states were the major producers contributing > 90 per cent pulses. These were Madhya Pradesh (> 8 MT), Rajasthan (>3 MT), Maharashtra (>3 MT) Uttar Pradesh (>2 MT) Karnataka (2 MT) and Andhra Pradesh (>1 MT) followed by Gujarat, Jharkhand, Tamil Nadu, and Chhattisgarh producing <1.0 MT each. Thus, production of pulses is concentrated in a few states, and similarly few states dominated the production pattern of individual pulse crops (Srivastava *et al.*, 2010) [17].

Gram, Tur, Moong, Urd and lentil are the major pulses produced and consumed in India. Gram (chickpeas) is the most dominant pulse with an average share of about 46 per cent in the total pulse production over the past five years. Gram recorded a highest ever production of 11.23 MT at a record productivity level of 1063 kg/ha in an area of 10.56 mha. Tur (Arhar) remained at second position in total pulse production with 4.25 MT of production in an area of 4.43 mha at a productivity level of 960 kg/ha. Urad (Blackgram), the third important crop group, was cultivated over an area of 5.44 mha (kharif + rabi) and recorded a production of 3.56 MT at a productivity level of 655 kg/ha. Similarly, Moong (Green gram) was sown over an area of 4.26 mha in (kharif + rabi) and recorded a production of 2.01 MT at and yield level of 472 kg/ha. Lentil also recorded an ever highest production of 1.61 MT from area of 1.55 mha at a productivity level of 1034 kg/ha, the ever highest yield level.

Even as the largest producer of pulses, the persistent and increasing demand-supply gap has been a problem that has led to higher prices leading to this good source of vegetarian protein that is inaccessible to the poor. The demand-supply gap is expected to increase further if there is no rise in the pulse production level in India. The per capita availability of pulses declined steadily on account of sluggish growth in the production of pulses. Dependence on imports is increasing to meet the country's growing demand for pulses. The government has procured nearly six million tons of pulses from farmers over the past three to four years, and has also raised the minimum support price for pulses, which has basically led to the success of the Pulse Mission. With recent enhancement in production of pulses in the country, imports have been decreasing in recent past. As a result, considerable amount of self-sufficiency has been achieved in the area of major pulses. Imports are decreasing gradually. There is definite increase in awareness about the need to consume pulses in the country. Government subsidy and pulse supply under the system of public distribution resulted in a half-rate distribution of one million tons of pulses among the poor and the poorest in India. This has led to an increase in the production and consumption of the pulses in our country as a consequence of a decrease in demand supply gap in recent years.

Objectives of Study

The major objectives of this study were

1. To analyze the growth rate of area, production and productivity of pulses in India
2. To analyze the demand - supply gap of pulses in recent years.

Methodology

The study is based on secondary data. Data on area, production and productivity of pulses in India were collected from the website of India Agristat. Data on Domestic Production and import of pulses were collected from the India Agristat. The present study had assessed the growth performance of pulses on regular intervals related to two decades from 1998 to 2018. Compound annual growth rate (CAGR) was used to study the growth rate of area, production and productivity of major pulses cultivated in India.

CAGR was calculated using the following formula:

Before calculating the growth rate, the exponential function of area, production and yield has to be estimated

i.e. $Y_t = ab_tu_t$

Where

Y_t = Area or production or yield of pulses in year t

a= Intercept

b= Regression coefficient

t = Year which takes value 1, 2, 3, …, n

u_t= Error term

Logarithmic transformation was applied to the above exponential function and hence, the estimating equation was

$\log Y_t = \log a + t \log b + \log u_t$

The equation was estimated by ordinary least square technique (OLS). Compound growth rate (g) was then estimated by g^ = (b^-1) 100

Where, g^ = Estimated compound growth rate in per cent per year and

b^ = Anti log of b

Results and Discussion

Growth rate in area, production and productivity of pulses

All the major pulse crops were showing an upsurge in Compound Annual Growth Rate (CAGR) over the last 20 years (1998-2018), bengal gram (Area- 2.5 per cent, Production- 3.8 per cent Productivity- 1.3 per cent), red gram (Area – 1.5 per cent, Production- 2.3 per cent Productivity- 1.04 per cent), green gram (Area – 0.17 per cent, Production- 3.52 per cent, Productivity- 1.96 per cent) and black gram (Area – 1.78 per cent, Production- 2.26 per cent, Productivity- 2.14 per cent) (India Agristat, 2018).

CAGR of Area, production and productivity of pulses over the period 1998 to 2018 are presented in table 1. In case of area and production, bengal gram showed an increasing trend. Productivity of selected pulses exhibited more variation over the years compared to area and production.

Table 1: CAGR of area, production and productivity of major pulses (1998-2018)

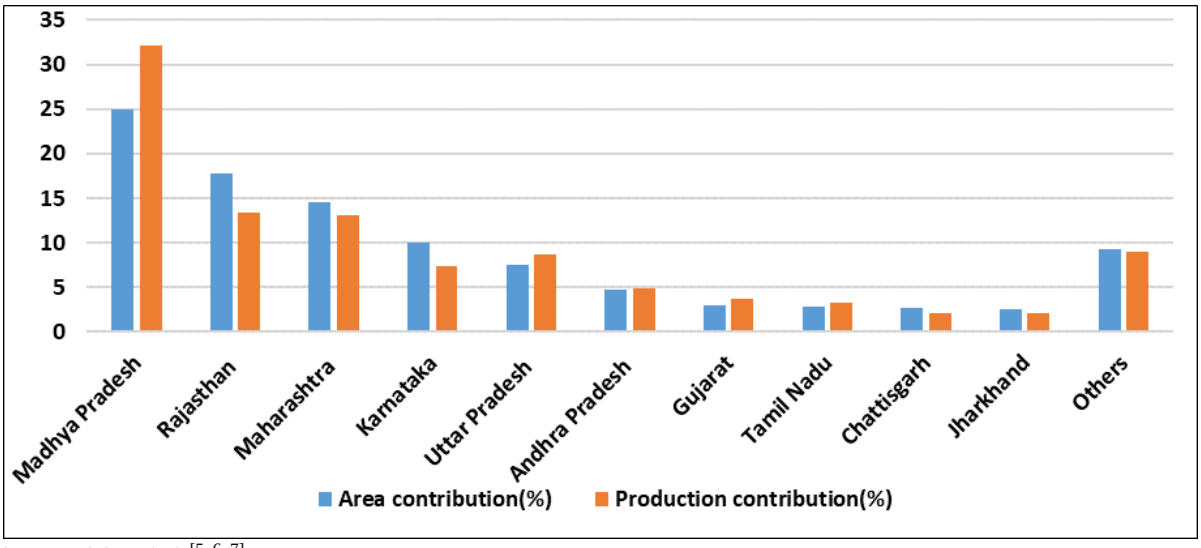
Crops	Compound Annual Growth Rate (CAGR)		
	Area	Production	Productivity
Bengal gram	2.5	3.8	1.3
Black gram	1.78	2.26	2.14
Red gram	1.5	2.3	1.04
Green gram	0.17	3.52	1.96

***Source*:** India Agristat, 2018

The growth rates of area was found to be high in case of Bengal gram (2.5 per cent), Black gram (1.78 per cent) Red gram (1.5 per cent) and it was low in case of Green gram (0.17 per cent).The CAGR of production was found to be high in the case of Bengal gram (3.8 per cent), Green gram (3.52 per cent), Red gram (2.3 per cent) whereas it was low in case of Black gram (2.26 per cent). The growth rate of productivity was high for black gram (2.14 per cent).

State-wise area, production and productivity of total pulses (2017-18)

In India, area (24.94 per cent) and production contribution (32.14 per cent) was highest for Madhya Pradesh followed by Rajasthan, Maharashtra, Karnataka and Uttar Pradesh.

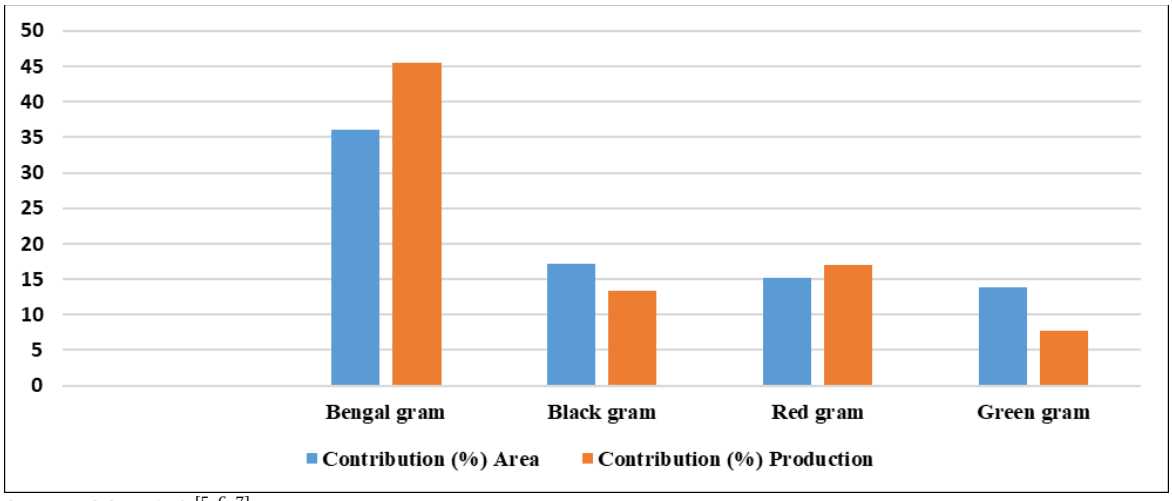


***Source*:** GOI, 2019 [5, 6, 7].

Fig 2: State- wise area and production of total pulses (2017-18)

Crop wise share of area, production and productivity of major pulses (2017-18)

Among the major pulse crops, Bengal gram has the largest area and production of 105.73 lakh ha and 111.58 lakh tonnes respectively followed by Black gram, Red gram and Green gram.



***Source*:** GOI, 2019 [5, 6, 7].

Fig 3: Crop wise share of area and production of major pulses (2017-18)

Analysis of demand- supply gap for pulses in India

With the increase in population, consumer awareness and affordability of middle /lower middle and other category citizens up to some degree, the demand of pulses has also increased overtime. The total domestic demand for pulses had increased substantially over the years and touched 23.56 MT meeting the supply of 23.4 MT in 2018-19 and it is likely to increase further with rise in income and population. The country witnessed near self-sufficiency in pulses. The year 2014-15 and 2015-16 were adverse crop years owing to drought and erratic behavior of rainfall across the major pulse growing states. However, by rising imports between 2014-15 and 2016-17 at around 5-6 MT per year in its buffer stock, the government ensured availability / supply as per demand, on the one hand, and on the other hand to counter natural disasters through development programmes, risk management through Pradhan Mantri Fasal Bhima Yojana (PMFBY), Price Support Scheme (PSS) and Price Stabilization Fund (PSF) procurement, etc. and also built confidence in the farmers to grow more pulses. So, production of pulses increased meeting the demand thus reducing the imports. The growth in the supply of pulses has been able to keep pace with the growth in demand and the gap between supply and demand is decreasing over years and there is decline in import of pulses.

During 2007-19, it was found that the import to demand ratio was found to be maximum in 2016-17 (29.02 per cent) and minimum in 2012-13 (7.3 per cent). Per capita availability enhanced during 2018-19.i.e., 20.2 Kg per head/year. In conformity to the objective of Food Safety Authority (FSA) - 2013 to ensure nutritional security, the per capita availability of pulses has increased from a low level of 15-16 kg/annum/person in 1991 to 20.2 Kg per head/year in 2019. Recommended rate of consumption of pulses in 2018-19 is 29.2 kg/person/year as per WHO.

Narayanmoorthy (2000) [11] projected that the total demand of pulses will be at 27.45 MT in the year 2030. The Indian Institute of Pulses Research, Kanpur, has projected the country's demand of pulses at 39 MT by 2050, which will require pulses production to grow at an annual rate of 2.2 per cent (IIPR, 2015) [8]. To fulfil the growing requirement, the country has to produce enough pulses as well as remain competitive to protect the domestic production.

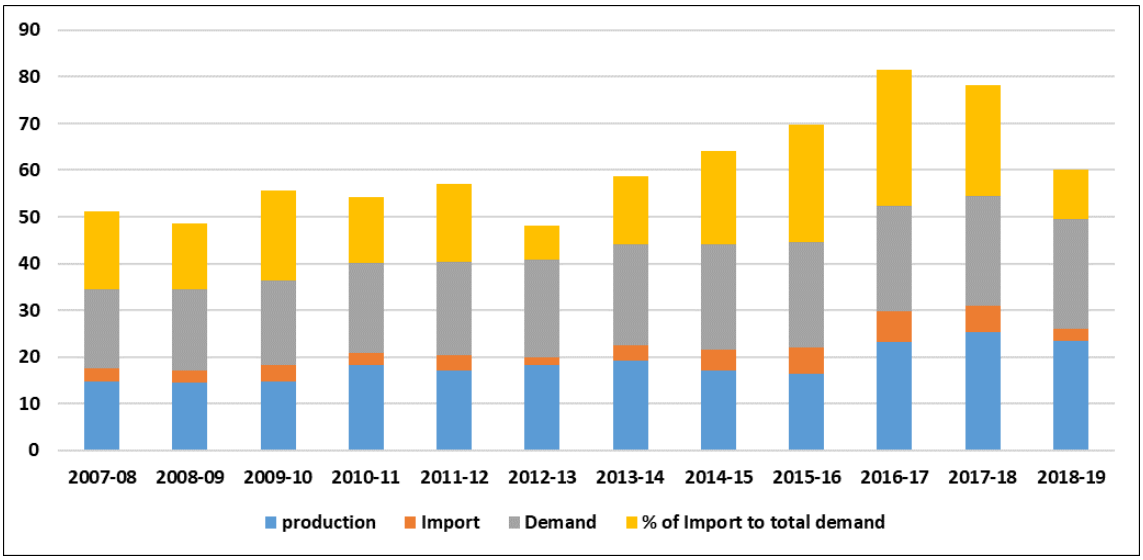


Fig 4: Demand and supply gap for pulses in India during 2007-19 (Quantity in MT)

Import of pulses by India

Pulses import had fallen to 2.5 MT in 2019 from a peak of 6.6 MT two years ago. (India Agristat, 2019). When the price of pulses was more a few years back, imports increased to a record high of 6.6 MT in 2017. The opportunity to grow more pulses in India stopped as imports flooded the country along with the Indian crop and prices went below the minimum support prices. However, after several restrictions were placed, imports started falling. From 2016-17, the Indian government initiated a number of measures like substantial increase in minimum support price, government procurement and introduction of tariff and non-tariff barriers on import to augment production. All of this led to a sharp decline in imports from 6.6 MT in 2017 to 2.5 MT in 2019. The decrease in pulse imports is expected to provide a big relief for Indian farmers who have faced a subdued price trend throughout the year. Decrease in imports also expected to improve prices in domestic market. With an estimated consumption of 25 MT, India has already achieved self-sufficiency in pulses. India's import of pulses is likely to decline by 68 per cent in 2020.

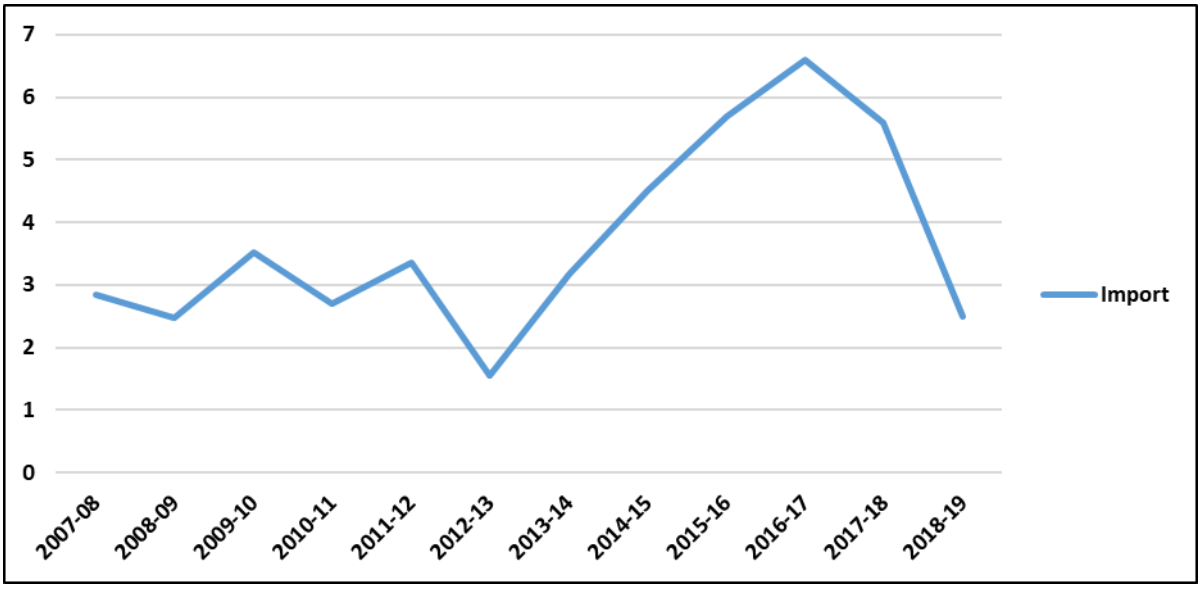


Fig 5: Import of pulses by India during 2007-19 (MT)

Farmer-friendly policy measures have helped to reduce import of pulses. Import of pulses during 2018-19 has declined by about 2.5 MT from previous year. It is expected that pulses production will be sustained in the country and India's import dependence on pulses will come down substantially.

To ensure that farmers get remunerative prices, the government has imposed import duty and introduced quantitative restrictions on the various varieties of pulses. Import duty on chickpea has been fixed at 60 per cent, while that for peas is 50 per cent, lentil 50 per cent and tur 10 per cent moong and urad 0 per cent as of Feb, 2018.

Table 2: Import duty on the major pulses (Feb 2018)

1	**Chickpeas (Chana)**	**60%**
2	Peas (Matar)	50%
3	Lentil (Masoor)	50%
4	Red gram (Tur/Arhar)	10%
5	Black gram	0%
6	Green gram	0%

Productivity performance of improved varieties

Total factor productivity (TFP) is an important measure to evaluate the performance of any production system and sustainability of a growth process. Total Factor Productivity measures the extent of increase in the total output, which is not accounted for by increase in the total inputs but by increase in new technology. In view of the nutritional importance of pulses as a relatively cheap source of protein, and the difficulties in importing huge quantities of pulses to meet the potential demand-supply gap, it is important to increase the domestic production and productivity of pulses. The growth in TFP has shown mixed results between different crops of pulses and time periods. The chickpea and green gram showed improvement in TFP, but in most of the states considered, pigeon pea and black gram showed no improvement in TFP which needs further research on these crops. There is a need to focus on developing varieties suitable for different agro-climates and emerging farming systems. It has also been noted that the changes in TFP have been contributed by both technical change and efficiency change. Technology fatigue in pulses is not widespread, but technology growth has been observed in most of the selected states in chickpea and green gram. Changes in technology and improvements in productivity are both necessary to accelerate TFP. (Suresh and Reddy, 2016) [16].

Yield gap analysis

Yield gap analysis is the difference between the potential yield of any crop at research station and the actual yield obtained by the farmers. Less than 20 to 30 per cent of yield gap is desirable. Yield gap was more in red gram followed by green gram and black gram. There was a huge gap between potential and actual yield in red gram in dryland areas. Indian Institute of Pulses Research (IIPR), Kanpur, and its nine main and 11 sub-branches had not released new variety of red gram seeds in the last three years. The production of red gram and pulses could be doubled if the States prepared a plan to tap the large production potential with the adoption of better water management practices and technologies in both rainfed and irrigated areas. But farmers should be supported by appropriate services like input supply, good quality seeds, balanced fertilizer, necessary infrastructure, and above all, assured and remunerative marketing.

The Cluster Front Line Demonstration programme has been started from 2015-16. The total targets during 2015-16 in 15382 hectares have been increased at 126 per cent during 2018-19. The transfer of technology through CFLDs have increased yield levels of total pulses shown upto 42 per cent and 54 per cent over local check and normal yield. Crop-wise details of CFLDs conducted, yield gaps of major pulses demonstrated during 2016-17 is given below (GOI 2019) [5, 6, 7].

Table 3: Productivity potential (kg/ ha) of improved technology of pulses (2016-17)

			Actual yield gap			% Yield gap	
Crop	**Demonstration**	**Local check**	**Normal yield**	**local check**	**Normal yield**	**local check**	**Normal yield**
Bengal gram	15.07	11.02	9.32	4.05	5.75	37	62
Green gram	8.3	5.9	5	2.4	3.3	41	66
black gram	8.67	6.39	6.32	2.28	2.35	36	37
red gram	14.5	9.92	7.25	4.58	7.25	46	100
Lentil	10.66	7.58	7.38	3.08	3.28	41	44

Conclusions

India has been a major importer of pulses over a long period of time due to the deficit in production to meet the demand. India is set to attain self-sufficiency in pulses this year due to three primary factors: increase in acreage under rabi pulses, aggressive replacement and availability of quality seeds during peak sowing season, and better irrigation facilities. Farmer-friendly policy measures have helped to reduce import of pulses. From 2016-17, the Indian government initiated a number of measures like substantial increase in minimum support price, government procurement and introduction of tariff and non-tariff barriers on import to augment production. All of this led to a sharp decline in imports from 6.6 MT in 2017 to 2.5 MT in 2019. It is expected that pulses production will be sustained in the country and India's import dependence on pulses will come down substantially. A decline in imports is also expected to improve prices in domestic market.

In order to stimulate the TFP and minimize the yield gap among the pulses, the Government should increase research funding for development of high yielding, short duration, pest, disease and drought resistant/ tolerant varieties of pulses and also strengthen the extension services. This can contributes to the increase in pulses production significantly that would reduce the dependence on imports of pulses besides realizing higher profitability to pulse farmers. All this will require proactive strategy from researchers, planners, policy makers, market forces and farmers for boosting the production and productivity of pulses in India. Over the last three to four years, the government has procured almost 6 MT of pulses from farmers and has also increased the minimum support price of pulses, which has virtually led to the success of the Pulse Mission. This is also scaling up the demand for pulses. To meet the rising demand, we are encouraging good agriculture practices like use of better quality seeds and improved irrigation to enhance productivity.

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