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Review paper

Policies and incentives for promotion of pulses production and consumption: A Review

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ABSTRACT

The paper delves into the current state of pulses in India, examining technological advancements, production trends, costs and returns, extent of subsidies and other policies related to pulses, competitiveness, and input utilization. It also assesses non-market benefits, such as nitrogen fixation, and suggests incorporating them into incentives for pulses production and consumption. Additionally, the paper explores the nutritional contributions of pulses and their potential distribution through government schemes to aid the impoverished. Policy scenarios, including the role of Minimum Support Price and procurement, are scrutinized for their historical impact on pulse production. The paper evaluates the demand-supply gap and advocates for improved trade policies. Ultimately, it recommends incentive policies based on the ecological contributions of pulses, use of advanced statistical methods for advanced production estimations to guide informed decisions by traders and importers, and long-term government contracts for pulses import/export to stabilize domestic prices. The goal is to ensure affordability for consumers and encourage farmers' participation in export markets, especially for crops like chickpea.

Key words: Competing crops, Cost-benefit analysis, Economic prices, Greenhouse gas emissions, Market prices, Pulses, Subsidies

INTRODUCTION

Pulses, represent a diverse category of about twelve types, which may include chickpea, pigeonpea, mungbean, urdbean, and lentil, among others. These are the dried edible seeds of certain plants within the legume family (Reddy, 2009). It is important to note that while peas and beans are also legumes, they are typically classified as vegetables rather than pulses. Pulses are characterized by their high protein and starch content, making them valuable sources of nutrition. Additionally, pulses are generally low in fat, distinguishing them from some other legumes like soybeans and peanuts, which have a relatively high fat content. The nutritional profile of pulses, coupled with their versatility, makes them an important component of food systems worldwide and especially in India.

Pulses play a crucial role in both Indian cuisine and the country's agricultural economy. Even today, a typical Indian lunch includes pulses alongside staples like wheat or rice, adding a rich source of protein to the diet. This is particularly significant in a nation where vegetarian diets are prevalent, as pulses contribute essential amino acids necessary for proper growth, development, and overall health. India holds a prominent position as the world's leading producer and consumer of pulses, contributing to 24% of global pulses production and utilizing a third of the global area for cultivation (Joshi and Rao, 2017). Despite this, the production of pulses has struggled to keep pace with population growth, resulted in increased relative prices of pulses, which reduced the per capita consumption below the recommendation by the Indian Council of Medical Research (ICMR), although there are some technological progresses in enhancing pulses production, especially in chickpeas (Mishra *et al.*, 2023). This is primarily due to a historical lack of negligence of pulses by policy makers and low investments in pulses research and development. There is an urgent need to increase pulses productivity by using low-cost technologies, so that in the process of increasing cost of production should not be increased and prices should not be beyond the affordability of the poor consumers. Although India increased its pulses production significantly in the past decade especially from 2017 onwards, still its dependence on imports is significant. India is importing nearly 2-3 million tonnes of pulses annual to meets its shortfall (Singh *et al*., 2022). Despite significant imports, the per capita availability of pulses in India has remained low and has declined over the years. In 1951, the net availability per person was 22 kg/year, decreasing to 18.7 kg in 1971, reduced further to 15.2 kg in 1991 and reached its lowest 11 kg in 2001 and then recently it increased to 18 kg in 2021 (Govt. of India, 2023). The most recent data shows Protein-Energy Malnutrition (PEM) is measured in terms of underweight (low weight for age), stunting (low height for age) and wasting (low weight for height) is a big problem among Indian population. The prevalence of stunting among under five is 48% and wasting is 20% and with an underweight prevalence of 43%, it is the highest in the world (Bhutia, 2014). Given that pulses are rich source of protein, there is an urgent need to increase pulses production. However, to increase production profitability of the pulse crops relative to other crops needs to be attractive to increase pulses area. The decline in the relative profitability of pulses compared to other crops, such as cereals, has been a major factor contributing to their poor production growth. This can be attributed partly to technological factors and partly to policies favoring subsidies for inputs like water and fertilizer, which predominantly benefit cereal crops. Hence, there is a need to rationalize the incentive structure in Indian agriculture to promote pulses. Further, pulses contribute significantly to the environment and soil health by enhancing soil fertility, reducing the need for fertilizers, and emitting fewer greenhouse gases compared to cereal crops. However, these contributions are often overlooked in providing incentives to pulses crops in terms of procurement and subsidies. Recognizing the impact of subsidies on farm income, the implications for natural resources, and the environment is becoming increasingly important. Understanding these distortions and accounting for contributions to sustainability are crucial aspects for a comprehensive evaluation of various production activities.

In addressing the intricate policy challenges surrounding pulse crops, this review paper aims to assess their status and provide policy recommendations for the sustainable development of both production and consumption. The paper is organized into ten sections to comprehensively cover various aspects of the pulses sector. Section 2 delves into trends in the production and productivity of pulses, shedding light on the current state and trajectory of pulse cultivation. Section 3 focuses on the costs and returns associated with pulses production, providing insights into the economic aspects of cultivating these crops. In section 4, the paper explores subsidies and externalities related to pulses, highlighting the policy landscape and the impact of support mechanisms. Section 5 examines the nutritional contribution of pulses to human diets, emphasizing their role in addressing nutritional challenges. The domestic pulses markets are the focus of section 6, analyzing the dynamics, trends, and challenges within the Indian market. Section 7 zooms out to explore global production and trade trends, offering a broader perspective on the international pulse market. Section 8 assesses the existing government support for the promotion of pulses, evaluating current policies and initiatives. Section 9 builds upon these insights to provide policy recommendations, offering strategic suggestions for enhancing the sustainable development of pulses. The final section (section 10), concluding remarks, summarizes the key findings and emphasizes the importance of comprehensive policies to foster the growth and sustainability of the pulses sector.

TRENDS IN PRODUCTION AND PRODUCTIVITY

Fig. 1 illustrates the pulses yield spanning from 1963 to 2023 divided into three distinct phases. The first phase, spanning from 1962 to 1988, was characterized by a primary focus on the green revolution and the expansion of paddy and wheat production. During this period, the growth in pulses productivity was a modest 2.25 kg/ha/year. In the second phase, from 1989 to 2005, despite the release of several improved pulse varieties, the growth rate in pulses productivity remained low at 1.6 kg/ha/year. The limited adoption of these improved varieties contributed to the restrained growth in productivity. The third phase, covering the period from 2005 to 2022, witnessed a substantial increase in the growth rate of pulse yield, reaching 17.1 kg/ha/year. This remarkable surge can be attributed to the expanded adoption of improved varieties, coupled with policy support and initiatives aimed at promoting pulse production. Notably, during this phase, there was a significant increase in the Minimum Support Price (MSP) in 2016-17, leading to higher domestic prices and improved profitability for pulse crops. The introduction of programs such as the Accelerated Pulses Production Programme (APPP), National Food Security Mission (NFSM)-pulses, and Rastriya Krishi Vikas Yojana (RKVY) further contributed to the growth in pulses productivity.

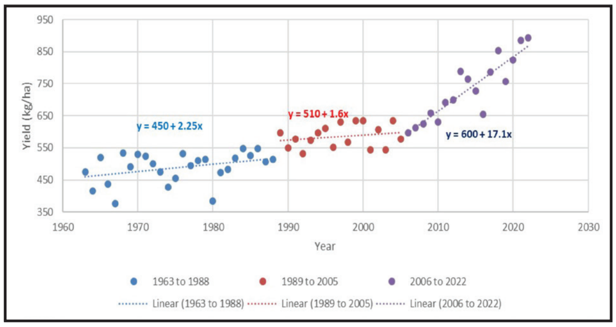

Fig. 1. Trends in pulses production. Source: Agriculture at a Glance (2023)

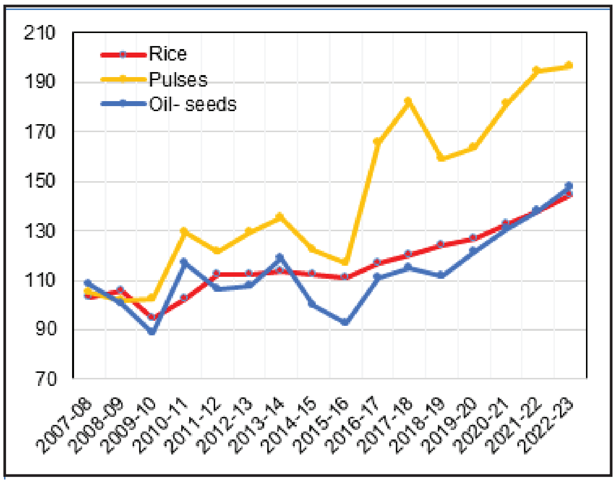

Fig. 2. Index number for agricultural production (Triennium ending 2007-08 = 100). Source: Directorate of Economics and Statistics (2023a)

Fig. 2 presents the index number production of pulses, rice, and oilseeds. Up until 2015-16, the production of pulses followed a similar pattern to that of other crops. However, there is a notable and sudden increase in the production of pulses from the agricultural year 2016-17 onwards. This surge in pulse production is primarily attributed to higher domestic and international prices, influenced by lower production levels in the years 2014-15 and 2015-16. The consecutive years of below-average production globally and domestically resulted in a significant decrease in stocks. The reduced availability of pulses led to a substantial increase in prices in the domestic market, a trend that was further supported by an increase in the MSP from the agricultural year 2016-17 onwards. This trend of increased production in pulses has continued, leading to a subsequent reduction in imports in the following years.

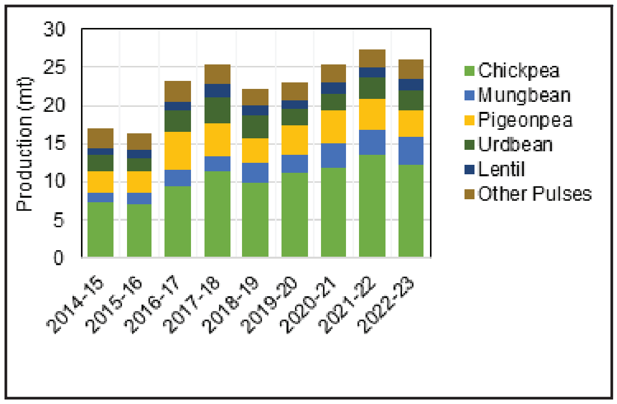

Fig. 3. Pulses production (mt). Source: Directorate of Economics and Statistics (2023b) https://desagri.gov.in/statistics-type/advance-estimates/#

Fig. 3 illustrates the remarkable expansion in chickpea production from 7 mt in 2015-16 to 14 mt in 2021-22, occurring within a span of six years. This growth is considered a notable example of how the right technology, supported by effective policies and incentives, can lead to significant improvements in crop production, even in dryland regions, for crops that were traditionally considered neglected. The success of the chickpea revolution is attributed to the introduction of short-duration, heat-tolerant, and mechanization-friendly chickpea varieties, coupled with higher farm gate prices and increased MSP. This success is particularly evident in Andhra Pradesh, where even small-scale chickpea farmers are utilizing cold-chain storage structures to store chickpeas during peak harvest periods and sell them at higher prices several months later. The overall production of pulses in India increased from 15-16 mt in 2014-15 to 27 mt in 2021-22.

Fig. 4 depicts the inter-state differences in pulses production and yield. Major pulses-growing states, including Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh, Andhra Pradesh, and Karnataka, play a crucial role in the overall production landscape. Some states, such as Madhya Pradesh, Uttar Pradesh, Andhra Pradesh, Gujarat, Jharkhand, Bihar, West Bengal, Haryana, and Punjab, have shown higher productivity compared to the national average. However, there is a need for increased focus on increasing productivity in states like Maharashtra and Rajasthan, where productivity is currently below the national average. Similarly, states like Karnataka, Chhattisgarh, Tamil Nadu, and Odisha should be targeted for efforts to enhance yields as their yields currently fall below the national average.

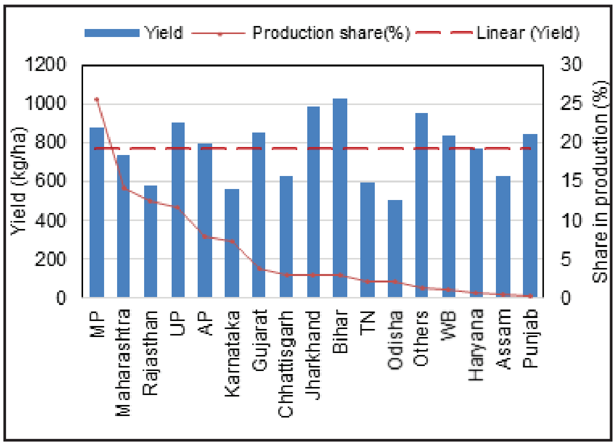

Fig. 4. State wise share in production and yield (kg/ha): average from 2018 to 2023. Source: Agriculture at a Glance (2023)

Table 1 provides insights into the changes in yield and input utilization for pigeonpea (a pulse crop) and cotton (a competing crop) in Madhya Pradesh over the last two decades. Profitability in agriculture is influenced by various factors, and understanding the dynamics of input usage is crucial. In terms of yield changes, pigeonpea productivity experienced a notable increase from 6 quintals to 8 quintals per hectare. Cotton, the competing crop, also showed improved yields, rising from 16 quintals to 26 quintals per hectare. Additionally, there was a reduction in yield variability over the observed period. Examining fertilizer use, it was found that pigeonpea, although utilizing relatively lower amounts, saw an increase from 15 kg/ha to 30 kg/ha. On the other hand, cotton witnessed a substantial rise in fertilizer application from 123 kg/ha to 306 kg/ha. The variability in fertilizer use for pigeonpea decreased, indicating a broader adoption of fertilizers among farmers. Regarding manure usage, a decline was observed in pigeonpea from a lower initial base, while cotton experienced an increase from a higher base. Pesticide use trends showed an overall increase in spending for both pigeonpea and cotton. However, cotton farmers used significantly more pesticides (7-8 times) compared to pigeonpea. The reduction in variability in pesticide use for both crops suggests an increased adoption of pesticides by farmers. The observations highlight that, despite using fewer inputs, especially fertilizers and pesticides, in cultivating pulses like pigeonpea, there is room for creating awareness about optimal input utilization. This awareness is crucial to enhance yields, reduce potential losses, and improve overall productivity and profitability in pulses cultivation.

Table 1. Input use and yield of pigeonpea and cotton in Madhya Pradesh (2002 to 2022)

Indicator	Crop	Item	2002-2012	2012-2022
Yield (q/ha)	Pigeonpea	Average	6	8
		CV%	35	22
	Cotton	Average	16	26
		CV%	45	23
Fertilizer (kg/ha)	Pigeonpea	Average	15	30
		CV%	83	26
	Cotton	Average	123	306
		CV%	30	43
Manure (q/ha)	Pigeonpea	Average	3	2
		CV%	72	78
	Cotton	Average	11	20
		CV%	45	49
Insecticides (INR./ha)	Pigeonpea	Average	185	857
		CV%	126	42
	Cotton	Average	1772	6288
		CV%	72	42

CV = Coefficient of variation; Source: Directorate of Economic and Statistics (2023c)

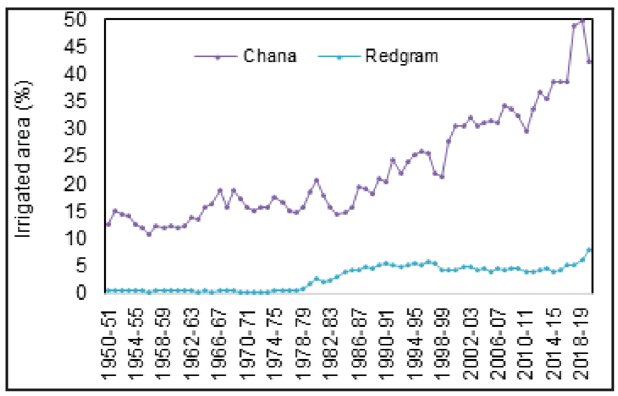

Fig. 5. Irrigated area (%) Source: Agriculture at a Glance (2023)

Table 1 highlights the notable disparity in input usage between pulses and competing crops. Within the category of pulse crops, particularly between chickpea and pigeonpea, distinct differences in input utilization emerge. Fig. 5 illustrates the evolving trends in the percentage of irrigated area for chickpeas and pigeonpea over several decades. For chickpea, there is a discernible upward trajectory in the percentage of irrigated area, escalating from 10% to 42% between 1950-51 and 2018-19, with a significant surge observed from 1985 onwards. In contrast, the irrigation percentage for pigeonpea remained minimal, remaining below 2% for nearly three decades, spanning from 1950-51 to 1978-79. Subsequent years saw a modest positive shift, with the percentage of irrigation gradually increasing from 2% to 8% between 1980-81 and 2018-19. The introduction of irrigation plays a pivotal role in enhancing various other input practices such as fertilizer usage. Additionally, it contributes to increased input use efficiency and, consequently, improved yield growth. The application of one or two irrigations at critical stages of crop growth, especially during the *rabi* season (post-rainy season), significantly boosts crop yields. While most pulse crops in the *kharif* season (rainy season) may not require irrigation if rainfall is normal and evenly distributed, providing lifesaving irrigation during conditions like a late onset of monsoon or prolonged dry spells proves instrumental in enhancing crop yields. Furthermore, the use of *Rhizobium* culture and sulfur has been proven to substantially increase the yields of pulse crops.

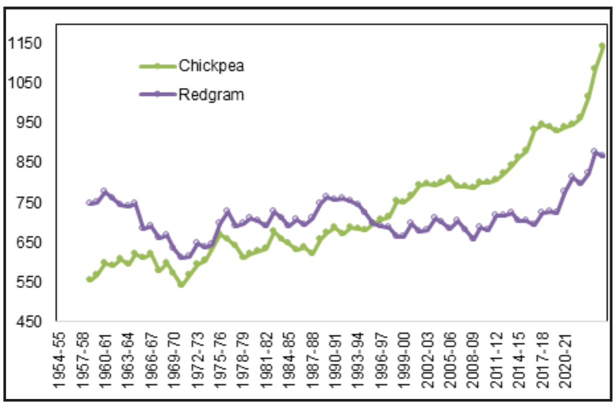

Fig. 6. Impact of technological progress in chickpea and pigeonpea (Yield : kg/ha)

Source: Agriculture at a Glance (2023)

The Fig. 6 illustrates a more significant progression in yields for chickpea compared to pigeonpea. Chickpea yields exhibited a noteworthy increase, rising from 554 kg/ha in the Average of Triennium Ending (TE) 1956-57 to a peak of 1142 kg/ha in TE 2020-21. In contrast, pigeonpea yields have remained relatively stagnant, experiencing some upward movement after 2008-09. From 657 kg/ha in 2008-09, pigeonpea yields increased to 865 kg/ha in 2020-21. The accelerated growth in chickpea yields can be attributed to higher percentage of irrigation, increased fertilizer usage, and enhanced yields in *rabi* cultivation. Setting a target to increase pulse yields to at least above 1 tonne/ha is crucial, especially considering that several districts have already surpassed this benchmark. The success in these districts can serve as a model for others, facilitating the achievement of higher yields across all regions. Similarly, distribution of districts based on their average yield of chickpea for the periods 2001, 2011, and 2017 are given in Fig. 7. Because of technological advances share of districts with more than 1 t/ha yield was increased from 32% in 2001 to 53% in 2011 and in 2017 its share increased to 62% (Fig. 7).

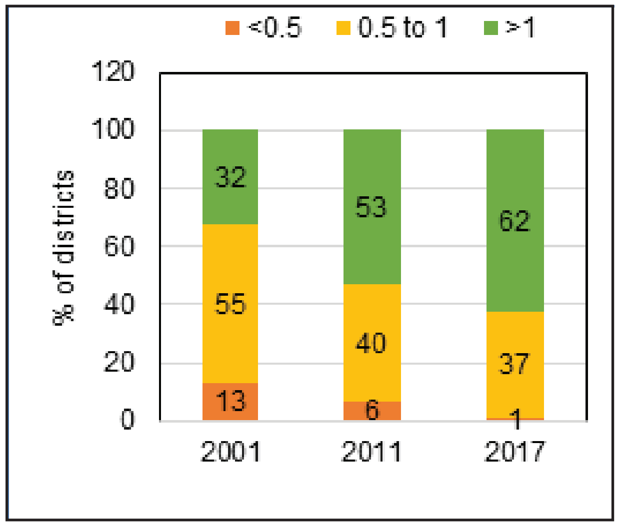

Fig. 7. Distribution of districts (%) with yield levels (ton/ha) in chickpea. Source: ICRISAT District Level Database. http://data.icrisat.org/dld/

COST AND NET RETURNS

This section delves into the cost of cultivation and profitability analysis for pulses and their competing crops in both the *kharif* and *rabi* seasons. Farmers make decisions regarding crop selection and input utilization based on the relative profitability of competing crops. The study relies on the data from the Commission for Agricultural Costs and Prices (CACP), considered as the most authentic and standardized database with a representative and extensive sample of farmers.

The cost and return analysis is specifically conducted for the state of Uttar Pradesh, a significant pulse-growing region characterized by a highly diversified agro-ecology and a sufficiently large sample size, making it an ideal context for comparing costs across different crops. For the *kharif* season, the selected crops include pigeonpea and mungbean among pulses, and maize among non-pulses. In the *rabi* season, chickpea is chosen as the pulse crop, while maize and mustard serve as competing non-pulse crops. It is important to note that the study intentionally avoids comparing pulses costs with paddy and wheat due to the distinct policy scenarios associated with these crops, including substantial subsidies and procurement at MSP.

RELATIVE PERFORMANCE OF KHARIF CROPS

Before generalizing the results, it is crucial to acknowledge the significant variations in crop yields and profitability, influenced by various factors such as market conditions and weather phenomena, which can fluctuate from year to year and season to season. The following cost and return figures provide a general understanding of resource utilization, input expenses, and profitability for pulses and their competing crops, serving as valuable insights for farmers and field demonstrations. In Uttar Pradesh, pigeonpea, mungbean and maize emerge as major competing crops for cultivation during the *kharif* season. Notably, seed costs are higher for maize compared to mungbean and pigeonpea. Fertilizer, insecticide, irrigation, and farm machinery usage are also higher for maize in comparison to both pigeonpea and mungbean (Table 2). However, other costs are higher for pigeonpea, given its relatively longer duration compared to mungbean and maize. Human labor stands out as the most significant cost for all crops, with pigeonpea incurring higher labor costs, followed by mungbean and maize. Remarkably, farmers hardly utilize manure and animal labor for all three *kharif* crops. Cost A2+Family Labor is highest for maize (INR. 39,536/ha), followed by pigeonpea (INR. 38,956/ha), and mungbean (INR. 27,942/ha). The yield of maize (27 q/ha) is approximately three times that of pigeonpea (9 q/ha) and nine times that of mungbean (3 q/ha). Consequently, the cost of production is higher for mungbean (INR. 9,132/q), followed by pigeonpea (INR. 3,705/q), compared to maize (INR. 1,260/q). Gross returns, based on market prices, are highest for pigeonpea (INR. 78,845/ha), followed by maize (INR. 53,350/ha), and least for mungbean (INR. 22,844/ha). After deducting Cost A2+Family Labor, the profitability to farmers is again highest for pigeonpea (INR. 39,888/ha), followed by maize (INR. 13,813/ha), while profitability from mungbean falls into negative territory.

PROFITABILITY OF PULSES RELATIVE TO COMPETING CROPS IN RABI SEASON

In the *rabi* season, major crops include chickpea, maize, and mustard, with wheat excluded from the comparison due to differing policy scenarios regarding input use and harvest procurement. The total cost of cultivation per hectare is relatively similar for all crops, with maize incurring the highest cost (INR. 36,594), followed by chickpea (INR. 36,502), and mustard with the lowest cost (INR. 33,640). For chickpea cultivation, expenses are primarily driven by human labor, while in maize, costs are higher in terms of seed and for mustard, expenses are elevated in machine labor, fertilizer, irrigation charges, and other miscellaneous costs. Yields exhibit a significant difference, with maize recording 3-4 times higher yields (36 q/ha) compared to chickpea (10 q/ha) and mustard (16 q/ha). Consequently, the cost of production is higher for chickpea (INR. 3,393/q), followed by mustard (INR. 1,968/q), and the least in maize (INR. 842/q). Gross returns per hectare are highest for mustard (INR. 86,337), followed by chickpea (INR. 59,676), and maize (INR. 52,120). Similarly, profitability is also higher for maize, followed by chickpea and mustard. Overall, in Uttar Pradesh, during the *kharif* season, pigeonpea emerges as the most profitable crop. However, in the *rabi* season, all three crops—chickpea, maize, and mustard—display more or less equal costs and returns, contingent on seasonality and market conditions.

SUBSIDIES AND EXTERNALITIES

Over the past four decades, there has been a substantial shift in cultivated areas from pulses to major crops like paddy, wheat, and sugarcane, driven by incentives, subsidies, and procurement policies favoring these crops. However, in recent years, a new shift is underway, with farmers moving from pulses to cotton cultivation. The Cotton Corporation of India's procurement at MSP and the adoption of Bt cotton, which is resistant to bollworm, have contributed to this trend. The relative decline in the profitability of pulse crops has led farmers to opt for less favorable production environments, such as marginal lands with lower fertility, where input use is limited. Policies providing subsidies for irrigation and chemical fertilizers have disproportionately increased the profitability of major crops like paddy and wheat over pulses. While these subsidies benefit farmers, it is crucial to recognize that society bears the financial responsibility for them. Therefore, assessments of income or profitability across different production activities should consider the long-term needs and benefits to society. Relying solely on market prices of inputs and outputs, as demonstrated in the previous section, may not offer a comprehensive evaluation of the broader contributions of pulses to society. Pulses play a pivotal role in enhancing soil fertility

Table 2. Costs and returns of pulses and their competing crops in Uttar Pradesh (2021-22)

	Kharif			*Rabi*		
Cost Items	**Pigeonpea**	**Mungbean**	**Maize**	**Chickpea**	**Maize**	**Mustard**
Human labour (INR/ha)	26643	20199	19150	19965	17874	13432
Animal Labour (INR/ha)	0	0	0	0	0	74
Machine Labour (INR/ha)	5925	4471	8611	6011	7500	8460
Seed (INR/ha)	3407	1977	5617	5476	5779	1940
Fertilizer (INR/ha)	186	155	3111	1319	2622	4009
Manure (q/ha)	0	0	0	0	0	0
Insecticides (INR/ha)	0	93	174	0	88	104
Irrigation Charges(INR/ha)	1170	548	1577	2603	1477	3478
Others cost(INR/ha)	1625	499	1296	1128	1254	2143
A2 (INR/ha)	17203	9788	31651	18959	29373	25314
A2+FL (INR/ha)	38956	27942	39536	36502	36594	33640
Yield (q/ha)	9	3	27	10	36	16
A2 (INR/q)	1758	2814	1029	1744	679	1508
A2+FL (INR/q)	3705	9132	1260	3393	842	1968
Gross returns (INR/ha)	78845	22844	53350	59676	52120	86337
Profitability over A2+FL(INR/ha)	39888	-5098	13813	23174	15526	52697

Source: Directorate of Economic and Statistics (2023c): Plot Level Summary Data Under the Cost of Cultivation Scheme, Department of Agriculture & Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India. Note: Cost A2+Family Labour includes Actual Paid Out Costs (These are the costs incurred by the farmer in cash or kind for various inputs such as seeds, fertilizers, pesticides, hired labor, fuel, irrigation, etc.) plus Imputed value of family labor

by introducing nitrogen during the growth phase, reducing the reliance on fertilizers, and improving overall soil suitability for agriculture. This section delves into net income from pulses and competing crops at prevailing market prices, economic pricing that incorporates subsidy effects, and valuation methods considering the impact on natural resources. Despite generating less revenue at market prices, pulses demonstrate higher profitability at the societal level compared to competing crops. Additionally, the cultivation of pulses contributes significantly less to greenhouse gas emissions compared to other crops, making a transition towards pulses environmentally favorable. By internalizing subsidies and acknowledging the multifaceted contributions of pulses, including soil enrichment and their impact on greenhouse gas emissions, this section establishes a scientific framework for a comprehensive assessment of benefits of pulses compared to competing crops. The aim is to argue for incentives from the government that align with the non-market benefits provided by pulses. This is carried out in two steps:

a. Comparison of net returns:

Evaluate the net return from cultivating pulses and other crops under current input prices.

Assess the net return from pulses and alternative crops when input prices are considered without subsidies.

b. Environmental and natural resource valuation:

Calculate and compare the revenue generated from cultivating pulses with that of alternative crops, incorporating environmental and natural resource valuations.

Through these steps, the section aims to provide a more nuanced understanding of the overall benefits of pulses cultivation, both in economic terms and in terms of environmental sustainability, and advocate for policy incentives that align with these comprehensive assessments. This analysis focuses on the states of Uttar Pradesh and Madhya Pradesh, utilizing data primarily sourced from the Ministry of Agriculture, Government of India's Cost of Cultivation Reports for the three most recent years, concluding with 2021. Data on input subsidies were also obtained from the Central Statistical Office and National Account Statistics of the Government of India. The study is specifically centered on significant pulses cultivated during the *rabi* season and their competing crops. In Madhya Pradesh, the analysis includes chickpea and wheat, while in Uttar Pradesh, lentil and mustard are considered. These selected pulses collectively account for approximately 80% of the *rabi* pulses cultivation area in the respective states.

Steps in measurement of subsidies

1. Cost-benefit analysis at market prices for pulses and competing crops.
2. Measurement of subsidies (fertilizer + water): subsidies are costs to government.
3. Measurement of externalities (CO_2 + Nitrogen fixation): negative externalities are costs to society and positive externalities are benefits to society.
4. Social cost-benefit analysis.

When assessing net income considering social benefits and costs, subsidies for crop-specific inputs, which include fertilizers, irrigation, and electricity supplies, are deducted from the net income at market prices. Specifically, for urea, a nutrient-based subsidy (NBS) is applicable, with a Maximum Retail Price (MRP) of INR. 242 per 45 kg bag (effective from 1st March 2018), while the actual cost is INR. 2,200. The subsidy amounts to INR. 43.5 per kg of urea, resulting in a subsidy of INR. 94.5 per kg of Nitrogen. The total irrigation and electricity subsidy, denominated in rupees are distributed among the selected crops based on the proportion of irrigated area under these crops. The methodology employed by the authors includes: (i) The value of nitrogen fixation by pulse crops at the prevailing nitrogen price. (ii) Imputed value of the reduction in greenhouse gas emissions to the atmosphere if pulse crops are grown instead of competing crops. The monetary value assigned to greenhouse gas (GHG) emissions, measured in terms of CO_2 kg equivalent, is determined to be INR. 0.58 ($10/tonne) (Chand, *et al.*, 2013).

Fig. 8 presents a comprehensive analysis of costs and benefits, incorporating market prices, subsidies (water and fertilizer), and externalities (such as N-fixation by pulses and GHG emissions by both pulses and non-pulse crops). Social benefits are computed by subtracting total subsidies and adding positive externalities (value of N-fixation), while deducting negative externalities (value of GHG emissions) from private profits. Wheat cultivation, due to higher input use and subsidies, incurs higher costs for farmers compared to chickpea. Although wheat yields higher private profits for farmers, the net social benefits for chickpea are INR. 28,000/ha, considering subsidies and net externalities. Similarly, lentil shows private profits of INR. 30,200/ha, with social benefits amounting to INR. 28,700/ha after accounting for subsidies and N-fixation net of GHG emissions. Mustard, with private profits of INR. 32,200/ha, exhibits lower social benefits of INR.16,100/ha due to higher subsidies and net negative externalities (Fig. 9).

The results emphasize that social benefits to society surpass private costs for pulse crops compared to non-pulse crops. Non-market costs borne by society (subsidies plus negative externalities) are INR. 4,900/ha for chickpea and

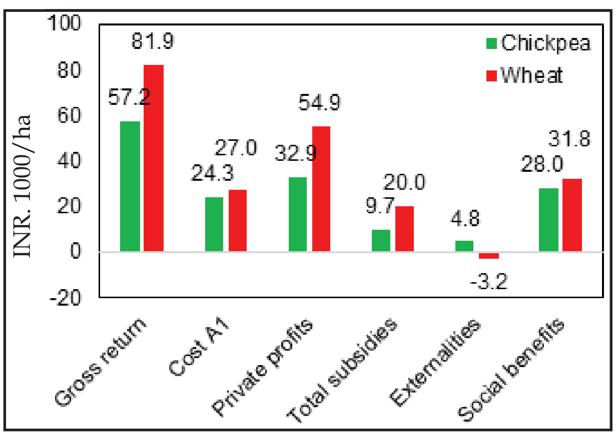

Fig. 8. Social cost-benefits of pulse crop (chickpea) and its competing crop (wheat) in Madhya Pradesh in Triennium ending 2021. Source: Directorate of Economic and Statistics (2023c)

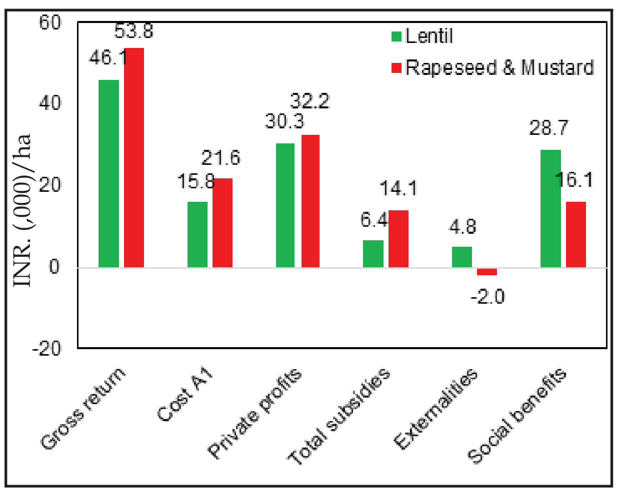

Fig. 9. Social cost-benefits of pulses and its competing crops in Uttar Pradesh in triennium ending 2021. Source: Directorate of Economic and Statistics (2023c); Source: Directorate of Economic and Statistics (2023c)

INR. 23,200/ha for wheat in MP, under the current incentive regime with substantial subsidies for fertilizers and water. Similarly, non-market costs for lentil cultivation are INR. 1,600/ha, while for rapeseed and mustard, it is INR.16,100/ha. This analysis underscores that non-pulse crops receive substantial incentives, resulting in significantly higher costs to society, ranging from 5 to 10 times those incurred in cultivating pulses, in both major pulse-growing states.

PULSES CONTRIBUTION TO HUMAN NUTRITION

Pulses play a crucial role as a staple food in daily diets, forming an integral part of household regular consumption. Widely recognized as the “poor man’s meat”, pulses hold significant nutritional importance due to their high protein content, offering a cost-effective source of this essential nutrient. Table 3 provides an overview of the nutritional value of various pulses.

Table 3. Nutrition value of different pulses per 100 g

Crops	Kilo calories	Protein	Carbohydrates	Fiber	Fat
Lentils	116	9.0 g	20.1 g	7.9 g	0.4 g
Chickpeas	164	8.9 g	27.4 g	7.6 g	2.6 g
Urad	132	8.9 g	23.6 g	6.5 g	0.5 g
Chana Dal(Split)	160	8.7 g	27.4 g	8.6 g	2.6 g
Moong Dal(Split)	105	7.0 g	19.0 g	6.0 g	0.4 g
Moong	347	7.02 g	19.15 g	7.60 g	1.15 g
Tur Dal	343	22.3 g	62.6 g	15.3 g	1.6 g
Peas	81	5.4 g	14.5 g	5.7 g	0.4 g

Source: United States Department of Agriculture, Agricultural Research Service. Food Data Central, 2022. https://fdc.nal.usda.gov; Hall *et al*. (2017)

In the realm of nutrition, an extensive array of pulse crops offers a plethora of health advantages. Among these, lentil stand out as a nutritional powerhouse, boasting a robust protein content of approximately 9.0 g per 100 g. This makes them a preferred choice for both vegetarians and health enthusiasts. Chickpeas, celebrated for their versatility, present a balanced nutritional profile with 164 kilo calories, 8.9 grams of protein, and 27.4 grams of carbohydrates per 100 grams. Urdbean, recognized not only for its role in popular dishes but also for its impressive 6.5 grams of fiber per 100 grams, significantly contributes to digestive health. Chickpea *dal* (Split), a staple in Indian cuisine, distinguishes itself with 27.4 g of carbohydrates, serving as a substantial energy source. Whole moong provides, particularly in terms of protein content, per 100 grams, it offers approximately 7.02 grams of protein. Mungbean *dal* (Split) provides a nutrient-rich option with 7.0 g of protein, while pigeonpea *dal* maintains a well-rounded balance across macronutrients, offering 343 kilo calories, 22.3 g of protein, and 62.6 g of carbohydrates. Peas, cherished in various dishes, may be modest in protein content, but they bring a notable 14.5 g of carbohydrates and 5.7 g of fiber per 100 g. This diverse assortment of pulses caters not only to diverse culinary preferences but also weaves a rich tapestry of essential nutrients, including fiber, proteins, and healthy carbohydrates. As such, these pulses play an integral role in fostering a well-rounded and nutritious diet.

Table 4 illustrates the per capita net availability of diverse food items in India spanning the years 1951 to 2021. The data is segmented into various food groups, encompassing rice, wheat, other cereals, pulses, foodgrains, edible oil, cotton, milk, meat, poultry, eggs, and fish. The comprehensive per capita consumption of foodgrains, comprising the sum of rice, wheat, other cereals, and pulses, experienced a rise from 144 kg in 1951 to 187 kg in 2021. In contrast, the consumption of edible oil witnessed a significant surge, registering a remarkable 533% increase from 1951 to 2021. Cotton consumption, measured in meters, demonstrated notable growth over the years. Per capita consumption of milk, meat, poultry, eggs, and fish exhibited positive trends, each displaying varying rates of increase across the decades.

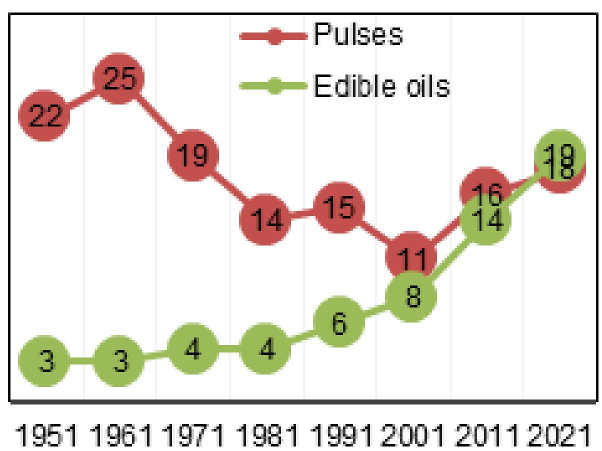

Fig. 10. Per capita availability of pulses and edible oils (kg/year). Source: Agricultural Statistics At A Glance (2023)

Table 4. Per capita net availability of foodgrains (per annum) in India (kg per year)

Year	Rice	Wheat	Other cereal	Pulses	Edible oil	Milk (g/day)	Meat	Poultry	Egg (number)	Fish
1951	58	24	40	22	3	130	3.3	0.2	5	2.1
1961	73	29	44	25	3	126	3.9	0.2	7	1.9
1971	70	38	44	19	4	110	3.8	0.2	13	3.0
1981	72	47	33	14	4	128	3.9	0.2	15	3.2
1991	81	60	29	15	6	176	4.4	0.6	25	4.1
2001	70	50	21	11	8	217	4.1	0.9	36	5.0
2011	66	60	24	16	14	263	4.3	1.8	51	5.9
2021	73	65	31	18	19	427	6.5	3.1	91	10.3
% increase	25.9	171	-23	-18	533	228	97	1450	1720	390

Source: Agricultural statistics at a glance (2023).

The provided graph illustrates the per capita availability of pulses and edible oils, showcasing a consistent increase in the per capita availability of edible oil over the years. In 1951, the per capita availability of pulses stood at 22 kg per year. Over the following decade, this figure gradually increased to 25 kg as pulses area and production expanded during pre-green revolution period. However, green revolution period onwards, the per capita availability of pulses declined and reached the lowest level in year 2001, from then onwards there some improvement and by 2021, it increased to 18 kg. As against pulses, edible oils consumption is constantly increased over the year, not due to increased production, but due to liberal import policies and imports constitute about 60-70% edible oils consumption, whereas only 10% in case of pulses.

Table 5. Frequency of pulses consumption by men and women in 2015-16

Frequency of consumption	Men		Women	
	2005-06 (%)	2015-16 (%)	2005-06 (%)	2015-16 (%)
Never	0.9	0.4	0.9	0.6
Daily	52.1	46.5	52.7	44.8
Weekly	38.6	44.1	36.8	45.1
Occasionally	8.4	9.0	9.6	9.5
All	100.0	100	100	100

Source: NFHS round 4 and NFHS round 3

The Table 5 illustrates the frequency of pulses consumption among men and women. In the 2005-06 period, about 52% of the men and women were consumed pulses daily, remaining 37-39% consumed weekly, 8-10% consumed occasionally. There is no much difference between men and women. Less than 1% never consumed pulses in the last 30 days of the survey (in a month). Between two periods, there was slight decrease in frequency of consumption by daily consumers. This slight decline may be due to increased availability and consumption of substitutes like vegetables and with meat and chicken products, wherever incomes households increased.

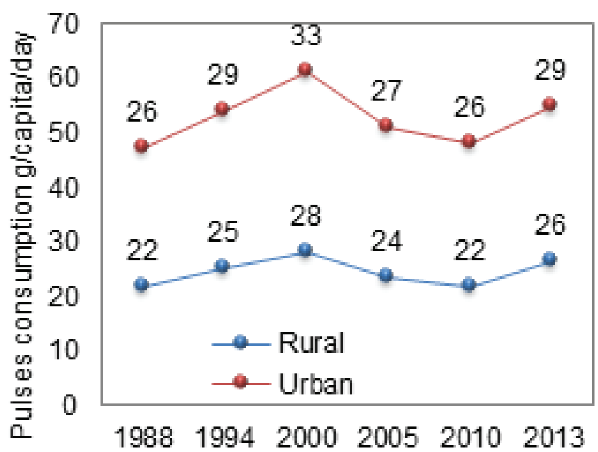

Fig. 11. Pulses consumption g/capita/day (rural and urban). Source: NSSO (2013) Consumption Expenditure 68th round (2011-12) and various rounds

While there is no notable difference between men and women in the consumption of pulses, a substantial gap has persisted between rural and urban consumers since the 1980s. The most recent data available from the National Sample Survey Organization (NSSO) for household consumption, as of the year 2013 (Fig. 11), indicates that urban consumption is 29 g/day/capita, whereas rural consumption is slightly lower at 26 g/day/capita. Despite a slight increase in pulses consumption in both urban and rural areas, the persistent gap underscores the need for policy action to address this disparity.

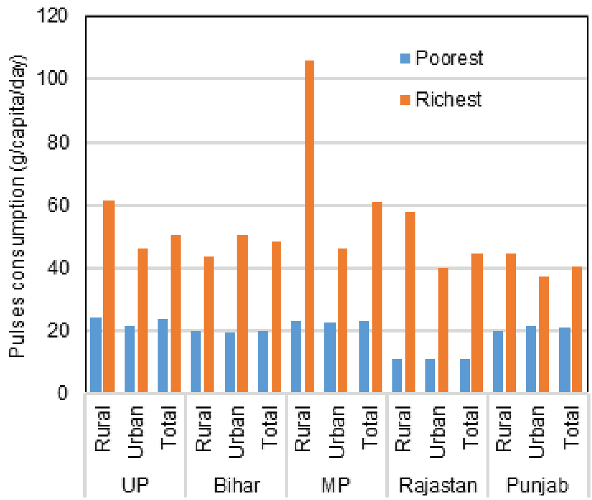

Fig. 12. Pulses consumption by poorest and richest consumers (g/capita/day) in 2011-12. Source: NSSO (2013) Consumption Expenditure 68th Round Survey

The NSSO 2013 report highlights a significant disparity in pulses consumption between the poorest and richest consumers, with this gap persisting across all states. Notably, the consumption gap between the rich and poor is more pronounced than the urban-rural divide (Fig. 12). Even in rural areas, the wealthiest individuals are surpassing the recommended dietary allowances, exemplified by the case in Madhya Pradesh where the richest consume over 100 g/capita/day, while the poorest only consume 20 g/capita/day. However, in developed states like Punjab, the gap between the richest and poorest is comparatively less. This underscores the need for targeted government schemes aimed at distributing pulses to the poorest segments of the population. Such interventions could play a crucial role in bridging the consumption gap and ensuring that all sections of society, particularly the economically disadvantaged, have access to an adequate and nutritious diet. Recently, the central government has provided state governments with greater flexibility to include additional items in the Public Distribution System (PDS) to address local needs. Notably, pulses acquired through the Price Stabilization Buffer and Price Support Scheme are now made available to states and Union Territories for distribution through the PDS.

DOMESTIC PULSES MARKETS

Indian foodgrains markets are highly complex. That too pulses markets are much more complex. There are many pulse crops, many different types of value-added products of varying quality exist in the markets. There a significant portion import and export of pulses in addition to the large domestic market. In addition to the trading in regulated *mandis*, the pulses also traded in weekly village markets in loose form, they are also sold in the form of packaged products in big retail shops. Data from the Ministry of Agriculture and Farmers Welfare highlights a noteworthy increase in the area dedicated to pulses cultivation, rising from 24.91 million hectares in 2015-16 to 30.37 million hectares in 2021-22. In the same timeframe, production escalated from 16.32 million tonnes to 26.96 million tonnes, with a corresponding increase in yield from 656 to 888 kg per hectare. Concurrently, pulses import during the same period reached 2.7 million tonnes. While India actively participates in imports of pulses during the last three decades, there is a noticeable trend indicating a decreasing dependence on imports. The import reliance has demonstrated a significant decrease, dropping from 19% in 2013–2014 to approximately 9% in 2021–22. Projections suggest that this trend is expected to continue, with import dependence anticipated to further decline to about 3% by the year 2030–31. This shift reflects a growing self-sufficiency in pulses production within the country, aligning with efforts to enhance domestic agricultural capabilities and reduce external dependencies. These figures underscore the complex dynamics of India's pulse market, marked by a delicate balance between domestic production, import reliance, and export activities.

TIMELY AND ACCURATE ESTIMATION OF PULSES PRODUCTION

The issue of randomness in pulses cultivation poses a persistent and complex challenge. The growing period for pulses during the rainy season spans from July to November, while the winter season growing period extends from December to March. Estimates of pulse production are made over several months, with the 1st - advance estimates released in September and the 4th advance estimates in August of the following year. This timeline allows importers to plan and adjust their imports accordingly. However, the significant variation between the first and final estimates, as shown in Table 6, introduces uncertainty year after year. The gap between these estimates can influence decision-making for importers, prompting the need for modifications in contract quantity or price. The decision-making process for sales at all levels, both in domestic and international markets, tends to be ad hoc in nature, lacking long-term contracts. Furthermore, the limited world trade in pulses, with India being a major importer, increases the risk of price hikes by exporting countries as soon as India places large-scale import orders. This dominance in the global pulse trade by a single major importer adds an element of vulnerability to price fluctuations, emphasizing the need for strategies in terms of long-term government-to-government contracts to mitigate risks and uncertainties in pulse markets.

Table 3 illustrates the time trend of four advanced estimates of pulses production compared to the actual production realized for the crop years 2015-16 and 2016-17. The table highlights the progression from initial assessments to the final actual production figures, showcasing the level of uncertainty in advance estimates. For the crop year 2015-16, the 2nd advanced estimates for chickpea were 8.09 mt, while the actual realized production was 7.06 mt. Similarly, the 1st advanced estimates for mungbean were 0.86 mt, whereas the actual realized production for the same year was 1.59 mt. The total pulses production during the 2nd advance estimates was estimated to be 17.33 mt, but the actual realized production stood at 16.35 mt. This pattern of uncertainty in advance estimates is observed for the crop year 2016-17 and other years as well, emphasizing the challenges in accurately forecasting pulses production for planning for reducing demand and supply gap through imports.

BRIDGING DEMAND AND SUPPLY GAP

The demand for pulses has been on the rise due to increased incomes among consumers. However, post green revolution phases, pulses have been relegated to low-fertile lands, and there has been a lack of investment in seeds, fertilizer, and irrigation. This has led to a stagnation in pulses production, except for chickpea. Indian pulses productivity, at about 800 to 900 kg per hectare, is only half of the productivity in Myanmar and China, and approximately a quarter of the productivity in developed economies. The per capita availability of pulses in India has witnessed a decline from 24 kg/capita/year in the 1960s to 12 kg/capita/year in 2022. This is well below the ICMR recommendation of 15 kg/capita/year. The growing demand-supply gap has resulted in a persistent increase in pulse prices, further exacerbating the challenges faced by consumers. Addressing these issues would require targeted interventions to improve productivity through better agricultural practices and increased investment in the pulses sector (Reddy, 2013).

MINIMUM SUPPORT PRICE AND PROCUREMENT

The Fig. 13 illustrates the Minimum Support Price (MSP) for pulses along with its competing crops. In the initial years from 1991 to 2006-07, the government announced only incremental growth in MSP. However, from 2007-08 onwards, there was a noticeable increase in the MSP for pulses, and this growth was slightly faster than that for competing cereal crops. This move aimed to incentivize pulses production by farmers and reduce growing imports. A significant boost in pulses MSP occurred from the year 2017-18 onwards, with the objective of further incentivizing pulses production to counteract the

Table 6. Timeline of information flow of production advance estimates (mt)

Crop	1st advance estimates	2nd advance estimates	3rd advance estimates	4th advance estimates	Final
	2015-16				
Pigeonpea	2.61	2.55	2.60	2.46	2.56
Chickpea		8.09	7.48	7.17	7.06
Urdbean	1.37	1.74	1.88	2.20	1.95
Mungbean	0.86	1.55	1.59	1.60	1.59
Pulses	5.56	17.33	17.06	16.47	16.35
	2016-17				
Pigeonpea	4.29	4.23	4.60	4.78	4.87
Chickpea		9.12	9.08	9.33	9.38
Urdbean	2.01	2.89	2.93	2.80	2.83
Mungbean	1.35	2.13	2.07	2.16	2.17
Pulses	8.70	22.14	22.40	22.95	23.13
Date of estimations	22.9. 2016	15.2. 2017	9.5.2017	16.8. 2017	

Source: Directorate of Economic and Statistics (2023b); Advance Estimates of Agricultural Production, Department of Agriculture & Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India.

steep rise in imports. Despite MSP being announced for major pulse crops in both *kharif* and *rabi* seasons, there has been limited procurement. The lack of procurement at MSP poses a challenge, as effective MSP implementation requires actual procurement to support farmers. In recent years, MSP for pulses is primarily serving as a signal price, and during the harvest period, farm gate prices often remain below the announced MSP. This situation underscores the need for effective procurement mechanisms to ensure that the higher MSP translates into tangible benefits for pulse farmers and encourages increased production.

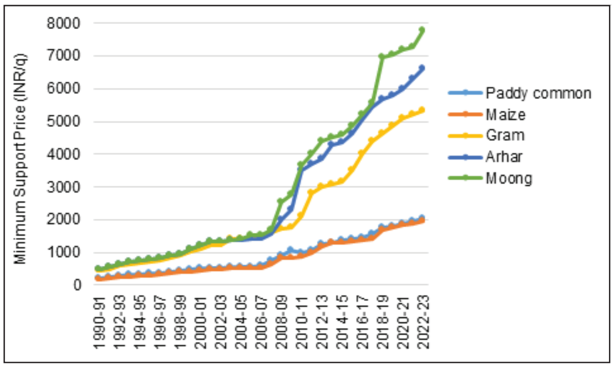

Fig 13. Minimum Support Price of different crops (INR/q). Source: RBI (2023) Handbook of Statistics on Indian Economy

Table 7 presents the procurement of rice, wheat, and pulses in relation to their production. Since 2015-16, rice procurement and wheat procurement have remained within the ranges of 33% to 43% and 24% to 36%, respectively. Past research indicates that procurement exceeding 20% of production at MSP can have a significant positive influence on market prices. In the case of paddy and wheat, procurement has consistently been above 25% of production at the all-India level, suggesting a positive impact on open market prices. In contrast, pulses procurement started in the year 2017-18 with only 6.4% of production being procured. The maximum procurement occurred in the year 2018-19, reaching 18.9%, but in the following year, it decreased to 6.5%. Practically, the procurement of pulses is negligible, indicating a need for improvement to incentivize pulses production. Strengthening procurement mechanisms for pulses could play a crucial role in supporting farmers and enhancing overall pulses production.

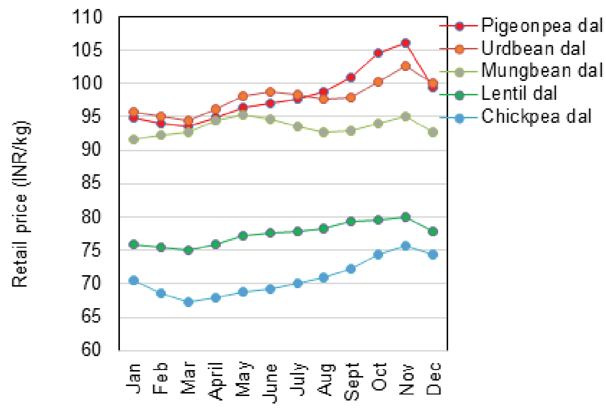

Fig. 14. Seasonal variation in retail prices of dal of different pulse crops (INR/kg: average of 2014-2023). Source: Department of Consumer Affairs (2024)

The Fig. 14 presents the seasonal variation in prices, showcasing average data from 2014 to 2023 for five pulses: Pigeonpea, urdbean, mungbean, lentil, and chickpea *dal*. The analysis reveals distinct patterns in price fluctuations over this period. Firstly, there is a notable correlation between the prices of different pulse crops. For instance, if the production of pigeonpea decreases, the prices of pigeonpea *dal* tend to increase. Consequently, some consumers may shift from pigeonpea dal to other pulses, leading to an increase in the prices of those alternatives. This interconnectedness in prices highlights the interdependence of various pulses in the market. Secondly, there is a clear seasonality in

Table 7. Procurement of rice, wheat, and pulses

Year	Rice		Wheat		Pulses	
	Production (lakh tonnes)	Procurement (% of production)	Production (lakh tonnes)	Procurement (% of production)	Production (lakh tonnes)	Procurement (% of production)
2015-16	1044.1	32.8	922.9	24.9	163.0	0
2016-17	1097	34.7	985.1	31.3	231.0	0
2017-18	1127.6	33.9	998.7	35.8	254.0	6.4
2018-19	1164.8	38.1	1036.0	32.9	221.0	18.9
2019-20	1179.4	43.3	1071.9	36.4	232.0	6.5

Source: http://164.100.24.220/loksabhaquestions/annex/178/AU3447.pdf

Source: Lok Sabha Unstarred Question No.3447 Answered On 23rd March, 2022 prices. As a considerable portion of pulses comes from the *rabi* harvest (such as chickpea and lentil), prices of *rabi* pulses begin to decline from February, reaching their lowest point in March. During this time, the low prices of chickpea and lentil contribute to dragging down the prices of other pulses. Conversely, when stocks are depleted, and there is minimal inventory in warehouses, awaiting the *rabi* harvest (October-November), prices tend to peak, especially for pigeonpea, urdbean, and mungbean *dal*. The rise in the prices of these pulses also exerts upward pressure on chickpea and lentil prices during these months. To address these seasonal price variations, there is a recognized need for low-cost storage infrastructure at the village level. Such infrastructure could help balance the impact of seasonal fluctuations by providing storage solutions that alleviate the pressure on prices during periods of low supply and high demand.

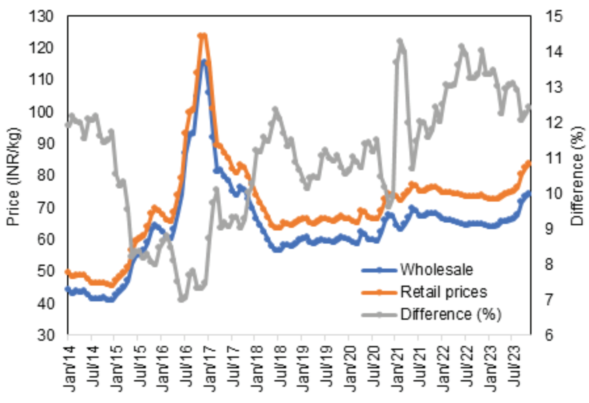

Fig. 15. Wholesale and retail prices of chickpea dal (INR/kg). Source: Department of Consumer Affairs (2024)

Fig. 15 illustrates the wholesale and retail prices of chickpea dal measured in INR/kg, along with the corresponding percentage difference. The data provides insights into the dynamics of the relationship between wholesale and retail prices, indicating their interdependence. In periods of rising prices, the gap between wholesale and retail prices tends to narrow. This suggests a partial transmission of the increase in wholesale prices to retail prices during upward price trends. This dynamic helps smooth the burden on consumers during times of price increases. Conversely, in scenarios of declining prices, the gap between wholesale and retail prices widens. This widening gap implies increased margins for traders at the expense of consumers. During steep price movements, whether upward or downward, the margins of traders tend to narrow, and adjustments to normal profits occur after some lag. Overall, the pulses market appears to be functioning normally, with no excessive difference observed between wholesale and retail prices. The observed trends reflect a responsive and dynamic market where changes in wholesale prices are transmitted, albeit with some lag, to retail prices. This mechanism helps maintain a balance in the market, benefiting both traders and consumers.

PULSES GLOBAL PRODUCTION AND TRADE TRENDS

Pulses hold a ubiquitous presence in numerous cuisines worldwide and play a vital role as a primary source of protein, particularly for the predominantly vegetarian population of the Indian subcontinent. Global production of pulses ranged between 77 and 80 million tonnes according to FAOSTAT (2023). Dry beans constitute the largest share at 32%, followed by chickpeas (16-17%), dry peas (8 to 15%), cowpeas (9 to 14%), lentils (5 to 6.5%), pigeonpeas (6 to 7.5%), and broad beans (3 to 6%). Asia contributes approximately 45 to 50% of the total pulses production, and India alone contributes about half of this output. While some crops, such as chickpeas, are produced and consumed globally, forming an active world spot market, others, like pigeonpea, are predominantly cultivated and consumed in India. About 20% of the world's pulses production is traded, with over 50% of peas, lentils, and pigeonpea being traded globally. In contrast, only 13% of chickpeas are traded. The volume of traded pulses has increased from 2.9 million metric tons in the 1980s to approximately 15.59 million tonnes by 2021. Developing countries account for 82% of global pulses imports, with Asia representing the largest share at 59%. India stands out as the world's largest importer, contributing to about 25% of the global pulse imports (Joshi and Rao, 2017). This highlights the significant role of pulses in international trade, with India playing a pivotal part in the global pulse market.

PULSES PRODUCTION AND IMPORTS IN INDIA

India is a major producer, consumer, and importer of pulses over the past fifty years in the world. First time, India crossed production of 25 mt in 2017-18, then after production is above 22-23 mt, during the last three years (2021 to 2023), production remain higher than 25 mt, with chickpea (40%), pigeonpea (13%), mungbean (10%), urdbean (10%), and lentil (10%) being the prominent pulses. Over the fifteen years from 2004 to 2022, pulses cultivation in India increased at an average rate of

3-4% per annum. However, the demand for pulses grew at a faster rate of 5-6% per annum, resulting in an annual demand of about 30 mt. This demand led to imports of approximately 7 mmt per annum in initial years, but later on due to increased production beyond 25 mt, imports reduced to 2-3 mt. India's share of the world's pulse imports is substantial, ranging from 25 to 30%. Notably, pulse types such as peas, pigeonpea, urdbean, and mungbean, India's share exceeds 80%. The year-to-year variation in imports and exports exhibits wide variability, further complicated by the concentration of production and trade in a few countries (Fig. 16). The major contributors to global pulse trade include Canada (41%), Australia (12%), Myanmar (11%), the USA (10%), China (7%), and Russia (4%). This concentration highlights the importance of these key players in influencing global pulse markets and trade dynamics.

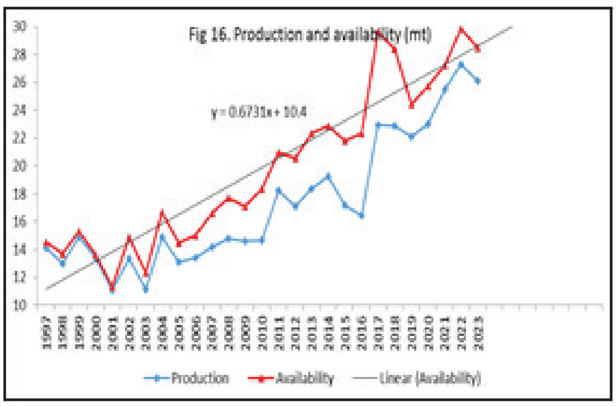

Fig. 16. Production and availability of pulses in India. Source: Agricultural Statistics at a Glance (2023)

CHANGING INTERNATIONAL TRADE PARTNERS

In the early 2000s, major pulses exporters included Canada, Australia, the USA, Myanmar, Tanzania, Thailand, and Russia. In recent years, Mozambique, China, and Ethiopia have emerged as exporters. During the early 2000s, Canada, Australia, Myanmar, and Russia emerged as significant importers in the Indian trade market. In the Indian trade market, the dominance in imports is primarily held with five pulses: Peas, Chickpea, Mungbean/ Urdbean, Lentil, and Pigeonpea. Among the major trade contributors, for each pulse type, imports are dominated by only one country–- Peas (Canada 60.97%), Chickpea (Australia 74.4%), Mungbean/ Urdbean (Myanmar 70.37%), Lentil (Canada 89.58%), and Pigeonpea (Myanmar 46.35%) (Table 8). Myanmar also serves as a leading exporter of mungbean and urdbean, and Mozambique emerged as pigeonpea exporter. The diversity in pulses suppliers present varying negotiation dynamics for India. In certain cases, such as with Canada, India may negotiate with countries in a relatively superior bargaining position, while in other cases, such as with Myanmar, India may have the upper hand in negotiations. This diversity underscores the complex and dynamic nature of the global pulse trade landscape and the scope for the simultaneous existence of *adhoc* imports in spot markets, as well as the potential for long-term government-to-government contracts, as is currently the case with Mozambique and Myanmar.

Table 8. India's major trade partners (Triennium Ending 2021)

HS Code	Pulses	Top five import sources
7131000	Peas	Canada (60.97%), Russia (14.26%), USA (6.96%), France (5.36%), Luthuania (4.15%)
7132000	Chickpea	Australia (74.4%), Russia (16.49%), Tanzania (2.79%), Myanmar (0.92%), USA (0.74%)
7133100	Mungbean/ Urdbean	Myanmar (70.37%), Kenya (7.43%), Australia (6.32%), Tanzania (3.15%), Uzbekistan (2.6%)
7134000	Lentil	Canada (89.58%), USA (7.47%), Australia (2.88%), Turkey (0.03%), Mozambique (0.03%)
7136000	Pigeonpea	Myanmar (46.35%), Tanzania (18.71%), Mozambique (15.36%), Malawi (12.56%), Sudan (3.36%)

Source: DGFT (2024). Note: Figures in parenthesis are % of different countries contribution to India's imports

OLIGOPOLY AND INSUFFICIENT INTERNATIONAL TRADED QUANTITY AND ADHOC IMPORT POLICY

The global pulse market faces challenges because only a limited number of countries produce pulses in significant quantities for export, resulting in thin and dominated world markets. Given India's status as the world's largest pulses importer, its signals for the need to import due to unexpected domestic shortfalls can have a pronounced impact. In such scenarios, the few countries capable of supplying pulses respond by increasing their prices. Even if India is willing to pay higher prices, there may be instances where pulses, particularly varieties like pigeonpea, mungbean, and urdbean, are not readily available in the international market. Conversely, when India's production exceeds forecasts, domestic prices initially fall. This drop in domestic prices is then followed by a decrease in import prices, as there is limited absorption for the international trade surplus. This situation can lead to a glut in both domestic and international prices, as observed in the 2018-19 period. The dynamics of the global pulses market underscore the vulnerability of prices to fluctuations in production, demand, and supply, especially given the limited number of key exporting countries.

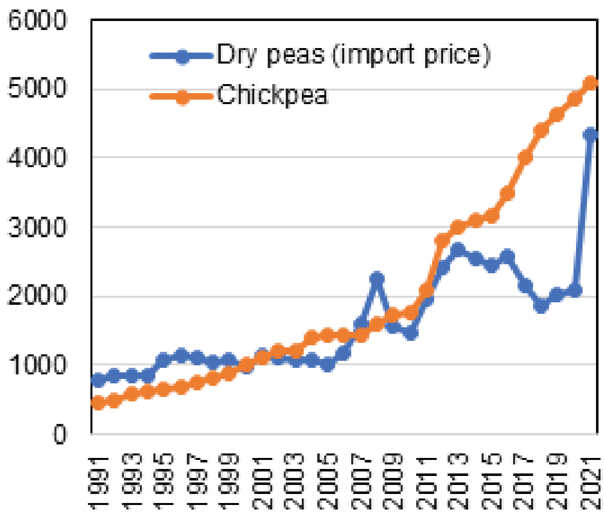

Fig. 17. Parity between domestic price of chickpea and imported dry peas (INR/q). Source: FAOSTAT (2024).

The graph illustrates the parity between the domestic prices of chickpeas and the imported dry peas in India, both measured in INR/q. In the initial years, there seems to be a relatively close alignment between the two, with minimal divergence, and both ranged between INR. 800-900/q. However, after 2011, the import prices of dry peas fell significantly below the domestic chickpea prices, making imports more competitive. This trend indicates that the cost advantage of importing dry peas, which are more affordable in the global market, enables their blending with other pulse products like chickpea besan in the domestic market. The resulting blended product can be sold at higher prices, contributing to the competitiveness of dry peas imports in India. This shift in price dynamics after 2011 indicates the changing dynamics in the import and domestic pricing of pulses in the Indian market.

AD-HOC IMPORT POLICY DESTABILIZES EQUILIBRIUM PRICE

The practice of implementing stop-gap imports as a policy response to frequent increases in domestic prices is suitable in scenarios where India's share of imports is negligible compared to the global tradable surplus, ensuring that India's import decisions do not significantly impact prices. Nevertheless, the particular challenges presented by the pulses market, marked by inadequate quantities in international markets and India's significant reliance on imports, complicate this approach. When India ventures into the global market for pulse imports, exporters tend to raise prices, placing India at a disadvantage. Recognizing this challenging position, the Indian government entered into contracts in 2016 with countries like Mozambique and Myanmar to secure pulses imports. Unfortunately, the inherent shipping lead-times associated with such arrangements resulted in both the imported pulses and the domestic harvest entering the retail market simultaneously, leading to a subsequent crash in prices. To address these issues, there is a pressing need to enhance the statistical accuracy of advanced estimations of production. Moreover, there is a crucial necessity to align import and export policies based on statistical data, replacing the current practice of ad-hoc imports and export bans triggered by shortages. This strategic shift to long-term government-to-government contracts is essential for creating a more stable and predictable market environment.

HISTORY OF ADHOC PULSES TRADE POLICIES IN INDIA

India's policies pertaining to agricultural exports and imports have historically been ad-hoc responses aimed at stabilizing domestic price trends (Saini and Gulati, 2017; Mu *et al.*, 2022). When

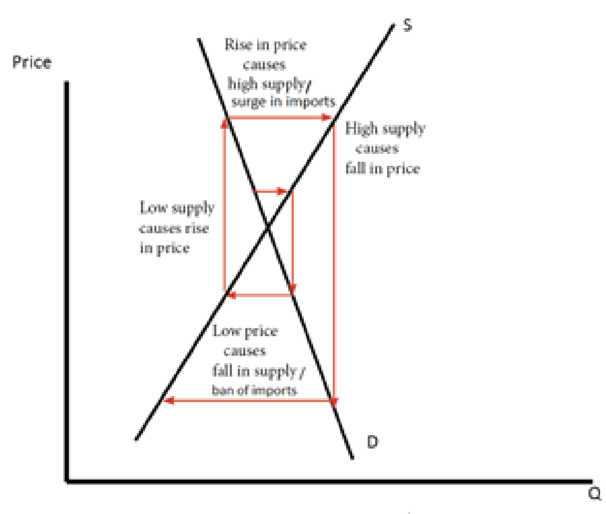

Fig. 18. Adhoc imports and cob-web spiraling of domestic prices

faced with rising prices, the government has often resorted to export bans and abrupt tariff increases as measures to control retail prices. Unfortunately, these interventions, driven by short-term goals, lack consideration for long-term commitments and the prospects of farmers. The consequence of these ad-hoc policies and interventions in free markets has been the emergence of the cobweb phenomenon in prices, characterized by periodic cycles of gluts and booms. This cyclical pattern reflects the challenges and unintended consequences arising from reactive policy measures, emphasizing the need for a more systematic and forward-looking approach to agricultural trade policies in India.

NEED FOR LONG RUN STABLE POLICY

In 2018, the Government of India, in its draft agricultural export policy, underscored the importance of establishing a stable and predictable agricultural import and export policy. The goal is to revitalize the entire value chain, spanning from farm production and processing to transportation, infrastructure, and market access. The agricultural production landscape, including pulses production, is particularly susceptible to the unpredictable nature of monsoons. Typically, only three out of every five years' experience normal monsoon patterns, with the remaining two years characterized by either severe deficits or excessive rainfall. Predicting which years will be normal is a challenging task. Unlike staple crops such as paddy and wheat, which benefit from large-scale procurement and mandated maintenance of buffer stocks to stabilize consumption and prices, pulses face a different scenario. Pulses, being in short supply both domestically and internationally, often have negligible buffer stocks. The unstable domestic supply, coupled with significant year-to-year variations in import demand, poses challenges. Additionally, the limited international supply of pulses necessitates the development of long-term import contracts to ensure a stable and secure market. This highlights the unique considerations and complexities associated with the import and export dynamics of pulses in the global agricultural landscape (Fig. 18). Pulses demand supply model in an open market scenario is presented in Fig. 19. The model clearly depicts that technology, subsidies and prices of both inputs and outputs play an important role in area and yield of pulse crops, which in turn decides production and supply. MSP and storage infrastructure also determine the total supply. On the demand side pulses demand is determined by incomes of consumers, population, and prices. The demand comes from food, feed and seed. The equilibrium between demand and supply can be adjusted by exports and imports. All these aspects are covered in this paper,

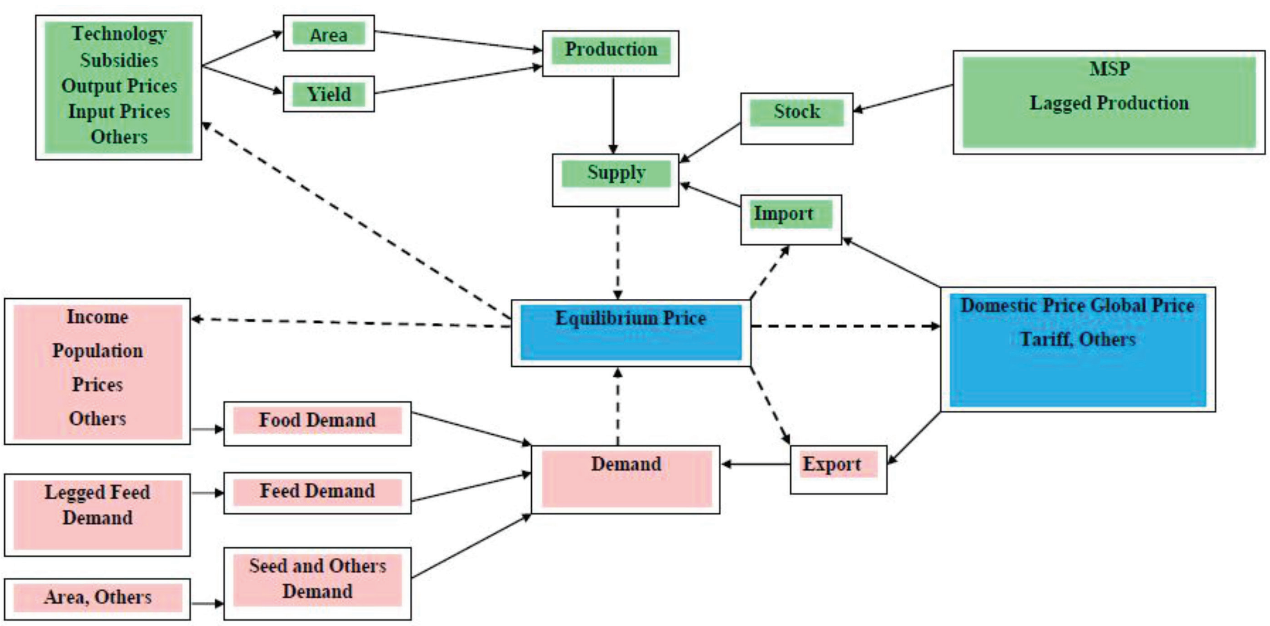

Fig. 19. Pulses demand and supply economic model

EXISTING GOVERNMENT SUPPORT FOR PROMOTION OF PULSES

Indian government introduced many government schemes to increase production and consumption of pulses time to time, which contributed to enhanced production of pulses over the years (Ministry of Agriculture and Farmers Welfare 2024). A brief description of the schemes is mentioned below.

- NFSM-Pulses Implementation: The Department of Agriculture and Farmers Welfare (DAFW) executes the National Food Security Mission Programme (NFSM) to boost pulses production in identified districts nationwide. NFSM-Pulses operates in 644 districts across 28 States and 2 Union Territories, providing farmers assistance for various interventions such as cluster demonstrations, distribution of high-yielding varieties, farm machineries, water application tools, and more. Certified seeds are also supplied free of cost, and 150 Seed Hubs have been established since 2016-17, producing over 1 lakh quintals of quality pulses seeds.
- Enhanced Seed Availability: The Indian Council of Agricultural Research (ICAR) conducts research in collaboration with State Agricultural Universities to develop high-yielding varieties and production packages for pulses. From 2014-2023, 343 high-yielding varieties/hybrids have been notified, and approximately 86,015 quintals of breeder seed were produced in the last five years, supporting the conversion into certified seed for farmers.
- Crop Diversification Program (CDP) under RKVY: Initiated in 2013-14 in original Green Revolution States and expanded to 17 States/ Union Territories, CDP aims to diversify crops, including pulses, through field demonstrations. A pilot project for diversifying 4.85 million hectares is set for five years (2023-24 to 2027-28) in 75 identified districts.
- Pradhan Mantri Annadata Aay Sanrakshan Yojna (PM-AASHA): Implemented since 2018, PM-AASHA comprises three sub-schemes: Price Support Scheme (PSS), Price Deficiency Payment Scheme (PDPS), and Private Procurement & Stockist Scheme (PDPS). It addresses gaps in procurement schemes, with states actively involved in physical procurement under PSS. Private sector participation under PDPS is an option.
- Strategic Buffer Stocks of Pulses: Buffer stocks stabilize prices by releasing pulses to discourage hoarding. Pulses from the buffer support welfare and nutrition schemes, including the Public Distribution System (PDS).
- Distribution of Pulses to States/UTs for Welfare Schemes: Since 2019, this scheme disposes of pulses procured under PSS by distributing them to States/uTs for welfare programs. A subsidy of INR 15 per kg supports disposal, transportation, processing, and distribution for various schemes.
- Price Stabilization Initiatives: Chickpea and mungbean stocks from PSS and Price Stabilization Fund (PSF) buffer are released to moderate prices. Chana is supplied to states at a discount for welfare schemes, and""Bharat Dal"" produced from government stock, is distributed at subsidized rates.
- TRFA-Pulses under NFSM Programme: Targeting Rice Fallow Area (TRFA)-Pulses, under NFSM, focuses on utilizing land left fallow after *kharif* paddy harvest. It introduces appropriate pulse varieties during Rabi season through technological interventions in 11 states.
- Reducing Postharvest Losses: Postharvest losses in pulses range from 6.36% to 8.41% (ICAR-CIPHET 2015) and 5.65% to 6.74% (NABCONS 2022). The Ministry of Food Processing Industries, under the Pradhan Mantri Kisan Sampada Yojana (PMKSY), implements schemes to create post-harvest infrastructure, reducing losses and enhancing value addition in the food processing sector.

POLICY RECOMMENDATIONS

Although there is a huge effort from the government to promote pulses, still there exists policy bias against pulses, which needs to be removed and policy needs to be reoriented towards promotion of pulses. Based on the above results in different sections, a comprehensive set of recommendations to address the neglect of pulse crops and promote their cultivation, considering their positive externalities are presented below

- Compensation for Positive Externalities: Advocate for compensating the positive externalities of pulses cultivation through government incentives.

- Quantifying Positive Externalities: Conduct a quantitative assessment of the positive externalities associated with pulses to guide policymakers in determining the appropriate level of incentives. This could include factors such as lower fertilizer, pesticide, and water use, reduced greenhouse gas emissions, and contributions to soil health through nitrogen fixation.
- Neutralizing Biased Subsidies: Propose the replacement of biased subsidies, particularly those embedded in fertilizers like Urea, with neutral direct money transfers. This aims to level the playing field for pulses compared to high-input-intensive crops like paddy and wheat.
- Enhancing Market Linkages and Infrastructure: Under the 'one-district one-product' initiative, recommend improvements in market linkages and infrastructure to promote pulses and pulse-based value chains. This can facilitate better access to both domestic and international markets for pulse farmers.
- Inclusion in Government Schemes: Advocate for the inclusion of pulses in various government schemes targeted towards poverty alleviation. This can ensure that the benefits of these schemes reach pulse farmers, contributing to their economic well-being.

These recommendations collectively aim to create a supportive policy environment for pulses cultivation, acknowledging and addressing the unique advantages and positive externalities associated with these crops.

CONCLUSIONS

The paper highlights the imperative of conducting a comprehensive assessment of crop profitability, particularly in the context of pulses production in India. It emphasizes that the disproportionate incentives directed towards paddy and wheat have led to a decline in the relative profitability of pulses, influenced by skewed subsidies. While market prices alone may suggest lower profitability for pulses, a holistic evaluation that incorporates social pricing—taking into account subsidies and externalities—reveals that pulses confer significant macro-level benefits to the economy. Pulses, with their non-market characteristics such as nitrogen fixation, lower greenhouse gas emissions, reduced use of fertilizers and pesticides, and water efficiency, contribute positively to the environment. Moreover, pulses play a crucial role in sustainable agriculture by enhancing soil fertility. Additionally, they contribute to human nutrition by addressing prevalent protein malnutrition. Recognizing these broader implications, policymakers are urged to formulate balanced policies that not only support farmers but also prioritize the long-term well-being of society and the environment

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