

RESEARCH ARTICLE

IMPACT OF TAXES ON COST OF PRODUCTION AND INPUT USE EFFICIENCY ON MAIZE, POTATO, AND BIG ONION CULTIVATION IN SRI LANKA

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ABSTRACT

Maize, potato, and big onion are strategically important and politically sensitive field crops due to their high demand and income-generating potential. However, the increasing cost of production (COP) of these crops, particularly amid rising input prices and taxes embedded in agricultural inputs such as fertilizers, seeds, agrochemicals, machinery, and fuel, is a commonly expressed concern among farmers and agricultural stakeholders. This study aims to assess the exact tax burden embedded in the production systems of these three crops and evaluate its impact on cultivation costs and input-use efficiency. Utilizing secondary data for the 2024 *Yala* season obtained from the Department of Agriculture and Sri Lanka Customs tariff schedules, a quantitative analytical framework was established. The methodology utilizes an enterprise budgeting approach coupled with Harmonized System (HS) code-based tax extraction to algebraically estimate the total tax burden (TT), tax incidence percentages (TI), and input cost structures (ICS). Empirical results show that taxes constitute a notable component of COP, accounting for approximately 9% for maize, 11% for potato, and 8% for big onion, including imputed costs. Excluding imputed costs, cash-tax incidence rises to 12%, 16%, and 10%, respectively, concentrating heavily at 16% to 17% within purchased inputs. This fiscal burden correlates with a low expenditure share on critical inputs, contributing to sub-optimal yields (1,761 kg/acre for maize, 4,929 kg/acre for potato, and 9,976 kg/acre for big onion) compared to regional economies. The study concludes that high embedded taxes distort input structures and limit production efficiency. To lower production costs and strengthen sector competitiveness, policymakers should rationalize agricultural tariffs and help farmers use resources more efficiently.

Keywords: Agricultural taxation, Cost of production, Input use efficiency, Sri Lanka, Tax incidence

INTRODUCTION

Agriculture plays a vital role in the Sri Lankan economy by contributing to food security, rural employment and livelihood improvement. Among field crops, maize, potato and big onion are strategically important commodities because of their high consumer demand, nutritional value and income generating potential for farmers in the dry, up-country, and intermediate zones. On the other hand, these three are politically sensitive crops like paddy. Prominent districts for maize cultivation are Anuradhapura, Monaragala, Badulla, and Ampara. Potato cultivation is mainly concentrated in Welimada and Nuwara Eliya, as well as several patches in the up country. In contrast, big onion cultivation is largely grown in the central and north-

central provinces. The targeted extent of cultivation for maize, potato and big onion for the *Yala* 2025 season was 16934ha, 2940ha and 4220 ha, respectively. (Department of Agriculture, 2025)

Over the years, the cost of production (COP) of maize, potato and big onion has increased significantly due to rising input prices, labour costs and policy-related factors. Among these, taxes imposed on agricultural inputs, machinery, fuel, agrochemicals, and imported seed materials have become a major concern. Although agricultural production is often considered a priority sector, several direct and indirect taxes are embedded within the production system, influencing farmers' production decisions and overall efficiency.

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Taxes such as import duties, PAL (Ports and Airports Development Levy), SSCL (Social Security Contribution Levy), CID (Customs Import Duty), VAT (Value Added Tax), cess, Excise and other para-tariffs applied through customs on inputs and related goods indirectly affect the COP of potato and big onion. However, empirical research in Sri Lanka that systematically quantifies the impact of these taxes on both production costs and efficiency remains limited. This knowledge gap restricts evidence-based policy formulation aimed at improving the competitiveness and sustainability of domestic potato and big onion cultivation.

Previous studies highlight that taxation policies can significantly influence agricultural production costs and farm-level efficiency (FAO, 2018). Studies conducted in South Asian countries indicate that indirect taxes on fertilizer, fuel, and imported seeds increase COP and reduce farmers' competitiveness against imports (World Bank, 2020). Jayasuriya *et al.* (2019), emphasized that policy-induced costs, including taxes and tariffs, indirectly affect farmers' net returns. Further, studies using Cobb–Douglas production functions have been widely applied to assess production efficiency in agriculture, demonstrating how cost factors influence output levels (Battese & Coelli, 1995). However, limited research has specifically incorporated tax components into such efficiency analyses for Sri Lankan field crops.

Despite government interventions to promote domestic cultivation of maize, potato, and big onion, farmers continue to face high production costs, farm-gate price volatility, and limited profitability. Taxes embedded in input supply chains may reduce production efficiency and discourage farmers from expanding cultivation. However, the scale and nature of tax impacts on COP and production efficiency remain unclear. In this context, comprehensive analysis is lacking on how different types of taxes and their magnitudes affect production costs and input-use efficiency in the production of maize, potato, and big onion in Sri Lanka.

The general objective of the study is to assess the impact of taxes on the production of maize,

potato and big onion in Sri Lanka. The study aims to achieve four specific objectives, viz., to investigate different tax types and amounts applicable to maize, potato and big onion inputs, to calculate the cost of taxes on the COP of three crops' cultivation, to identify the impact of taxes on input use efficiency in the production of maize, potato and big onion cultivation and to make appropriate suggestions to ensure efficiency of maize, potato and big onion cultivation in Sri Lanka.

MATERIALS AND METHODS

Research design and framework

This study adopted a quantitative, analytical approach based entirely on secondary data to assess the impact of taxes on production costs and input-use efficiency in maize, potato, and big onion cultivation in Sri Lanka. Rather than relying solely on descriptive summaries, this study applies a multi-stage algebraic estimation framework. First, it uses an enterprise budgeting technique to break down cultivation expenditures. Second, a Harmonized System (HS) code-matching protocol identifies embedded import tariffs. Finally, the study computes tax incidence and input cost structure indicators to model fiscal pressure on farm-level economics.

Data sources and sampling

The study relied entirely on secondary data from relevant government institutions, with the methodology specifying the data sources and institutions alongside the corresponding datasets. The study obtained COP data for maize, potato, and big onion from the Department of Agriculture (DOA) Cost of Production publications. The analysis used the most recent consistently available COP data for the 2024 *Yala* season. Specifically, we used Badulla District 2024 *Yala* season (irrigated) data for maize, Nuwara Eliya District 2024 *Yala* season (irrigated) data for potato, and Matale District 2024 *Yala* season (irrigated) data for big onion. Data on input usage, input cost, yield per acre and profit per acre were considered. The analysis therefore represents the tax burden embedded in the production cost structures observed in these selected 2024 *Yala* production systems. Because tax rates remain stable over long periods and be-

cause *Yala* is the main cultivation season for the three selected crops, the study assesses the consistent impact of these taxes on the COP without seasonal rate distortions.

HS codes relevant to agricultural inputs such as seed maize, seed potatoes, onion seeds, fertilizers, agrochemicals, machinery and fuel, together with applicable tax rates including import duty, VAT, cess and other para-tariffs, were obtained from Sri Lanka Customs. Since these tax rates are statutory rates associated with the relevant HS classifications, they are not determined by the production season. However, the estimated tax amount and its proportion of total COP depend on the input quantities, input prices and production cost structure represented in the 2024 *Yala* COP data.

Estimation of cost of cultivation

To establish the baseline production cost structure, the study used an enterprise budgeting approach. The study aggregated all physical expenditures incurred during the production cycle into three primary, mutually exclusive categories: Labour Cost (LC), Machinery Cost (MC) and Material/Input Cost (MIC). The total cost of cultivation per acre including imputed costs (COP_{inc}) was defined using the following relationship:

$$COP_{inc} = LC + MC + MIC \quad \text{Eq. 1}$$

Where the individual components for each crop *i* (maize, potato or big onion) were mathematically specified as follows:

Labour Cost: Estimated by accounting for both hired and family (imputed) labor across all field operations:

$$LC = \sum_{j=1}^n (L_j \times w_j) \quad \text{Eq. 2}$$

Where L_j represents the total labour days required for agricultural operation *j* and w_j represents the prevailing regional wage rate per labour day (Rs.).

Machinery Cost: Formulated as the summation of machinery hiring and operational costs across all mechanizable field stages:

$$MC = \sum_{j=1}^m M_j \quad \text{Eq. 3}$$

Where M_j represents the machinery or tractor hiring fee for operation *j*.

Material Cost: Calculated as the direct expenditure on physical commercial inputs:

$$MIC = \sum_{k=1}^p (Q_k \times P_k) \quad \text{Eq. 4}$$

Where Q_k is the quantity of physical input *k* applied per acre and P_k is the prevailing retail market price of input *k* (including embedded taxes). Physical inputs included seeds, fertilizers, weedicides, pesticides and micronutrients.

Estimation of embedded tax components

To measure the tax burden on maize, potato, and big onion farming, this study estimates the cumulative statutory taxes on imported inputs like seeds, fertilizer, and agrochemicals using trade schedules from Sri Lanka Customs and the Department of Agriculture. This study assumes that import duties and border taxes (such as the Port and Airport Development Levy, CESS, and VAT) apply mainly to the Cost, Insurance, and Freight (CIF) value and are directly passed through to retail prices for farmers.

Hence, exact wholesale and retail margins are hard to track across complex supply chains; these calculations do not show the exact tax incidence. Instead, they serve as scenario-based approximations assuming border taxes pass fully into retail prices. The tax calculations follow standard national tariffs alongside any exemptions for farm inputs. The study used the imported share of each major input to calculate the weighted average tax wedge embedded in the total CoP. It therefore isolated the absolute tax burden embedded in purchased commercial inputs by applying the combined statutory import duty and indirect para-tariff rates (TR_k), extracted from the Customs tariff schedules to the baseline input values.

The absolute tax amount (Tax_k) embedded in each input type *k* was isolated as follows:

$$Tax_k = IC_k \times \left(\frac{TR_k}{100} \right) \quad \text{Eq. 5}$$

Where IC_k represents the total retail cost of input k as recorded in the DOA production books, and TR_k is the cumulative applicable tax rate (%) assigned to that input classification via its HS code (e.g., 19.8% for chemical fertilizers, 13% for seed imports, and 22.55% - 34.60% for specific crop-protection agrochemicals).

The DOA calculates machinery costs by dividing the initial purchase price by the machine's lifespan or by using rental rates. For this study, we spread the taxes paid when buying or importing machinery across its useful life to find the annualized tax share per season. The study therefore assumes that a proportional share of this total tax is gradually reflected in each season's COP. When calculating the tax adjustment for machinery based on its useful life, the study excluded operating costs, labour, maintenance, and service-provider margins because those components do not carry import or purchase taxes. Instead, the study assumes that the proportional tax on the equipment is already embedded within the rental rate.

The total absolute tax burden per acre (TT) acting upon a given cultivation system was determined by summing the tax components across all input lines:

$$TT = \sum_{k=1}^p Tax_k \quad \text{Eq. 6}$$

Analytical indicators for tax incidence and efficiency

To systematically analyze how these tax components alter production costs and affect resource-use incentives, three analytical indices and a productivity benchmark model were deployed:

I. Tax Incidence on Total Production Costs (TI)

To evaluate the macro-level fiscal pressure on agricultural production, the tax incidence was modeled under two distinct scenarios; including and excluding non-cash imputed costs:

- Tax Incidence including Imputed Costs (TI_{inc}):

$$TI_{inc} = \left(\frac{TT}{COP_{inc}} \right) \times 100 \quad \text{Eq. 7}$$

- Tax Incidence excluding Imputed Costs (Cash Cost Basis) (TI_{exc}):

$$TI_{exc} = \left(\frac{TT}{COP_{exc}} \right) \times 100 \quad \text{Eq. 8}$$

Where COP_{exc} isolates the direct cash expenditures by removing the imputed values of family labor and owned land.

II. Tax Percentage of Marketed Purchased Inputs (TMP)

Because taxes are structurally isolated within commercial transactions, a specific indicator was designed to measure the concentration of taxes strictly within purchased capital inputs (materials and machinery), excluding local labor factors:

$$TMP = \left(\frac{TT}{MIC + MC} \right) \times 100 \quad \text{Eq. 9}$$

III. Input Cost Structure Analysis (ICS)

To evaluate input utilization efficiency and see if high tax rates cause sub-optimal spending balances, the relative financial share of individual inputs (ICS_k) was mapped out against the total cost architecture:

$$ICS_k = \left(\frac{IC_k}{COP_{inc}} \right) \times 100 \quad \text{Eq. 10}$$

This index was targeted at key productivity-enhancing components, specifically isolated for seeds, fertilizers, weedicides, and pesticides.

IV. Yield and Cross-Country Productivity Benchmarking

Crop productivity (Y) was normalized per unit area:

$$Y = \frac{Q}{A} \quad \text{Eq. 11}$$

Where Q is the total recorded harvest volume (kg) and A is the designated cultivation area (1 acre).

To analyze the relationship between input tax distortions and input-use efficiency, the calculated local yields and input cost shares were mathematically benchmarked against national potential target yields and cross-country yield data from competing regional developing economies (e.g., India, Bangladesh, Indonesia, and China). This comparative approach links input pricing distortions directly to agricultural efficiency gaps.

RESULTS AND DISCUSSION

First objective of the paper is to investigate different tax types and amounts applicable to maize, potato and big onion inputs. Presents a comparative overview of major agricultural inputs used in the cultivation of potato, maize, and big onion, with specific emphasis on their import dependency, Harmonized System codes and applicable import duties in Sri Lanka were shown in the Table 5 in the Annex. This information is crucial in understanding the cost structure, foreign exchange implications, and vulnerability of these crops to external market conditions.

The Table 5 in the Annex clearly shows the input composition for three crops and their import dependency. According to the table, a significant proportion of key inputs particularly chemical fertilizers, seeds and agrochemicals are mostly imported for all three crops. For instance, potato cultivation relies heavily on imported seed potatoes and chemical fertilizer mixtures, while maize production depends entirely on imported fertilizers such as Urea, TSP and MOP. Similarly, big onion cultivation uses imported fertilizers and partially imported seeds, although a notable share (76%) of onion seeds is locally produced. In contrast, certain inputs such as organic fertilizers (e.g., poultry manure) and land preparation activities were largely sourced locally because imports of organic manure to Sri Lanka are banded. This indicates a partial reliance on domestic resources, particularly for labor-intensive operations and organic amendments.

Regarding the tariff structure and cost implications, the table shows that most imported agricultural inputs were significant in volume.

Fertilizers generally attract a duty of around 19.80%, while agrochemicals fall within a higher range of 22.55% to 34.60%. Additionally, some specialized inputs such as micronutrients and organic amendments can face duties up to 40.63%. Seed imports for potato and maize were taxed at 13.00%, which, although relatively lower, still contributes to overall production costs. These tariff rates suggest that imported inputs significantly increase cultivation costs, affecting farm profitability and market prices.

Cost of cultivation per acre of maize

Table 1 shows the cost of cultivation for maize and indicates that material cost constitutes a substantial proportion of total production cost, significantly influencing overall farm expenditure. Of the total cost including imputed values (Rs. 202,515.00 per acre), material cost alone accounts for Rs. 80,091.00, which is notably higher than machinery cost and closely comparable to labour cost, highlighting the input-intensive nature of maize cultivation. In particular, fertilizer application represents the highest material cost component (Rs. 47,312.00), followed by costs associated with weedicide application and pest and disease control, reflecting the dependency on agrochemicals. Importantly, the tax weight embedded within these material inputs is also considerable; for instance, fertilizer incurs a tax cost of Rs. 9,368.00 (19.8%), while weedicide and pest control inputs show even higher tax percentages of 34.6%. Overall, the total tax component amounts to Rs. 17,573.00, about 9% of total cost including imputed values and 12% excluding imputed costs, indicating that taxation on agricultural inputs, particularly materials, adds notable financial pressure on farmers. Therefore, the high material costs and their associated embedded taxes represent notable components of the COP of maize in the Badulla district 2024 *Yala* production system.

Cost of cultivation of potato

Table 2 on the COP of potato in *Nuwara Eliya* for the 2024 *Yala* season clearly shows that material cost was the dominant component of total production cost and also carried a substantial tax burden of the total cost of Rs. 831,

837.00 per acre (including imputed cost) material inputs alone account for Rs. 489,783.00, the largest share compared to labour and machinery. Within material costs, seed potatoes (Rs.343,998.00) and fertilizers (Rs.91,153.00)

constitute the most significant expenses, reflecting the heavy dependence on imported inputs in potato cultivation. Importantly, these material inputs were also subject to notable indirect taxes, where seed potatoes incur a tax

Table 1: Cost of cultivation per acre of maize

Operation	Cost (Rs/ac)			Total	Tax (Rs/ac)	Tax (%)
	Labour	Machinery	Material			
Pre-weedicide application	1222		5078	6300	1148	22.6
General land preparation	7240			7240		
1st plough with 4wt	1195	13700		14895	685	25
(do with 2wt)	(2213)	(10000)				
(do manually)	(31624)					
(do with buffaloes)	(3320)	(5000)				
Digging holes & seeding	17398		16465	33863	2140	13
Fertilizer application	9369		47312	56681	9368	19.8
Weeding & earthing up	15932			15932		
Weed control with weedicide	1302		6915	8217	2351	34.6
Pest & disease control	2244		4321	6565	1495	34.6
Water management	17342			17342		
Harvesting & drawing	19997			19997		
Processing with Tsunami	2129	4786		6915	239	25
Processing with Maize Thresher	(3678)	(2254)				
Drying	4832			4832		
Transport produce to stores	790	2946		3736	147	25
Total including imputed cost	100992	21432	80091	202515	17573	9
Total excluding imputed cost	46095	16508	80091	142694	17573	12
Total tax percentage for Material and Machinery cost						17

of 13%, fertilizers 19.8%, and agrochemicals used in pest and disease control as high as 35%. As a result, the tax component attributed mainly to material inputs amounts to Rs. 81,549.00 per acre, which is a considerable addition to the overall cost of production. In contrast labour related activities such as weeding, harvesting and general field operations show minimal or no direct tax burden, further em-

phasize that taxation was heavily concentrated on imported material inputs rather than local factors of production. Therefore, the table highlights that the high cost of cultivation in potato farming in *Nuwara Eliya* is largely driven by material input expenses and their associated taxes, indicating the vulnerability of farmers to import prices, tax policies and exchange rate fluctuations, and highlighting

Table 2: Cost of cultivation per acre of potato

Operation	Cost (Rs/ac)			Total	Tax (Rs/ac)	Tax (%)
	Labour	Machinery	Material			
General land preparation	29070			29070		
1st plough with 2wt	3189	9986		13175	619	25
(do manually)	(34795)					
2nd plough with 2wt	(1231)	(8327)				
(do manually)	(30068)					
Preparation beds & ridges	37470		6,310	43780	1249	19.8
Digging holes & seeding	40448		343,998	384446	44720	13
Fertilizer application	25268		91,153	116421	18048	19.8
Weeding & earthing up	35583			35583		
Pest & disease control	24441		48,322	72763	16913	35
Water Management	53302	19271		72573		4.5
Harvesting & drawing	64026			64026		
Total including imputed cost	312797	29257	489,783	831837	81549	10
Total excluding imputed cost	224738	26550	489,783	741071	81549	11
Total tax percentage for material and machinery cost						16

the importance of considering local input production and tax structures in efforts to manage production costs in the potato production system examined.

Cost of cultivation for big onion

Table 3 on the cost of production for big onion shows that material costs are the most dominant component of the overall production cost, indicating a highly input-intensive cultivation system. Out of the total cost including imputed values (Rs. 562,756.00 per acre), material cost accounts for a substantial Rs. 191,502.00, exceeding both labour and machinery costs and thereby highlighting the heavy reliance on external inputs such as seeds, fertilizers and agrochemicals. Among these, fertilizer application represents the highest material cost (Rs. 71,405.00), followed by transplanting-related materials (Rs. 54,009.00) and pest and disease control inputs

(Rs. 31,217.00), emphasizing the critical role of chemical inputs in big onion production.

Importantly, the associated tax burden on these material inputs was also significant, with fertilizer alone incurring a tax cost of Rs. 14,138.00 (19.8%). In comparison, weedicide and pest control inputs carry even higher tax rates of 34.6%, resulting in tax costs of Rs. 6,774.00 and Rs. 10,801.00, respectively. Total tax amounts to Rs. 46,554.00, representing about 8% of total cost including imputed values and 10% excluding imputed costs, indicating a considerable financial burden arising mainly from taxed material inputs. Therefore, the high magnitude of material costs and their embedded taxes constitute important components of the COP of big onion in the Matale district 2024 Yala production system, with implications for farmer profitability and cost management.

Table 3: Cost of cultivation per acre of big onion

Operation	Cost (Rs/ac)			Total	Tax (Rs/ac)	Tax (%)
	Labour	Machinery	Material			
All nursery preparation	20061		6340	26401	824	13
Pre-weedicide application	2011		8954	10965	3098	34.6
1st & 2nd Plough with 4wt	3201	36105		39306	1805	25
(1st plough with 4wt)	(808)	(22000)				
(do manually)	(17787)	(27500)				
Preparation beds & ridges	28753			28753		
Transplanting	59101		54009	113110	7021	13
Fertilizer application	8037		71405	79442	14138	19.8
Weeding & earthing up	20633			20633		
Weed control with weedicide	3775		19577	23352	6774	34.6
Pest & disease control	7273		31217	38490	10801	34.6
Water Management	60235	37729		97964	1886	25
Harvesting & drawing	29236			29236		
Processing manually	48895			48895		
Transport produce to stores	2076	4133		6209	207	25
Total including imputed cost	293287	77967	191502	562756	46554	8
Total excluding imputed cost	205737	59394	185,029	450160	46554	10
Total tax percentage for out of Material and Machinery cost						17

Cost of taxes on the COP of three crops cultivation

The table below (Table 4) presents a comparative assessment of the tax weight embedded within the COP of three crops. It clearly indicates that taxes constitute a notable share of production costs across all crops. Total tax as a percentage of COP, including imputed costs, was 9% for maize, 11% for potato, and 8% for big onion. In comparison, these values increase to 12%, 16%, and 10%, respectively, when imputed costs are excluded, suggesting

that the effective tax burden on farmers was more pronounced when only cash expenses were considered. Furthermore, the proportion of tax embedded within material and machinery costs remains consistently high, ranging between 16% and 17% across the three crops, emphasizing that indirect taxes on agricultural inputs such as fertilizer, agrochemicals, and machinery services significantly contribute to the overall COP. This finding is consistent with previous studies in Sri Lanka, where input-related taxes and market distortions have

been identified as key factors increasing production costs and reducing farm profitability (Weerahewa *et al.*, 2010; Bogahawatte, 2012). To reduce COP through tax-related measures, policy interventions such as rationalizing import duties on essential agro-inputs, providing targeted tax exemptions or subsidies for smallholder farmers, and improving the efficiency of input distribution systems have been recommended in both Sri Lanka and other developing country contexts (Fan *et al.*, 2008; World Bank, 2019). On the other hand, without reducing taxes, COP can be minimized through improved resource-use effi-

ciency, adoption of integrated nutrient and pest management practices, mechanization to reduce labour dependency, and strengthening farmer organizations to benefit from bulk purchasing and economies of scale, as evidenced by studies conducted in countries such as India and Bangladesh (Rahman *et al.*, 2015). Therefore, while tax reduction policies can directly alleviate cost pressures, significant scope also exists to reduce COP through technological, institutional, and management improvements within the existing taxation framework.

Table 4: Cost of taxes as a percentage of the COP of three crop cultivation

	MZ (Irr.)–Badulla–Y	PT (Irr.)–NE–Y	BO (Irr.)–Matale–Y
Total including imputed cost	09%	11%	08%
Total excluding imputed cost	12%	16%	10%
Total tax% for out-of-material and machinery cost	17%	16%	17%

Where: MZ: Maize; PT: Potato; BO: Big Onion; Irr.: Irrigated; N.E.: Nuwara Eliya; Y: Yala.

As calculated via the input cost structure (ICS_k) and productivity (Y) formulas defined in the analytical framework, the low allocation of expenditure on key productivity-enhancing inputs directly corresponds with a depressed yield profile. The ICS indices reveal that out of the total cost including imputed values (COP_{inc}), the allocation for vital yield-enhancing inputs remains remarkably low: seeds account for an ICS_{seed} of just 8%, fertilizer is at an ICS_{fert} of 23%, weedicides are at 3%, and pesticides are restricted to a mere 2%. This comparison confirms that tax-induced cost distortions disproportionately reduce the resource-use efficiency of critical production inputs in the local maize sector. This inadequate application of essential inputs was reflected in the comparatively low yield of 1,761 kg per acre (approximately 4,350 kg per hectare), below the potential yields observed under improved management practices. When compared with other developing countries, the productivity gap becomes more evident; for instance, average maize yields in countries such as Indonesia and Thailand have reached around 2,800–3,600 kg per hectare even under moderate input conditions, while countries like China have achieved yields exceeding 4,800 kg per hectare due to higher input use and improved agronomic

practices. Moreover, global cereal yield averages around 3,800 kg per hectare, comparable to Sri Lanka's general cereal productivity but still indicating room for maize-specific improvement. Empirical evidence from agronomic studies further confirms that increased application of nitrogen fertilizer, improved seed varieties, and better crop management significantly enhance maize yields, often resulting in yield gains of 20–40% in developing country contexts. Therefore, the relatively low share of material inputs in the COP structure may have contributed to the observed low maize productivity in the study area, and improving the efficient use of these inputs is essential to achieve higher yields and improved farm profitability, in line with other developing agricultural economies.

Applying the quantitative framework to the potato cultivation data explicitly highlights how an imbalanced input cost structure (ICS_k) limits the optimization of crop yields (Y). The calculated cost-share metrics show that seed material consumes a disproportionate share of the production budget ($ICS_{seed} = 41\%$), leaving an inadequate operational buffer for complementary productivity inputs, as shown by a low ICS_{fert} of 12% for fertilizers and ICS_{pest} of 6% for plant protection. As a direct result

of this distorted input structure, the calculated yield performance (Y) is restricted to 4,929 kg per acre (approximately 12,180 kg/ha). Compared with international productivity benchmarks, this yield profile falls far below that of peer developing agricultural nations; for instance, India and Bangladesh consistently achieve 20,000-25,000 kg/ha through balanced nutrient application regimes, while China reports yields above 30,000 kg/ha. This algebraic evaluation shows that the heavy tax burden on imported components prevents balanced, efficient investment across essential material factors. This distribution suggests that although farmers invest heavily in seed material, inadequate application of complementary inputs, particularly fertilizer and crop protection chemicals, may limit the realization of the crop's full yield potential. This was reflected in the recorded yield of 4,929 kg per acre (approximately 12,180 kg per hectare), which, although moderate in the local context, remains below the productivity levels achieved in several other developing countries. For instance, average potato yields in countries such as India and Bangladesh range between 20,000-25,000 kg per hectare under improved input management, while countries like China report yields exceeding 30,000 kg per hectare due to balanced fertilizer use, effective pest and weed control, and adoption of improved agronomic practices. Empirical findings from developing-country agriculture consistently show that potato is a highly input-responsive crop, where balanced nutrient management and proper crop protection significantly enhance productivity. Therefore, the observed low allocation to critical inputs such as fertilizer and weedicide in the study area is a key factor contributing to the relatively lower yield levels, underscoring the need for improved input-use efficiency and balanced investment in material inputs to achieve higher productivity and profitability in potato cultivation.

The structural evaluation of big onion cultivation in Matale district further clarifies the direct relationship between input expenditure constraints and the resulting productivity ceiling. The computed input cost structure indices indicate an overly modest financial allocation

toward yield-bearing assets, with an ICS_{seed} of 10%, ICS_{fert} of 13%, ICS_{weed} of 4%, and ICS_{pest} of 6%. When these input ratios are processed alongside final output data, the normalized yield (Y) comes to 9,976 kg per acre (approximately 24,650 kg/ha). Cross-country benchmarking reveals that this output level lags behind regional competitors like India and Bangladesh, which commonly secure 25,000-30,000 kg/ha under optimized, tax-rationalized input settings. In comparison, Egypt and China exceed 30,000 kg/ha due to superior resource efficiency. This confirms that the current local taxation framework creates an artificial barrier to achieving potential crop yields by raising procurement costs and driving sub-optimal crop management choices. This pattern reflects relatively low investment in essential yield-enhancing inputs, particularly nutrient management and crop protection, which are critical for a crop like big onion that is highly responsive to intensive input use. Consequently, the recorded yield of 9,976 kg per acre (approximately 24,650 kg per hectare) suggests only moderate productivity when viewed against international benchmarks. In comparison, developing countries such as India and Bangladesh commonly achieve yields in the range of 25,000-30,000 kg per hectare under improved input regimes, while countries like China and Egypt report even higher productivity levels exceeding 30,000 kg per hectare due to more balanced fertilizer application, efficient pest and disease management, and better agronomic practices. The relatively lower proportion of expenditure on inputs such as fertilizer and agrochemicals in the local context may therefore limit farmers' ability to achieve higher yield potential. Hence, increasing the efficiency and adequacy of input use, particularly for plant nutrition and crop protection, is essential to enhance big onion productivity in line with performance observed in other developing agricultural economies.

CONCLUSION

This study assessed the tax burden embedded in the production cost structures of maize, potato, and big onion using 2024 Yala Cost of Production data and applicable tax rates identified according to the relevant HS classifica-

tions. The results indicate that taxes constituted a notable component of total cultivation costs, accounting for approximately 9% of COP for maize, 11% for potato, and 8% for big onion when imputed costs were included. When imputed costs were excluded, the corresponding tax incidence increased to 12%, 16%, and 10%, respectively. Furthermore, the proportion of tax embedded within material and machinery costs ranged from 16% to 17% across the three crops. The analysis also indicates that the selected production systems allocated relatively low expenditure shares to several productivity-enhancing inputs, while realized yields remained below the respective potential yield levels. These findings highlight the importance of considering both tax-related cost pressures and the adequacy and efficiency of input use in agricultural production. However, the findings should be interpreted within the context of the selected 2024 Yala production systems and should not be interpreted as establishing a causal relationship between taxation and crop productivity. Based on the findings, rationalizing the tax structure applicable to essential agricultural inputs could help reduce production cost pressures in the selected crops. Particular attention could be given to taxes associated with fertilizers, agrochemicals, seeds, and machinery-related inputs. Measures that facilitate access to essential inputs at reasonable prices, together with improvements in input distribution systems, may support more efficient input use and contribute to improved farm productivity. In addition, farmers could be encouraged to improve the efficiency and adequacy of productivity-enhancing inputs through appropriate nutrient management, integrated pest and disease management, improved production practices, mechanization, and collective input purchasing where feasible. These measures could complement tax-related policy interventions by supporting more efficient resource use and reducing avoidable production costs. The present analysis assesses the tax burden embedded in the selected 2024 Yala production systems. For future research, the analysis could extend across multiple production seasons to examine how changes in input prices, input-use patterns, and production cost structures influ-

ence the magnitude and composition of the embedded tax burden over time. Incorporating season-specific COP data with corresponding historical tax schedules, particularly for imported machinery and other major agricultural inputs, would provide additional evidence on the dynamics of taxation and agricultural production costs.

AUTHOR CONTRIBUTION

ALS conceptualized and designed the study. ALS and SAKBS jointly coordinated data acquisition and compilation from relevant secondary sources. SAKBS and TADS contributed to the data analysis and interpretation. TADS prepared the initial manuscript. ALS and TADS jointly reviewed, revised, and finalized the manuscript for submission. All authors reviewed and approved the final version of the manuscript.

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ANNEX

Table 5: Comparative overview of major agricultural inputs

Input	Comp.	Description	L./Imp.	HS Code & Desc.	TDC (%)
Maize Fertilizer	TSP	Phosphatic fertilizer (Triple Super Phosphate) used as a source of phosphorus to promote strong root and seed development.	Mostly imported	3103.11.00 and 3103.19.00 - Triple Super Phosphate / Phosphatic fertilizer	19.80%
	MOP	Muriate of Potash fertilizer providing potassium to improve drought resistance and grain quality.	Mostly imported	3104.90.00 and 3104.20.00 - Muriate of Potash)	19.80%
	Urea	Nitrogen fertilizer used to promote vegetative growth and leaf development	Mostly imported	3102.10.00 -Urea	19.80%
Seed	Maize – Seed	Certified hybrid maize seed varieties such as Jet, Pacific, and CP 808 used for higher yield and disease resistance.	Mostly imported from regional seed companies and local distributors	1005.10 - Maize (corn) Seed	13.00%
Pest & Disease Control	Pest & Disease Control	Application of insecticides, fungicides, and herbicides to control major maize pests and diseases. Includes sprayers and protective equipment.	Mostly imported (Agrochemicals imported; sprayers may be imported or locally assembled)	3808.91.00 - Insecticides; 3808.92.00 - Fungicides; 3808.93.00 - Herbicides (under Chapter 38 - Pesticides and similar products)	22.55% - 34.60%
Other	General land preparation/ Weeding & Earthing Up	Initial land clearing, ploughing, and leveling before planting; includes labor and tractor operations. Weeding and earthing up support plant growth and moisture conservation.	Local – mainly hired or family labour; machinery may be imported with tax relief	No specific HS code (labour/service activity). If using tractor hire, machinery classified under 8701.90.90 - Agricultural tractors.	-
Potato Fertilizer	Poultry manure	Organic fertilizer from poultry droppings; improves soil fertility and structure.	Mostly local (produced on poultry farms or on-farm)	3101.00.00	Not importing
	Potato mixture	Chemical fertilizer mixture (usually a blend of Urea, TSP, MOP) as per DOA recommendation.	Mostly imported (some blending done locally using imported raw materials)	3105.20.00 – Mineral or chemical fertilizers containing two or three of N, P, K; 3102.10.00 - Urea; 3103.11.00 and 3103.19.00 - Triple Super Phosphate (TSP) / Phosphatic fertilizer; 3104.90.00 and 3104.20.00 - Muriate of Potash (MOP)	19.80%

Input	Comp.	Description	L./Imp.	HS Code & Desc.	TDC (%)
Seed	Other (Fertilizers)	Minor nutrients, biofertilizers, compost, or organic soil amendments.	Mixed (some local compost, some imported micro-nutrients)		19.8% - 40.63%
	Seed Potatoes	Certified seed potatoes for planting; high-yield varieties such as Granola, Desiree, etc.	Mostly imported (Netherlands, France, Australia, etc.)	0701.10.00 – Potatoes, fresh or chilled, seed	13.00%
	Pest & Disease Control	Application of insecticides, fungicides, and sometimes herbicides to control pests and diseases such as aphids, blight, and tuber moth. Includes sprayers and protective gear.	Mostly imported (Agrochemicals imported; sprayers may be imported or locally assembled)	3808.91.00 – Insecticides; 3808.92.00 – Fungicides; 3808.93.00 – Herbicides (under Chapter 38 – Pesticides and similar products)	22.55% - 34.60%
	Other	Initial clearing, ploughing, and levelling of land before planting; includes machinery and labour costs. Field operation to remove weeds and mound soil around potato plants to promote tuber growth and prevent greening. Includes manual labour, small tools, or tractor use.	Local – mainly hired or family labour; machinery may be imported with tax relief	No specific HS code (labour/service activity). If using tractor hire, machinery classified under 8701.90.90 – Agricultural tractors.	-
Big Onion Fertilizer	TSP	Phosphatic fertilizer (Triple Super Phosphate) used as a source of phosphorus to promote strong root and bulb development	Mostly imported	3103.11.00 and 3103.19.00 - Triple Super Phosphate / Phosphatic fertilizer	19.80%
	Onion Mixture	Custom fertilizer blend formulated for onion cultivation, providing balanced nutrients (NPK and micronutrients)	Mixed – part imported (raw materials), part locally formulated	3105.10.00 – Fertilizer mixtures containing two or three nutrients (NPK)	19.80%
	Seed	Certified big onion seeds of high-yielding varieties such as Vethalan, BIMA Super, and Serrano.	Local - 76% locally produced; 24% Other	1209.91 - Vegetable seeds	13.00%
	Pest & Disease Control	Application of insecticides, fungicides, and herbicides to control major pests and diseases such as thrips, purple blotch, and basal rot. Includes sprayers and protective equipment.	Mostly imported agrochemicals; sprayers may be imported or locally assembled	3808.91.00 – Insecticides; 3808.92.00 – Fungicides; 3808.93.00 – Herbicides (under Chapter 38 – Pesticides and similar products)	22.55% - 34.60%
	Other	Initial clearing, ploughing, and levelling of land before planting; includes machinery and labour costs. Field operations to remove weeds and build ridges around plants to support bulb growth.	Local – mainly hired or family labour; machinery may be imported with tax relief	No specific HS code (labour/service activity). If using tractor hire, machinery classified under 8701.90.90 – Agricultural tractors.	-

Where: L./Imp.: Local or Imported; HS Code & Desc.: HS Code and Description; Comp.: Component; TDC (%): Total Duty of CIF (%).