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Should Sri Lanka Attempt to Achieve Self-Sufficiency in Pulses?

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Agriculture is the mainstay of Sri Lanka's rural economy and employs about 26.5 percent of the country's total employed population, rural and urban (Department of Census and Statistics [DCS] 2023a). Paddy occupies the largest portion of cropland; tea, rubber, coconut, spices, fruits, vegetables, pulses, and other cereals occupy the rest (Thibbotuwawa 2021; Senanayake and Premaratne 2016; Adhikarinayake 2005). Nonetheless, food and nutrition security remain a major challenge: nearly 3.9 million people, or 17 percent of Sri Lankans, experience moderately acute food insecurity; nearly 10,000 are severely acute food insecure; and 56 percent of households have adopted food-based coping strategies, including reducing meal portion sizes (36 percent) and skipping meals (19 percent) (FAO 2023a). Moreover, the prevalence of underweight in women and anaemia in adolescent girls and women is high in South Asia (UNICEF 2023), and micronutrient (iron, zinc, and/or folate) deficiencies are also highest there (72 percent).

Even though rice is not considered a quality protein source, it is the principal source of protein in the Sri Lankan diet with an average annual per capita consumption of 114 kilograms (kg). Pulses are Sri Lanka's third major protein source. A rich source of amino acids, pulses provide protein particularly to the rural and urban poor, estate residents, and vegetarians. However, pulses comprise only 8 percent of Sri Lanka's per capita protein supply (DCS 2023b). Consumption of quality protein in Sri Lanka is declining (Global Food Security Index 2015), with the country ranked among the bottom 5 of 22 Asian and Pacific countries on this indicator (EIU 2015). Calories derived from protein are less than the recommended intake for Sri Lankans (Esham et al. 2017). The Indian Council of Medical Research recommends a daily intake of 40 grams (g) of pulses, equivalent to 14.6 kg per year for a balanced diet for an average sedentary man (Rampal 2016). Per capita availability of pulses for consumption in Sri Lanka is 8 kg/year, nearly half the recommended quantity (DCS 2023b). Thus, Sri Lankans may not consume an adequate amount of quality pulses.

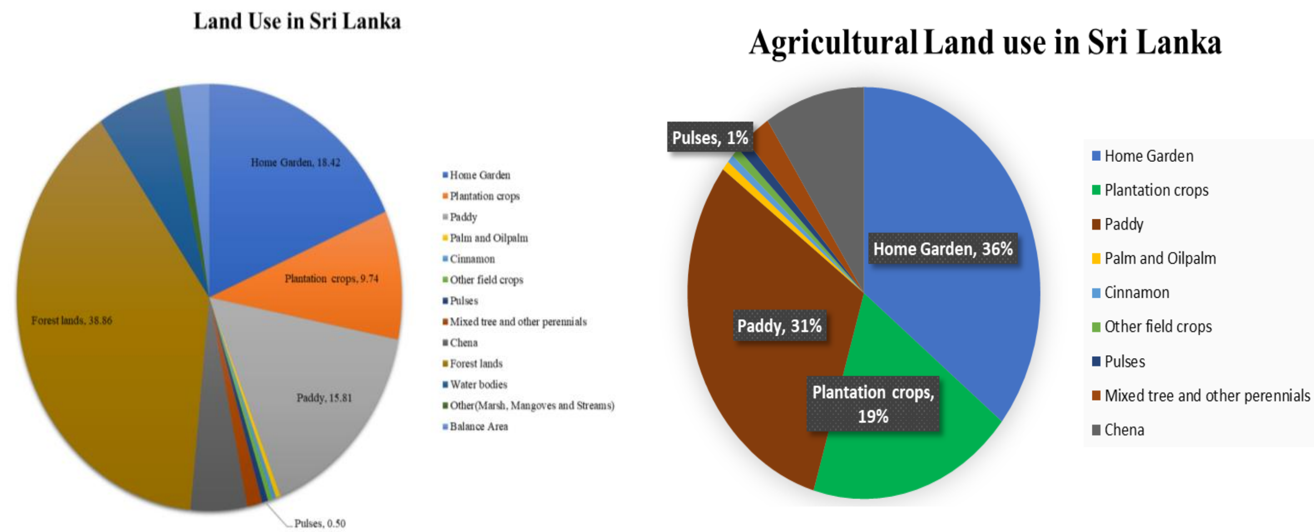
In Sri Lanka, pulse production is also at a crossroads. Pulse-based farming systems help mitigate climate effects by fixing atmospheric nitrogen to enrich soil fertility and increase its organic content. Despite these benefits, Sri Lankan pulse production remains low, and actual yields are much lower than their potential (Malaviarachchi et al. 2019). Anecdotal evidence indicates that increasing yield will require in-depth adaptive research on locality-specific innovations and approaches (Ray et al. 2023; Fernando 1972). Expanding area under pulses is possible through intercropping and cropping pattern changes, with an extension system to guide farmers on appropriate technology and market access. Pulse imports can help meet the demand. Sri Lanka introduced a liberalization regime in 1977, but policymakers aimed to draft protectionist policies to safeguard local farmers (Pursell and Ahsan 2011). A combination of local production and imports is needed to reduce long-term dependency on the latter.

This brief analyzes the trends in pulse production, consumption requirements, trade, and associated policy options and provides policy recommendations for sustainable pulse production to meet the dietary consumption and nutritional requirements of Sri Lanka's growing population.

Agriculture in Sri Lanka

Sri Lanka is South Asian island nation located in the Indian Ocean. Its total land area is approximately 65,610 square kilometers (km), or 6.56 million hectares (ha), half of which is used for agricultural purposes (Department of Agriculture [DOA] 2022). Paddy occupies 31 percent of all agricultural lands, while coconut, tea, and rubber together comprise 19 percent, and home gardens 36 percent (Figure 1). Pulses currently occupy less than 1 percent of agricultural land.

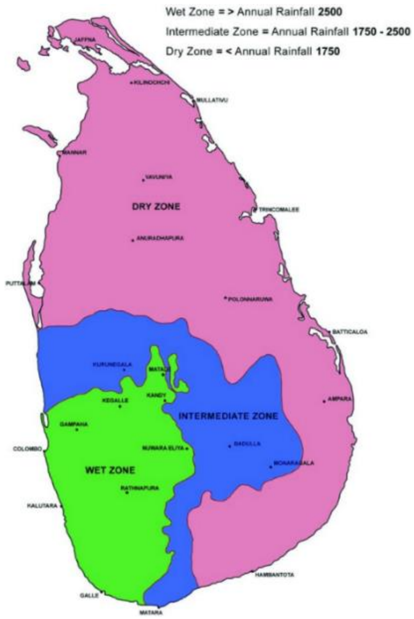
Figure 1: Land use in Sri Lanka



Source: DOA (2022), Agstat. Department of Agriculture of Sri Lanka.

Sri Lanka has three main agroclimatic zones: the Dry, Wet, and Intermediate Zones (Figure 2). These comprise 64 percent, 23 percent, and 13 percent, respectively, of all agricultural land. Sri Lanka's tropical monsoon climate has two distinct monsoons: the South-West Monsoon (SWM) (May–September) and the North-East Monsoon (NEM) (December–February). These correspond to two distinct cropping seasons: the major cultivation season, or *Maha* (October–March), follows the NEM rainfall; the minor cultivation season, or *Yala* (April–September), follows the SWM rainfall (Esham et al. 2017).

Figure 2: Agroclimatic zones in Sri Lanka



Pulse crops can be successfully cultivated in the Dry and Intermediate Zones with rainwater in the *Maha* season and under irrigated conditions in the *Yala* season. Sri Lankan farmers primarily cultivate four major pulses: Green gram, cowpea, black gram, and soybean, mainly in Hambantota, Monaragala, Ampara, Kurunegala, and Anuradhapura districts. On average over 2015–2022, green gram, cowpea, black gram, and soybean comprised 29.8, 27.3, 27.1, and 15.8 percent, respectively, of total pulse production in Sri Lanka (DOA 2022). Over 2015–2020, local pulse production was only 20 percent of total supply, with the rest imported (DCS 2023b; FAO 2023b).

Trends in Pulse Production in Sri Lanka

A compound annual growth rate analysis covering 1974–2022 indicates that in Sri Lanka the area under pulses increased by 7.87 percent over 1974–1990 but decreased by 1.56 percent over 1991–2022. Production of all pulses increased by 8.31 percent over 1974–1990 but exhibited a meager positive growth rate (0.09 percent) over 1991–2022 (Table 1). The area under green gram, cowpea, black gram, and soybean also increased by 9.51, 5.69, 11.42, and 15.69 percent, respectively, over 1974–1990, but over 1991–2022 green gram and cowpea areas decreased by 3.35 and 1.89 percent, respectively. Black gram (4.01 percent) and soybean (6.82 percent) exhibited minimal but positive growth rates. Production of other pulses showed a similar trend. Concurrently, the area under paddy increased by 0.59 percent between 1974–1990 and 1.28 percent between 1991–2022. Thus, it appears that the objective of self-sufficiency in pulses has been compromised.

Table 1: Growth in area and production of major pulses in Sri Lanka

	Area growth (%)		Production growth (%)	
Pulses	**1974–1990**	**1991–2022**	**1974–1990**	**1991–2022**
Green gram	9.51	-3.35	10.26	-1.62
Cowpea	5.69	-1.89	5.65	-1.34
Black gram	11.07	0.68	11.42	2.05
Soybean	15.69	4.01	15.39	6.82
Total pulses	7.87	-1.56	8.31	0.09
Paddy	0.59	1.28	3.9	2.41

Source: Economic and Social Statistics of Sri Lanka, Central Bank of Sri Lanka; DOA (2022). AgStat, Department of Agriculture of Sri Lanka.

While long-term growth statistics appear gloomy, a recent revival in pulses can be seen between 2015 and 2022, domestic production of green gram, cowpea, and black gram increased by 26.6, 66.12, and 91.92 percent, respectively (Table 2), possibly due to the national campaign to increase the productivity and production of pulses with improved varieties and technologies and subsidized inputs by the Ministry of Agriculture (Malaviarachchi 2019). Only soybean production dropped, from 11,254 metric tons (mt) in 2015 to 4,631 mt in 2022, a decrease of 58.85 percent.

Table 2: Area and production of pulses in Sri Lanka, 2015–2022

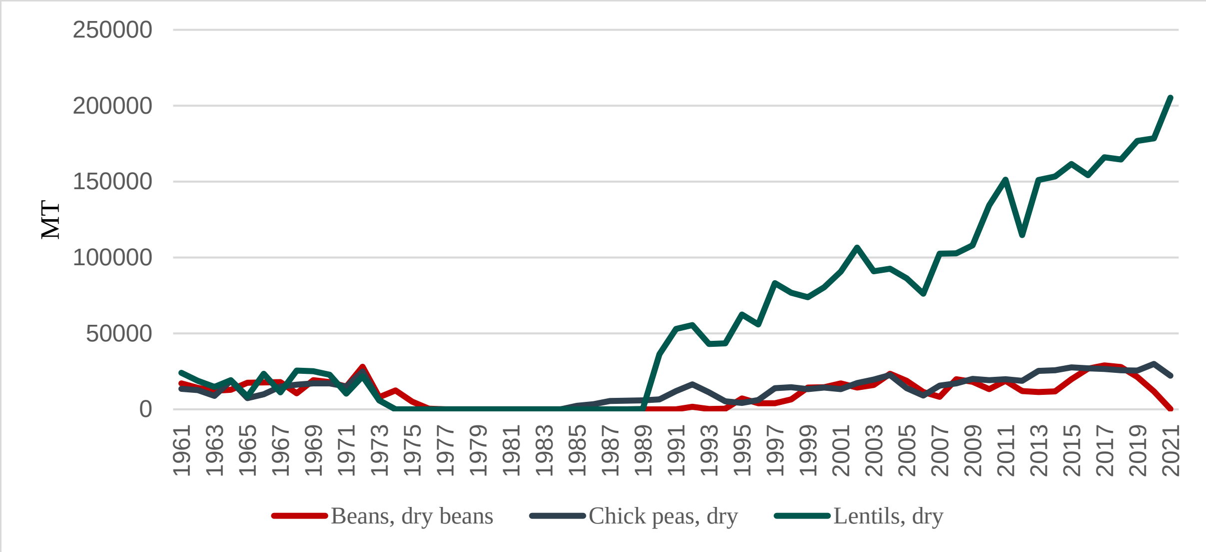
	2015	2016	2017	2018	2019	2020	2021	2022	% change from 2015 to 2022
Crop area (ha)									
Green gram	11346	11302	7371	8615	6156	10889	17841	14364	26.60
Cowpea	9200	8220	6807	9499	7196	11518	10431	15283	66.12
Black gram	12305	11159	8089	12976	5302	8812	13671	23616	91.92
Soybean	6383	6301	8316	1510	914	3538	1915	2481	-61.13
Crop production (mt)									
Green gram	15058	14546	9392	9856	7355	13497	18931	14163	-5.94
Cowpea	12276	13740	8576	11180	8067	13216	11878	15209	23.89
Black gram	11901	11197	7329	11852	4908	9562	14364	22545	89.44
Soybean	11254	7946	14363	2500	2197	7879	3793	4631	-58.85
All pulses	50489	47429	39660	35388	22527	44154	48966	56548	
Per capital production (kg/ person)	2.4	2.2	1.8	1.6	1.0	2.0	2.2	2.5	

Source: DOA (2022), AgStat, Dept. of Agriculture of Sri Lanka.

Trends in Pulse Imports to Sri Lanka

During the 1960s, Sri Lanka imported up to 50,000–60,000 mt of dry beans, chickpeas, and dry lentils, but between 1974 and 1990 these imports were negligible (FAO 2023b), evidence of the country's attempts to achieve self-sufficiency in pulses despite its extensive liberalization policy in 1977 (Figure 3). But after the 1990s, pulse imports rose: dry lentil imports alone exceeded 200,000 mt in 2021. Recent increases in imports can be attributed partly to the introduction of alternative pulses such as lentils to meet the growing population's increasing nutritional needs; and to the low prices of these alternative sources in international markets. Moreover, consumers prefer lentils over local pulses (Ariyawardana, Govindasamy, and Lisle 2015).

Figure 3: Pulse imports to Sri Lanka, 1961-2021



Source: FAO (2023b).

About 80 percent of Sri Lanka's total pulse supply is imported annually (DCS 2023b). Red lentils comprise the majority (64 percent), followed by chickpeas (11 percent), green gram (9 percent), and cowpeas (6 percent) (Table 3). Thus, pulse trade is an important strategy to meet the population's nutritional requirements.

Table 3: Total pulse imports, 2020

Pulse	Quantity (mt)	Share (%)
Green gram	24,249	9
Cowpeas	17,175	6
Black gram	10,025	4
Soybeans	13,136	5
Red lentils	174,879	64
Yellow lentils	3,568	1
Chickpeas	29,885	11
Total	**274,937**	**100**

Source: Food Balance Sheet (DCS 2021).

Sri Lanka imposes a 57.5 percent import tariff on green gram, 63.5 percent on cowpeas, 32.5 percent on black gram, 47.5 percent on soybeans, 17.5 percent on lentils, and 32.5 percent on chickpeas (Table 4) (Sri Lanka Customs 2021). The farmgate price of pulses is lower than their price after imposition of the tariff, indicating a very protectionist system. At the same time, the trade liberalization policy for lentil imports reduces border prices, but retail prices do not effectively change as they are affected by transport costs, middleman markups, competitors' prices, and availability of local substitutes (Nicita 2009).

Table 4: Import tariffs and prices of pulses (Rs./kg)

Pulse	General duty	Total tariff *	CIF value	Price after tariff	Farmgate price	Retail price
Green gram	40%	57.5%	164.69	286.32	227.57	309.86
Cowpea-White	46%	63.50%	127.11	247.38	219.31	349.42
Cowpea-Red	46%	63.50%	127.11	247.38	221.41	338.19
Black gram	15%	32.50%	154.40	274.91	227.57	309.86
Soybean	20%	47.50%	82.63	126.86	96.64	242.2
Red lentils (whole)	Free	17.50%	79.90	118.08		261.6
Red lentils (split)	Free	17.50%	112.38	174.73		261.6
Yellow lentils (whole)	Free	17.50%	84.13	120.59		
Yellow lentils (split)	Free	17.50%	107.24	128.39		
Chickpeas (whole)	15%	32.50%	141.82	202.13		
Chickpeas (split)	15%	32.50%	143.97	190.92		

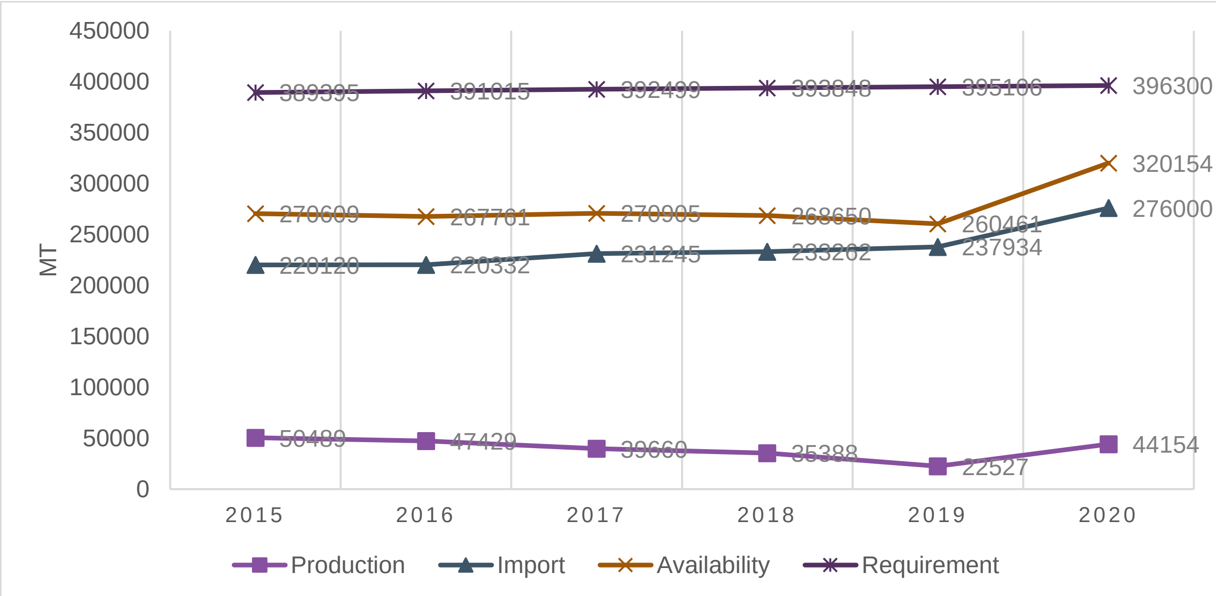
Note: Total tariff includes general duty, Value Added Tax (VAT), Cess, and Social Security Contribution Levy (SSCL). The total tariff value was calculated based on Sri Lanka Customs (2021). Though Department of Census and Statistics of Sri Lanka graphics show highly inflated prices of green gram and cowpea, due to the unavailability of published data the Cost, Insurance, and Freight (CIF) value, farmgate prices, and retail prices were extracted from AgStat DOA (2022).

Gaps in Sri Lanka's Supply of Pulses

The daily Recommended Dietary Allowances (RDA) of pulses for men and women are 60 g and 55 g, respectively (Gurusamy et al. 2022), or an average per capita requirement of 18 kg/year. But current domestic production of pulses contributes 2.5 kg/year/person (85 percent less than required). Hence, imports are needed to satisfy Sri Lankan's dietary requirements. Figure 4 maps the production, imports, total availability, and requirements of pulses in Sri Lanka. It indicates that the available quantity of pulses (production + imports) in Sri Lanka (320,154 mt) provides only 12–14 kg/year/person. In addition, the 2020 Food Balance Sheet indicates that the supply of pulses is 13 kg/year/person (DCS 2021), and that domestic production contributes only 2.03 kg/year/person. Therefore, to satisfy the population's nutritional needs and achieve self-sufficiency, pulse production must increase or be met with additional imports.

The Department of Agriculture of Sri Lanka has forecast pulse production of 50,503 mt in 2023 (Table 5). Given the total annual requirement of 404,840 mt at the RDA of 57.5 g/day/person, the 415,020 mt deficit must be imported.

Figure 4: Gaps in pulse supply in Sri Lanka



Source: Authors' calculation based on available data from FAO (2023b) and DOA (2022) AgStat, Department of Agriculture of Sri Lanka.

Table 5: Expected demand and supply gap for pulses, 2022–2023

Pulse	Production (MT)		
	Maha 2022–2023 (actual)	*Yala* 2023 (forecast)	Total production (expected)
Green gram	4,875	9914	14,789
Cowpeas	3,831	7,479	11,310
Black gram	7,854	2,957	10,811
Soybeans	443	13,150	13,593
Total production			50,503
Total requirement (Average 57.5g/day/person)			465,524
Deficit			-415,020

Source: Department of Agriculture of Sri Lanka (DOA). 2023. "Crop forecast Monthly Report".

Pulse Productivity and Efficiency Gap

Despite the rise in acreage under pulses, increasing their productivity is a major criterion for self-sufficiency. Hence, we calculate the efficiency gap (EG) of Sri Lanka pulses to indicate the existing gap that can be bridged by increasing yield via different pulse cultivars and other crop management practices. The EG is a ratio that captures the difference in a crop's productivity between countries by comparing it with the benchmark (highest productivity) country. Though Sri Lanka exceeds the global average productivity (985 kg/ha), all Sri Lankan pulses have a huge EG (Table 6), implying that productivity can be augmented by exploiting their immense genetic diversity. As Ireland has the highest average productivity (5,013 kg/ha) in the world (Shripad Bhat et al. 2022), this benchmark is used to calculate the EG. Within Asia, yields are higher in East Asia (1,514 kg/ha), Southeast Asia (1,272 kg/ha), and West Asia (1,413 kg/ha) than the rest of Asia (Joshi and Rao 2017).

Table 6: Productivity and efficiency gap of pulse production in Sri Lanka

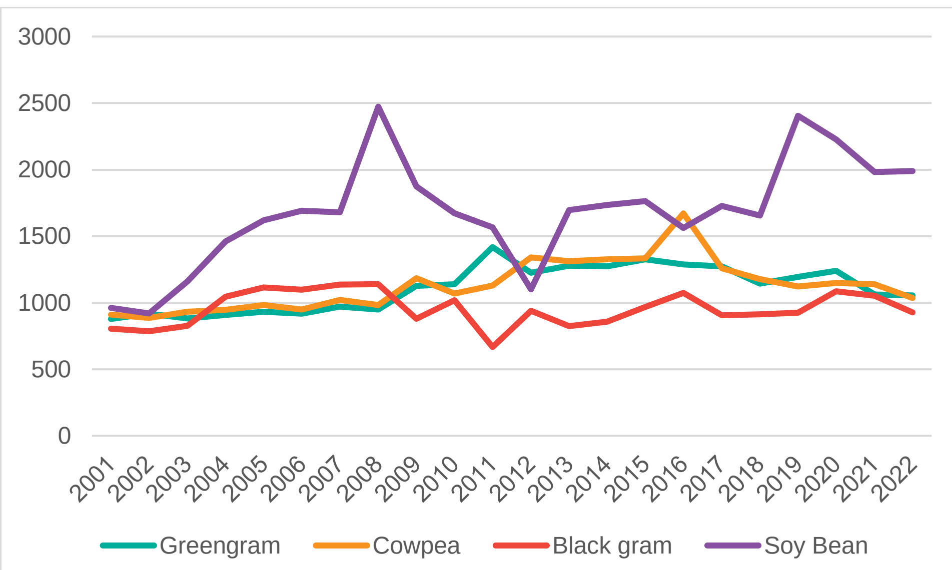
Pulses	Productivity* (kg/ha)	Efficiency gap (%)			
		Ireland	East Asia	Southeast Asia	West Asia
Green gram	1,081	78.44	28.60	15.02	23.50
Cowpeas	1,082	78.42	28.53	14.94	23.43
Black gram	1,008	79.89	33.42	20.75	28.66
Soybeans	2,054	59.03	-35.67	-61.48	-45.36

Source: DOA (2022). AgStat, Department of Agriculture of Sri Lanka.

Note: EG = [1- (Actual yield/Benchmark yield)] *100.

Reducing the EG is challenging since pulse productivity declined for the past six years after remaining stagnant since the 2010s (Figure 5). Further, pulse crops are cultivated by resource-poor farmers with low investments in cultivation improvements such as quality seeds, better crop management, etc., which might have contributed to the yield stagnation (Malaviarachchi 2019). Moreover, pulses are mainly cultivated during the *Maha* season under rainfed conditions, and poor drainage conditions due to climate change and diseases frequently cause heavy yield losses.

Figure 5: Yield fluctuation in pulse crops, 2001-2022



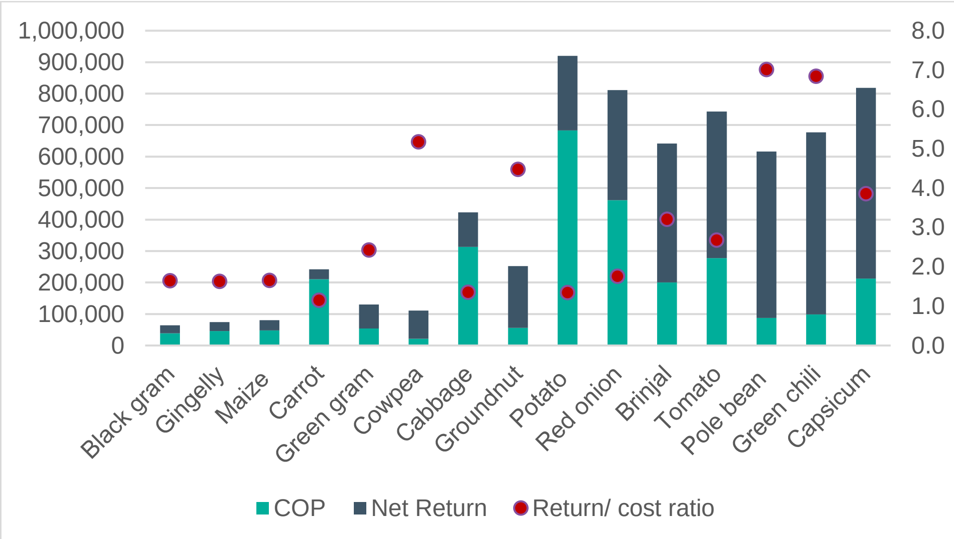
Source: DOA (2022). AgStat, Department of Agriculture of Sri Lanka.

Cost of Production and Profitability

To understand the relative profitability of pulses, we conducted a comparative analysis with other vegetable crops using the Department of Agriculture's cost of cultivation data (Figure 6). Capsicum has the highest net return (Rs. 606,441/acre), followed by green chili (Rs. 577,658/acre), pole bean (Rs. 528,248/acre), tomato (Rs. 465,618/acre), brinjal (Rs. 441,509/acre), red onion (Rs. 349,656/acre), and potato (Rs. 237,052/acre); black gram has the lowest net return (Rs. 25,053/acre). Green gram (Rs. 76,913/acre) and cowpeas (Rs. 89,538/acre) also have relatively low profits. Pulses' lower costs of cultivation may offset their lower net returns when farmers choose which crops to plant. For example, cowpeas have the lowest estimated cost of cultivation per acre (Rs. 21,462), followed by black gram (Rs.

38,787), while potatoes have the highest cost per acre (Rs. 920,100) (Figure 6). Overall, rates of return on investment for pulses vary widely, from 1.6 for black gram and 2.4 for green gram to 5.2 for cowpeas, the third highest return after pole beans (7.0) and green chili (6.8).

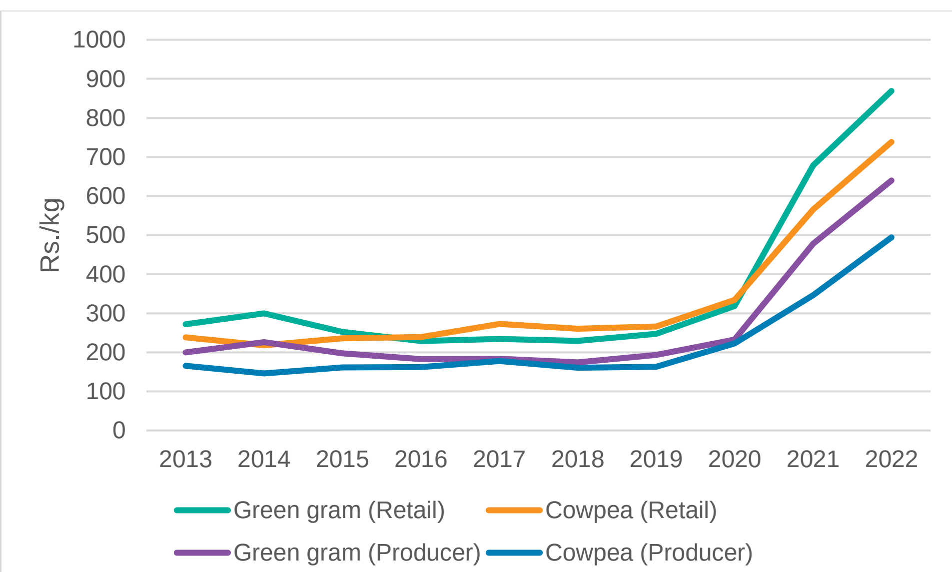
Figure 6: Profitability of major field crops



Source: DOA (2022). AgStat, Department of Agriculture of Sri Lanka.

Stagnation in nominal prices and the drop in real prices received by farmers are also responsible for pulses' lower profitability (Figure 7). Since 2019, both producer and retail prices have trended upward, but this can be attributed to external pressures due to the COVID-19 pandemic and Sri Lanka's overall deteriorating macroeconomic situation, which triggered a rise in prices across the board. Also, poor marketing facilities (lack of an assured market) and unstable prices coupled with a widening retailer-producer price gap have placed pulse producers in a precarious position.

Figure 7: Fluctations in producer and retail prices for pulses



Source: DOA (2022). AgStat, Department of Agriculture of Sri Lanka.

The Way Forward

Self-sufficiency in pulse crops typically depends on various factors, including agricultural practices, government policies, market dynamics, and climate change. Given the current level of pulse production in Sri Lanka, achieving self-sufficiency will require both short- and long-term strategies. The short-term goal should be to improve production and productivity gradually, while filling gaps in supply to achieve dietary requirements through imports. The import basket should include pulses like red lentils that do not compete directly with local pulses to meet the population's protein requirements, especially the poor. Imports can also help fill the supply gap and stabilize prices. Long-term strategies must focus on coordinated efforts involving policy support, research and extension, and market and demand considerations. Four strategies to increase pulses' role in generating rural income and providing food security follow.

Crop diversification

Sri Lanka's domestic agricultural production concentrates on green gram, cowpea, black gram, and soybean. However, Sri Lanka's breeding research highlights huge potential to grow kollu, an underutilized pulse crop grown in dry upland cropping systems (Malaviarachchi 2019). Pigeon peas and chickpeas are other potentially important food sources.[1] Therefore, incentives for farmers to grow underutilized pulse crops are needed. The share of total agricultural land under paddy cultivation is 15 percent versus less than 1 percent for pulses. Thus, large scope remains to increase pulses' area under the "pulse in rice fallow" method. Rice fallows could increase legume production with few inputs, as they contain residual moisture and are suitable for short-season, low-water-consuming grain legumes such as chickpeas, black gram, green gram, and lentils (Gumma, Mohammed, and Panjala 2022).

Research and extension services

To address Sri Lanka's demand, supply, and yield gaps in pulses, more investment is needed in research and extension services. The National Agriculture Research System should develop high-yielding, drought-tolerant, and disease-resistant varieties and other technological and best agricultural practices, including proper seed selection and planting, pest and disease management, and improved post-harvest handling to ensure pulses' quality. Pulses' productivity and profitability can be increased by exploiting their immense genetic diversity. Efficient pulse-breeding programs are needed to develop new improved varieties, taking into consideration biotic–abiotic stresses, the benefits of including pulses in cereal-based cropping patterns, and various uses of pulses as food, feed, and fuel (Bhat et al. 2022). Pulse breeding research should also concentrate on increasing pulses' nutritional content, since they provide the main source of protein for the poor. Dissemination of new and improved varieties, practices, and technologies should be conducted through extension services and farmer training.

Marketing and pricing mechanisms

Successfully marketing of pulse crops in Sri Lanka depends on crop quality, market demand, pricing, and effective distribution channels. Collaboration among value chain stakeholders can strengthen demand for and supply of pulses. Adequate storage facilities and proper handling, drying, and storage methods can maintain pulse crops' quality. Fair pricing mechanisms that ensure farmers receive a reasonable return can be achieved through a combination of measures like short-term price support and

[1] https://foodplantsolutions.org/wp-content/uploads/2019/01/Potentially-Important-Food-Plants-of-Sri-Lanka-Draft.pdf

subsidies. Other actions include: integrating smallholder farmers directly with dynamic modern supply chains; creating cooperatives or farmer groups; promoting value addition like processing, packaging, and branding to increase market value and reduce postharvest losses; and providing market intelligence through digital technologies for farmers to make informed decisions about when and where to sell.

Improved consumer preferences

Sri Lankan's dietary habits and preferences are important factors in the pulse sector's development strategy. Given the country's malnutrition rate and pulses' nutritional benefits, efforts are needed to influence consumers' demand for pulses. As they are not a traditional staple in the Sri Lankan diet, consumer education and awareness should focus on pulses' benefits and how to incorporate them into meals. Special attention should be given to promoting locally available pulses, currently less preferred than imported lentils.

Conclusions

Pulses can pave the way for regenerative agriculture in Sri Lanka. They not only satisfy dietary protein requirements but also increase environmental sustainability via nitrogen fixation, contributing to soil health and reducing the need for chemical fertilizers. Investment in increasing pulses' availability will help achieve food and nutrition security and build resilience. Sri Lanka's climate and soil conditions are suitable for various pulse crops. Successful pulse cultivation will ultimately depend on selecting appropriate varieties and proper agronomic practices. The government can play a crucial role in promoting the supply of and enhancing the demand for pulse crops through the strategies discussed herein.

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