Assessment of the impact of ASMP intervention into local dry chili production on the National Dry Chili Market of Sri Lanka - Strategic Analysis of the Chili Industry

AGRICULTURE SECTOR MODERNIZATION PROJECT
2024

Final Report –Dec 2024

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1. INTRODUCTION

1.1 Background to the Assignment

Having recognized the importance of increasing local dry chili production, chili has been listed as one of the prioritized 16 crops, of which the local production expected to be increased (Presidential Secretariat, 2020). As a result, the Government directed the Agriculture Sector Modernization Project (ASMP) also to contribute for the development of the local dry chili industry. ASMP introduced a package of management practices as a technology package to the cultivation of first local Hybrid chili variety MI CH HY1 developed by the Department of Agriculture Sri Lanka in 2015. MI CH HY1 is an important breakthrough in hybrid program of Sri Lanka, a variety which is high-yielding and somewhat resistant to virus diseases, on par with or still better performing than the imported hybrid chili varieties. The ASMP technology package included some of the practices had been in introduction with the hybrid chili varieties time to time by government and private sector, in addition several other management practices that are land, labour and input saving technologies. By the year 2024, the project has established 11 chili clusters in 11 project districts and also chili was introduced as an intercrop in many other crop clusters. Further to that the project established a F1 Hybrid chili seed production cluster consisting of 20 Farmers in Dambulla which is in successful operation. The total chili grown area of the ASMP is about 1600 Ac. With the target of producing 20% of the national dry chili requirement through the project, ASMP invested in dry chilli production by introducing a farmer company model in which ASMP supported chilli farmers are also the shareholders. Financial support of World Bank and EU grant support met the capital requirement and the implementation cost in addition to technical support.

1.2 Objectives of the Assignment

The objective of this assignment is to analyze the impact of ASMP intervention on the domestic production and marketing system of chili and propose appropriate changes in government policy towards increasing the cultivation and production of green and dry chili domestically and supporting dry chili import in a suitable time frame to meet domestic requirements and potential export demand.

1.3 Scope of the Consultancy

The scope of the consultancy is to undertake the impact assessment of the ASMP intervention on the local chili industry through chili cultivation, production of green chili & dry chili, primary processing of dry chili and value addition, and to propose appropriate policy changes that make the chili industry profitable and sustainable for the relevant stakeholders (farmers and value-added producers) to continue to actively engage in the chili industry.

1.4 Tasks of the Assignment

- Study the status of the chili industry in Sri Lanka, including chili cultivation, production of green chili & dry chili, processing and value addition, import of dry chili & value-added products and export of green chili & value-added products, spending and earning of foreign exchange.
- ASMP has undertaken successful chili cultivation in 11 project districts and production of dry chili in about 10 districts, with the new technology package. Assess the impact of ASMP intervention, in terms of the cost-effectiveness of domestic green and dry chili production, by undertaking a detailed cost-benefit analysis of green and dry chili production comparing the ASMP technology package vs traditional technology with import parity, and estimate the investment requirement for dissemination of ASMP technology package.
- Accordingly, assess the total land extent that could be cultivated using ASMP technology within traditional chili growing districts and in other districts, estimate the potential supply pattern of green and dry chili in the domestic market, and the import demand.
- Assess the acceptable minimum price for green and dry chili, in different seasons in different locations to make the green and dry chili production and processing profitable for the farmers/ farmer companies and local industries.
- Study the government policy intervention at present and identify new policies/policy changes/policy instruments that the government could use to make the appropriate strategic plan for the local chili industry and to decide the import requirement.

2. METHODOLOGY

2.1 Technical Approach

Chilli is a traditional chena crop cultivated with maha rains, while cultivation during yala takes place with supplementary irrigation. By restricting imports, chilli cultivation was promoted as an import-substituting crop during the 1970s. With the gradual liberalization of trade after 1977, the extent of chilli cultivation dropped continuously and cultivation was continued under protection, quotas, and licensed imports. Legal restrictions on chena cultivation and irrigation development in the dry zone also resulted in a drop in the extent of maha cultivation. During the 1980s and early 1990s, there was a clear shift in chilli cultivation to irrigated rice fields, particularly under Mahaweli H. A Floor Price Scheme was also implemented by the government for dry chillie purchases. Once the dry chilli imports were fully liberalized in 1994 and the 35% duty protection was removed in 1996, imported chilli from India flooded the market at very low prices. This price disparity made it economically unviable for local farmers to continue producing dry chillies, leading to a near-abandonment of dry chilli cultivation. Since then, domestic chilli production has largely shifted towards green chilli, which remains viable in local markets.

Low chilli yield and high input cost per unit of output made Sri Lanka noncompetitive across borders. Generally, output growth depends on three factors: the state of technology or the kind of production process utilized, the quantities and types of resources put into the production process, and the efficiency with which those resources are utilized. Chilli yield, input use efficiency and relative cost of inputs are therefore important in determining the competitiveness of chilli production under opened borders.

There is a gradual increase in chilli yield and in particular after 2015. Under the varietal development programs of the DOA few open pollinated varieties were released. MI 2 and KA-2 are the widely adopted varieties by farmers those are with higher yields under low management practices and occasional water stress. The new varieties released during 20’s such as MI Hot, MI Green, Galkiriyagama Selection are on the adoption. No specific hybrid import had the adaptability to the local conditions to create a substantial demand. According to the DOA, high incidences of pest and diseases, particularly leaf curl complex (LCC), moisture stress, use of inferior quality seeds, poor crop management and high input costs have hindered realizing potential yield of chilli.

In 2015 the 1st local chilli hybrid, MI CH HY 1 was developed by the DOA in their chilli hybridization program which is highly suitable for green chilli with the potential yield of 32 t/ha of green chilli. MI CH HY 1 performs well in all the major chilli growing areas within the country during both yala and maha seasons. This variety is moderate resistant to Chilli Leaf Curl Complex, the major problem in chilli cultivation within the country. This technology breakthrough is considered by all stakeholders that can shift the chilli production frontier making

dry chilli production competitive in the country with supported intervention and can cut down the current chilli import bill of 100 US $ Mn.

F1 seed production is primarily the responsibility of DOA by maintaining parental lines, monitoring production protocols and certifying the F1 seeds. Currently F1 seed production is done by DOA, DOA contract farmers, private sector particularly CIC, and the ASMP supported farmers both ASMP 1 & ASMP 2. The protocol to be followed by farmers to produce F1 seeds has been issued by DOA. Already there are private sector investments in chilli hybrid seed production and state banks have disbursed loans for chilli seed production in poly tunnels. Through the ASMP project, investments have been made to the parental line program of DOA. In addition to F1 seed production program, the supply of 25 % of the seed requirement of OPV is a combined effort of DOA and private sector, particularly CIC. Imported hybrids also constitute a small proportion of seed supply to the industry.

Currently chili cultivation is done in all districts in 2 seasons using few production technologies.

Open Pollinated Varieties (OPV) with traditional farming practices

Local Hybrid Chilli Varieties (LHCV) /Imported Hybrid Chilli Varieties (IHCV) with traditional farming practices

Local Hybrid Chilli Varieties with DOA Recommendations/Improved Management practices

Local Hybrid Chilli Varieties with ASMP technology package (1600 Ac ~ 650 Ha)

Currently a total extent of 10,000-15,000 ha (2/3rd maha season) are cultivated under chilli and a total 65,000 to 80,000 mt of green chilli is produced. The total Chili grown area of the ASMP is about 1600 ac. However, 90 % of dry chilli requirement which is about 55,000-60,000 tons (based on annual consumption of 2.1-2.3 Kg per capita) is met through imports incurring about 100 US $ Mn.

The cultivation of hybrid chilli varieties has seen an increasing trend over the past decade, reflected in their higher productivity and average yields. Locally Hybrid Chilli Varieties (LHCVs) have gained popularity over imported varieties due to their superior crop yields, relatively higher resistance to Leaf Curl Complex (LCC), longer crop duration, and ease of harvesting due to the height of the plants. However, small-scale farmers face several barriers to initiating commercial-level cultivation of LHCVs, such as the high market price of seeds (e.g., MI CH HY 1), the unprofitability of rain-fed conventional cultivation methods, and the need for substantial initial capital and variable costs (HARTI, 2023). Even with credit support for commercial cultivation, an oversupply of green chilli could lead to unprofitable markets, as the cost of processing excess green chilli into dry chilli is high. Farmers find it difficult to compete with the lower-priced dry chilli imports from India due to unfavorable climatic conditions during drying seasons, high labor

demand, and the resulting increase in unit costs, which make dry chilli production less profitable for local farmers.

Agricultural Sector Modernization Project (ASMP) intervention aimed at promoting the production of dry chilli by reducing the unit cost of production. The strategy focuses on several key areas:

- Producing quality F1 seeds at lower costs compared to imported F1 seeds: Lowering the price of seeds to make it more affordable for farmers.
- Increasing green chilli yield: Encouraging farmers to adopt better management practices to boost productivity of local hybrid chilli.
- Improving fertilizer and water use efficiency: Optimizing input use in green chilli production for better cost-effectiveness.
- Lowering labor costs: Replacing manual labor with machinery during the drying process to reduce labor expenses and by introducing poly mulch, Fertigation etc..
- Reducing transaction costs: Establishing production and marketing infrastructure and adopting an institutional arrangement, such as a farmer company model, to streamline operations and minimize costs.

Although the ASMP intervention aims to lower production costs and improve efficiency in dry chilli farming, its broader implementation depends on various economic, ecological, and market-related factors in achieving the some self-sufficiency of dry chilli production locally.

Therefore scaling up the ASMP model requires validation of its effectiveness over other production technologies and careful consideration of other factors, including:

- Agro-ecological suitability: Ensuring that the new production model works well in different environmental conditions.
- Simulated market behavior: Analyzing how the market might respond to increased production and the potential risks of oversupply.
- Protection during transition: Assessing the level of protection or support needed until the model is fully adopted.
- Impact on the industry: Understanding how increased local dry chilli supply might affect the broader industry, including competition with imports.

2.2 Empirical Approach

Accordingly, to carry out tasks given in the assignment following data collection methods and analysis will be used.

Task 1: Study the status of the chili industry in Sri Lanka

Secondary data collection

	Data sources
Extent of chili cultivation, production of green chili & dry chili, Prices; Farm Gate and Wholesale	Secondary data from DOA, DCS, HARTI HARTI
Processing and value addition	Industry Interviews, Private sector
Import of dry chili & value-added products	Custom Data, ITC trademap, importers
Export of green chili & value-added products	Industry Interviews, Customs data, exporters
Spending and earning of foreign exchange	Customs, ITC trademap

Task 2: Comparative analysis of cost-effectiveness of domestic green and dry chili production, of green and dry chili production comparing the ASMP technology package vs traditional technology with import parity and investment requirement for dissemination of ASMP technology package

Secondary data - ASMP investment data (Fixed costs & variable costs)
Seed prices and other input prices
Cost of cultivation data from DOA

Primary data collection

	Type of data	Method of data collection	Locations
Chilli seed production data	Costs related to tunnel construction, variable costs and company operation	Focus group discussions with seed farmers and	Matale ASMP implementation site DOA program - Anuradhapura
Green Chilli production data by production technology			
ASMP technology	Input data Production and Harvesting data Cost of production and price data, Company operation	Focus group discussions (10 -15 Farmer group)	4 ASMP chilli clusters Thambuththegama, Thirappane, Vavuniya, and Kandy
LHCV F1 Program/ DOA/traditional	Cost of production and price data	Focus group discussions (10 -15 Farmer group)	2 dry chiili producing areas in Anuradhapura
Dry chilli production data	Drying process, cost and company operation	Focus group discussions (10 -15 Farmer group)	Vavuniya

Key Informant Interviews and Discussion

Experience sharing discussion session with all chili cluster coordinators and PMU staff in Colombo

Interview the International Agronomist (Dr.Julian Velze) to understand the ASMP technology package for chili cultivation, with justifications.

Analysis

Fixed Cost calculation to estimate the investment requirement per unit area
Enterprise budgets for various production technologies

Task 3: Assess the total land extent that could be cultivated using ASMP technology within traditional chili growing districts and in other districts, estimate the potential supply pattern of green and dry chili in the domestic market, and the import demand.

Secondary data and Key informant discussions

Analysis

Assessment of cultivation expansion under ASMP technology is done based on past cultivation patterns and experts views
Potential supply is simulated taking yield parameters and seasonality factor under different price structures (profitability levels)
Viability of Company Model for sustainable adoption of ASMP technology for expansion

Task 4: Assess the acceptable minimum price for green and dry chili, in different seasons in different locations to make the green and dry chili production and processing profitable for the farmers/ farmer companies and local industries.

Secondary data - HARTI monthly price data farm gate, Monthly Wholesale prices of Dried Chili, CIF price, tariff structure

Analysis

Two-enterprise market model with trade was developed assuming green chilli has no substitute and dry chilli import as a near perfect substitute to domestic dry chilli. Simulations were done to determine price of dry chilli to optimize chilli production to meet the domestic requirement of both green and dry chilli by considering phyto-sanitary tariffs in the simulations. Other policy variables were also tested.

Task 5: Required government policy intervention to make the appropriate strategic plan for the local chili industry and to decide the import requirement.

Due consideration will be given to the policy gaps in the following areas based on the finding of the investigation and analysis

Research and Development Policy, Technology transfer policy
Trade Policy, Environmental Policy, Seed Policy, Institutional policy (Company model)

3. CURRENT STATUS OF CHILLI INDUSTRY

Chilli is one of the important cash crops grown in the country and is an essential condiment in the Sri Lankan diet. It was traditionally a Chena crop that occupied large tracks (about 5 acre per farmer) in the dry zone Chena and was cultivated with maha rains. Cultivation during Yala takes place with supplementary irrigation. During the 1970-1977 closed economy period, chilli was promoted as import substituting crop and the imports were restricted. Extent cultivated sharply increased. However, legal restrictions on Chena cultivation and irrigation development in the dry zone dropped the extent under maha cultivation from its peak recorded in 1977. Chilli continued to be a protected crop even under the open market economic policies introduced in 1977 by limiting the government monopoly imports only to off seasons. During 1980's to the beginning of 1990's there was a clear shift of chillie cultivation to irrigated rice fields particularly under Mahaweli H. Expansion of cultivation in Mahaweli H increased crop yields and higher total production.

Liberalization policies implemented on the import substitution crop sector after 1992 affected the dry chilli production in the country significantly. In 1992, imports were handed over to the private sector subject to quota and licenses. In 1994 imports of chilli were completely liberalized. Immediately after liberalizing, bulk quantities of dry chilli were imported by the private sector that badly affected the farm gate price. In 1996 the government removed the existing 35% duty on imported chilli which resulted imported chilli from India flooded the market at a very low price. Farmers couldn't compete with the price of imported dried chilli arriving from India. Subsequently the dry chilli production drastically declined and the chilli cultivation mainly took place for green chilli production.

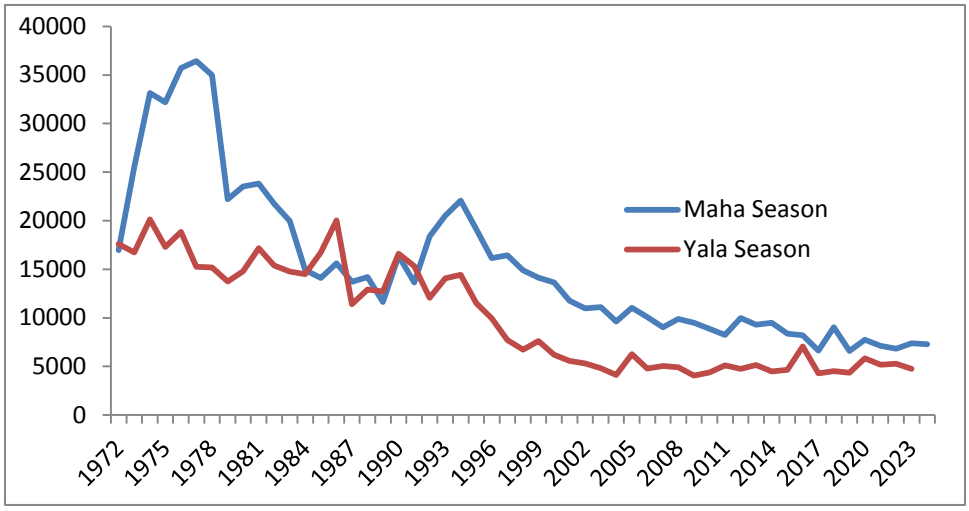
Per capita consumption of chili in the form of dry chili is estimated to be 2.1-2.3 kg per annum. Average green chili consumption is also in the same range. Thus, the national annual requirement of dry chili is around 55,000-60,000 tons. Total green chilli production in 2023 amounted to 67,397 mt from both seasons. Only a small fraction of th green chilli production goes for annual dry chilli production which is about 7,500 Mt. In 2023, country imported 40,055 mt of dry chilli from India amounting to 96,080 thousand US Dollars (92 million US Dollars). Sri Lanka is a main export destination for Indian dry chilli exports (15- 18% of dry chilli exports of India to Sri Lanka) and relatively lower FOB price to Sri Lanka is maintained.

3.1 Extent under chilli

The extent under chilli has drastically come down up to early 2000 and has been constant thereafter (Figure 1). Currently maha cultivation takes place in dry uplands 'Goda hena" mainly in Anuradhapura (22%), Moneragala (10%). In Kalpitiya Peninsula chilli is cultivated in both maha and yala seasons with supplementary irrigation, 9% in Maha and 12% in Yala (Table 1). Close proximity to Marketing infrastructure at in Norochcholai Dedicated Economic is an

advantage for chilli farmers in Kalpitiya. Other important districts are Hambantota, Kurunegala, Badulla, Matale and Jaffna.

Figure 1: National Extent Cultivated (Ha)



Source: DCS

Table 1: Average Chilli Extent Cultivated (2010-2024) (Hectares)[1]

Maha Season			Yala Season		
National	8073		National	5030	
Anuradhapura	1788	22%	Puttalam	619	12%
Monaragala	793	10%	Anuradhapura	473	9%
Puttalam	718	9%	Kurunegala	380	8%
Hambantota	514	6%	Badulla	311	6%
Kurunegala	510	6%	Hambantota	295	6%
Badulla	453	6%	Matale	273	5%
Jaffna	373	5%	Monaragala	256	5%
Nuwara Eliya	261	3%	Kandy	248	5%
Mullativu	254	3%	Jaffna	201	4%
		70%			61%

Source: DCS

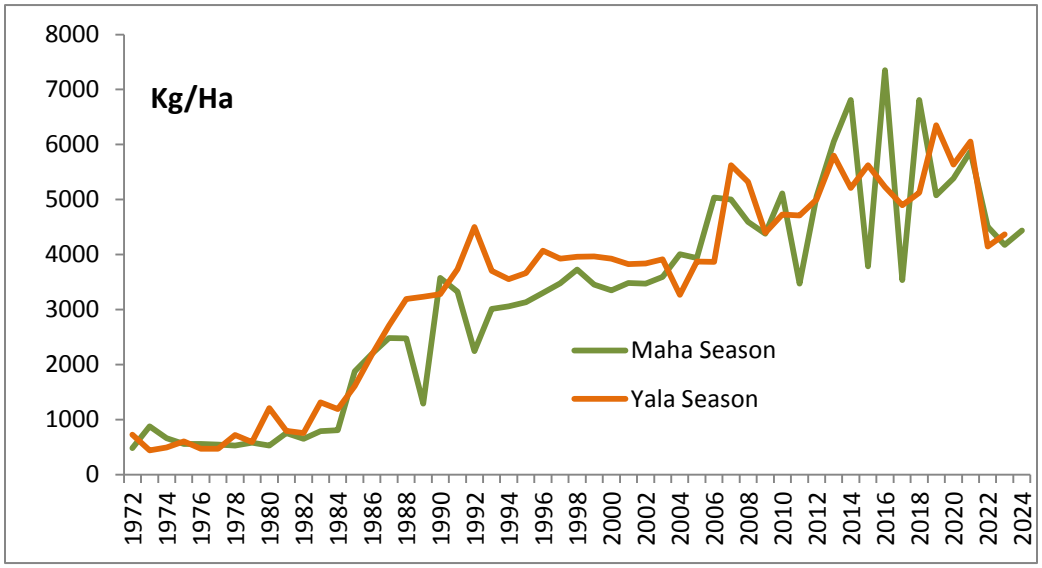
[1] Annex 3

3.2 Varietal Developments and Productivity of chilli

Chilli being a highly cross pollinated crop, a significant high level of exploitable heterosis is reported. Hybrids are highly productive and respond very well to hitech management practices and always assure a uniform quality produce to the market. Exploitation of heterosis by developing hybrids is the best way of achieving higher yield and other quality characters. The productivity has increased in major producing areas by more than 100% from 1.44 ton ha−1 in 2000 to 3 ton ha−1 in 2023 due to the cultivation of high yielding hybrid cultivars in place of the traditional open pollinated cultivars.

Although hybrid program in Sri Lanka was delayed, the hybrid varieties developed by FCRDI of DOA are superior to many exotic hybrid varieties. The price of imported hybrid seeds is very high and most of the exotic chilli hybrids are highly susceptible to major pest and diseases in chilli showing less adaptability under local condition. There is a scope for harnessing hybrid vigor further through varietal development program. Also F 1 seed production program is important in realizing the potential yield.

Figure 2: Green Chilli Yield in Anuradhapura district

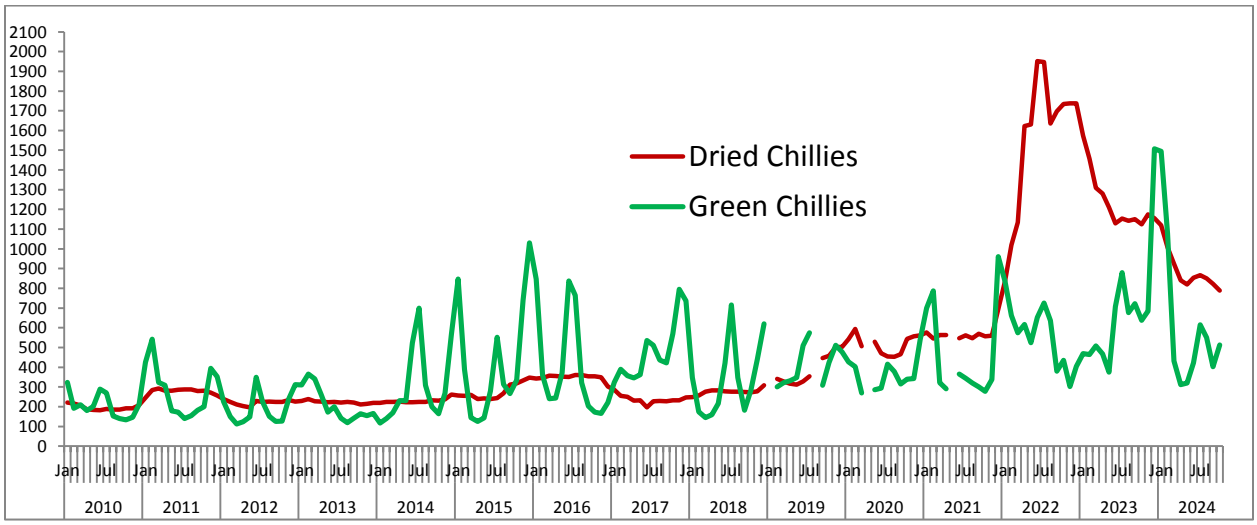


Source: Department of Census and Statistics

Variability in Chilli yield in Anuradhapura is very characteristic particularly during maha season although varietal developments have been able to increase potential yield of chilli (Figure 2). Therefore improved management practices are important to realize the potential yields of improved varieties. Most of the chilli growing countries in the world have increased the

productivity using hybrid chilli varieties along with high-tech agriculture (green house, drip and sprinkler irrigation). Moreover, productivity improvements in the country have not translated into a substantial increase in overall production, particularly for dry chili so that the dry chilli production can be promoted in the country. The extent under chilli has either declined or remained constant overtime and the production is mainly limited to green chilli production and continue to fetch a good price in the market.

Figure 3: Average Whole Prices (Rs/Kg) of Dry Chilli and Green Chilli at Dambulla Market



Source: HARTI

When comparing the market prices of dry chilli and green chilli, it is evident that they function as two distinct commodities with separate demand dynamics. Imported dry chilli price is more or less equal to green chilli price except for the years when the exchange rate escalated (Figure 3). This price parity poses a significant challenge for local farmers, as they struggle to compete with the lower-priced dry chilli imports from India.

The industry has evolved to capitalize on these imports, with imported dry chilli being processed into various value-added products—such as chilli powder, flakes, and pastes—primarily for export to the Sri Lankan expatriate market overseas. This niche segment has grown into a profitable venture, generating annual export revenue of approximately 500,000 to 600,000 US dollars.

On the one hand, the heavy reliance on cheap imports limits opportunities for local dry chilli production to thrive and on the other hand, the commercial cultivation of chili even with the credit support could lead to unprofitable markets due to oversupply of green chilli, as the cost of processing excess green chilli into dry chilli is high. This dilemma in the chilli production and marketing system pose challenges to promote dry chilli production in the country.

4. ASMP INTERVENTION PROGRAM AND ITS IMPACT

With the target of producing 20% of the national dry chili requirement through the project, ASMP invested in value chain development through various interventions. The objectives of this project intervention are;

- Reducing seed costs: Lowering the price of seeds to make it more affordable for farmers.
- Increasing green chilli yield: Encouraging farmers to adopt better management practices to boost productivity of local hybrid chilli.
- Improving fertilizer and water use efficiency: Optimizing input use in green chilli production for better cost-effectiveness.
- Lowering labor costs: Replacing manual labor with machinery during the drying process to reduce labor expenses.
- Reducing transaction costs: Establishing production and marketing infrastructure and adopting an institutional arrangement, such as a farmer company model, to streamline operations and minimize costs.

ASMP introduced a package of management practices to the cultivation of MI CH HY 1, Hybrid chili variety developed by the Department of Agriculture Sri Lanka in 2015 which is high-yielding, on par with the imported hybrid chili varieties and somewhat resistant to virus diseases. In addition to the management practices that had been in introduction with the hybrid chili varieties time to time by government and private sector, high density planting was introduced by the project along with the technology package. Project established chili clusters in 11 project districts and also chili is grown as an intercrop in many other crop clusters. Further to that the project has established a Hybrid chili seed production cluster consisting of 20 Farmers in Dambulla which is in successful operation. The total Chili grown area of the ASMP is about 1600 ac. ASMP invested in dry chilli production by setting up processing centers and supplying drier plants to 9 farmer clusters and by introducing a farmer company model to manage the dry chilli production in which ASMP supported chilli farmers are shareholders.

Project Components

- Hybrid Chilli Seed Production Program
- Material support and technical advice for green chilli and dry chilli production
- Building an institutional organization through farmer companies

4.1 Hybrid Chilli Seed Production Program

The Chilli Seed Production Program of ASMP was implemented as a pilot project in Matale districts in 2019 in the chili seed pilot clusters in Galewela, Naula, Dambulla and Matale to enhance domestic seed production and reduce dependence on imports. With the ASMP support the selected farmer entrepreneurs established 20 poly tunnels capable of producing 400 kg of F1 MI CH HY 1 hybrid seeds annually, sufficient for cultivating 1,600 Ac of chilli extent. The technology package introduced included, parental seeds from Department of Agriculture, irrigation-equipped poly tunnels, pollination techniques, and crop management and harvesting practices. The program has supported 20 chilli seed producing farmers to produce chilli seeds to cultivate 1,600 acres of commercial chilli cultivation expecting to yielding 12,000 metric tons of dry chilli—one-fifth of the national requirement.

The initial harvests of F1 seeds were sold through a private buyer Land Mark Agro. Then the chilli seed clusters formed a company by the name Eco Agri Ltd and registered with registrar of companies. Company setup a sales center in Galewela to sell all agricultural inputs in addition to their F1 seeds. Seed sales are currently managed by this registered farmer company to their company name as the brand name with ongoing production and harvesting, contributing to strengthening the local chilli value chain. The total investment of ASMP to this project component was Rs 52.96 million (Table 2).

Table 2: Information on Chili Seed pilot cluster

Project Location	Galewela, Naula, Dambulla & Matale
Year Started	Planted in 2019
Technology Package given	Parental Seeds from the DOAto produce MI CH HY 1 Poly tunnels with irrigation facility, Pollination Techniques, Crop Management & Harvesting and seed production technology
No of Beneficiaries (Target)	20
No of Poly tunnels established	20
Total F1 Production	400 kg
Present Status	continues
Collecting /Processing Centre	Seed sales centre
Farmer Company	Registered
Total Project Investment in Chili seed production	Rs Mn 52.96

A focus group discussion was held with 3 seed producing entrepreneurs of the company and the cluster coordinator on 10th November 2024 at their sales center and visited the site of chairman of the company.

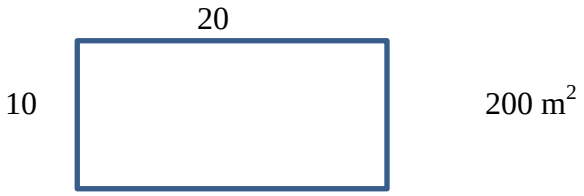
Focus Group Discussion

Location- Galewela, Dambulla

Cost of construction of tunnel structure is Rs. 1,200,000.00
Wet pad, net and Other equipment cost is Rs.800,000.00
ASMP Contribution per tunnel on average is Rs. 2,648,000.00

Parental line ratio -Male 25 Female 425
Parent stock is purchased from FCRDI of DOA

Technical advice on management of the crop, protocols to be followed throughout the process are provided by DOA.



200 m^2

F1 seed supply from the 200 m^2 tunnel is minimum 20 Kg per year

Table 3: Cost calculation for F1 Chili seeds

Size of the poly tunnel - 154 Sqm
Variety MI -CH 1
No of season per year - 01
Expected yield per year - 25 Kgs

Item	Unit cost Rs	No of units	Total cost	
Grow bags (16")	35	240	8,400.00	
Compost (Kg)	50	200	10,000.00	
Coir (Kg)	20	1000	20,000.00	
Seeds (15g)	1,650	1	1,650.00	
Fertilizer 1 Uta (Kg)	580	10	5,800.00	
Fertilizer 2 Ilder	680	10	6,800.00	
Fertilizer 3 Yaramila	655	5	3,275.00	
Fertilizer 4 Albertsolution	2,050	25	51,250.00	
Cal/N	700	5	3,500.00	
K45	1,750	5	8,750.00	
Mancoset	1,680	1	1,680.00	
Cabrio crop (400g)	6,310	1	6,310.00	
DP 98 (400 ml)	1,735	1	1,735.00	
Grow more (1kg)	2,940	1	2,940.00	
Abar mactium (800ml)	6,930	1	6,930.00	
Labour cost	1,000	660	660,000.00	
Electricity cost	18,000	12	216,000.00	
Water bill	4,000	12	48,000.00	
Packaging cost	36	20000	720,000.00	
Total Variable Cost				**1,783,020.00**
Depreciation cost Structure (10%)		1,200,000	10%	120,000.00
Depreciation cost for other equipment (20%)		800,000	20%	160,000.00
Total cost				**2,063,020.00**
Cost per Kg				82,520.80
Farm gate price				160,000.00
Farmer margin per Kg				77,479.20
Net profit per Poly tunnel				1,936,980.00

Source: Eco Agri Ltd Records

After 40 days seeds are taken from the full pod and it continues for 6 months
Drying in the sun, separation and chemical spray are post-harvest operations.
DOA set the quality for seeds
Seed Certification and Plant Protection Centre (SCPPC) of DOA visit the tunnel and get few samples for inspection on germination and hybridity. However, they carry out only germination test but not the hybridity/purity test. Also the time taken to get the results is lengthy.

Soon after seed production it goes to the field. At least 2 years should be kept before releasing to farmer to cultivate in the field. F1 seeds are sold to the brand name Eco Agri Ltd at Rs 1600/10 g packet.

The lack of seed purity testing and the premature release of seeds for cultivation are considered to be factors hindering quality seed production.

4.2 Commercial Chilli Production under ASMP cluster program and dry chilli production

As the next important project component to increase the dry chilli production in the country, ASMP invested to promote commercial chilli production in an area of 1600 Ac to realize the potential productivity of local hybrid chilli with quality F1 seeds produced in ASMP supported poly tunnels and with ASMP-ISP technology in major chilli growing areas. The main objectives of this program are to;

- Increasing green chilli yield: Encouraging farmers to adopt better management practices to realize the potential productivity of local hybrid chilli
- Improving fertilizer and water use efficiency: Optimizing input use in green chilli production for better cost-effectiveness.
- Lowering labor costs: Replacing manual labor with machinery

Project was implemented in 11 districts initially with the support of World Bank and later with the support of EU. A technology package that included a set of new management practices that required capital cost to erect new structures and technical knowhow were supported by the project by providing material input and extension. In total, more than 3200 farmers were supported to cultivate some 1600 Ac with technology package introduced by the project as follows;

	District	Area	No. of Farmer beneficiaries	Extent Cultivated (Ac)
1	Anuradhapura	Talawa, Galnewa & Thirappane	400	200
2	Polonnaruwa	Mahaweli System B, NLDB	400	200
3	Kandy	Kurunduwatta, Nawalapitiya	347	173
4	Batticoloa	Kaluthavalai	200	100
5	Monaragala	Buttala, Monaragala & Siyambalanduwa	200	100
6	Vavuniya	Vavuniya & Vavuniya South	300	150
7	Mullativu		275	135
8	Ampara	Potuvil, Thirukovil and Damana	300	150
9	Jaffna	Chavakachcheri	200	100
10	Killinochchi	Kandawalai and Karachchi	300	150
11	Badulla	Mahiyanganaya and Rideemaliyadda	300	150
			3222	1608.5

4.2.1 ASMP Technology Package for Commercial Production

Nursery Management

Coir Fiber pith disk and Plastic Trays

Cocopel Grow Pellet is a compressed coir fibre pith disc. The disc comes with added fertiliser and is covered in a bottom sealed biodegradable net with EU certification"

The pellets are expanded to nursery size containers by adding moisture. Then the Chili seeds are sowed one at a time in the expanded pellet. The seedlings need to grow for at least 30 days to reach a height of 12 cm – 15 cm. They are ready for transplanting (field ready) at the specified height and have 5 to 6 well developed leaves, in addition to being free from pests and diseases.

The fertilizer content of the pellet is supplemented once per week with foliar applications of fertilizers containing micronutrients until the seedlings are field ready. After sowing and for the growing period in the elevated nursery stand (approximately 30 days), the pellet containers are placed on plastic trays designed to support a good number of the expanded pellets.

Better Land preparation

High bed -1 &1 /2 feet – good drainage, less water logging, better root system, vigorous plant
Drainage – U type
Drip irrigation - Low pressure, high frequency

Drip Irrigation

After making the beds, one drip tape line is installed in the middle of the bed for irrigation purposes. The drip tape is double layer, white in color and UV resistant (the outer layer is UV treated). Its wall is 0.30 mm thick, and the tape has a 16 mm diameter. Emitters are spaced at 30 cm on the tape and the flow rate for the emitters is 2 Lt/Hr at 1 Bar of pressure.

Chili requires 6 mm per day of water for optimum production. Low pressure irrigation is the best method of applying uniform and precise amounts of water directly to the root zone of the plants, as per their above requirement, through emitters at frequent intervals over a period, via a pipe network comprising of mains, submains, and laterals. In this system, water is applied drop by drop on the soil surface or below it (sub-surface), at a rate lower than the infiltration of the soil

Weeding and Soil Moisture Retention

Mulching

The drip tape is followed by a silver and black plastic mulch with a thickness (gauge) of 30 microns to 40 microns and a width of 5 ft (1.52 meters). The mulch is placed on top of the planting beds.

Plastic mulch, combined with drip tape irrigation, high planting beds and high-density planting is considered the current "state of the art" technology for high value crop production. This combination is one of the most efficient and productive systems for maximizing both yield and irrigation efficiency.

Two rows of plants are placed on every bed. The distance between the two rows is approximately 40 cm to 45 cm. The planting distance inside the planting rows of 30 cm is then marked on the mulch with a planting guide or template that uses sharp nails to make the planting marks. The

planting pattern for the two rows of the crop on every bed should be triangular to minimize the high-density effect on plant-to-plant competition. This planting pattern is always preferred for high density planting.

Weeds are controlled using agricultural type plastic mulch which offers several distinct advantages in agricultural applications:

One of its primary benefits is weed suppression, as the opaque nature of the mulch effectively blocks sunlight, preventing weed growth and reducing the need for chemical herbicides.

Additionally, plastic mulch helps to conserve soil moisture by minimizing evaporation, thus supporting more efficient water use and reducing the frequency of irrigation.

The mulch also serves to warm the soil, promoting earlier planting and enhancing overall crop development, particularly in cooler climates.

Furthermore, the use of plastic mulch can lead to improved fruit and vegetable quality by preventing direct contact with the soil, reducing the risk of rot and spoilage.

Overall, plastic mulch contributes to increased crop yields, improved crop quality, and more efficient use of resources, making it a valuable tool in modern agricultural practices. Nevertheless, while plastic mulch offers several benefits in agriculture, including weed suppression, soil moisture retention, and increased soil temperature, it also presents several notable management challenges:

Pest and Disease Control

Insect Proof Net

The use of insect nets represents a highly effective and environmentally friendly method for protecting crops from insect pests as part of an IPM approach. By strategically protecting crop fields with peripheral fine-mesh insect nets, farmers can create a physical barrier that prevents harmful insects from reaching the plants, thereby reducing the need for chemical pesticides. These nets serve as a protective shield, effectively blocking the entry of a wide range of pests, including aphids, thrips, whiteflies, and caterpillars, while also providing a barrier against certain diseases carried by insects. Furthermore, insect nets allow for the passage of air, light, and water, ensuring that crops receive the necessary resources for healthy growth. With the ability to significantly reduce pest damage and minimize the risk of crop losses, the use of insect nets demonstrates a sustainable and integrated approach to crop protection, contributing to both higher yields and the promotion of eco-friendly agricultural practices.

Sticky Yellow Traps

Sticky yellow traps play a crucial role in integrated pest management strategies for field crops, offering farmers a valuable tool for monitoring and controlling insect populations. By strategically placing these traps throughout crop fields, farmers can effectively monitor insect

populations and identify potential threats to the crops. The bright yellow color of the traps acts as a powerful attractant for a wide variety of flying insects, including aphids, thrips, leafhoppers, and other pests known to damage field crops. Once captured on the adhesive surface of the traps, these insects are effectively removed from the crop environment, helping to mitigate potential yield losses and reduce the need for chemical insecticides. By incorporating sticky yellow traps into their pest management plans, farmers can contribute to the sustainable and environmentally conscious cultivation of field crops, promoting healthier yields and minimizing the impact of harmful pests on agricultural production.

Fertigation

Chili is a relatively heavy user of nitrogen (N), phosphorus (P) and potassium (K). Hence, application of fertilizers is essential to boost the yield and get higher returns. The deficiency of micronutrients in some soils may also limit the production.

Plant nutrition (N, P, K) required depend on the stage of development of the chili crop. The fertilizer application is based on soil test results. Fertigation done by through the Drip irrigation system and it helps to increase the efficiency of the fertilizer usage.

Fertiliser is recommended after soil testing taking few samples from the representative locations. Usually every 2 year soil testing is recommended.

Copy of soil test reported in annexed.

4.2.2 Project Support by chilli cluster

In addition to providing material support and technical expertise, farmers in each cluster were organized under a company model to function as a sustainable business entity focused on dry chilli production. Yet, some clusters were supported to continue with green chilli production. The project also invested in establishing a processing center, which serves a dual purpose: as an input supply hub for farmers and as a sales outlet for their produce. Dryers were setup in the processing centers. To formalize this structure, the company was registered with the Registrar of Companies, enabling farmers to become shareholders by obtaining company membership. This approach empowers farmers with ownership, strengthens their collective bargaining power, and fosters long-term viability in the dry chilli value chain.

Chili cluster in Kandy

Main crop	Chili for dry Chili Production
Technology Package given	Hybrid Chili Seeds MI CH HY 1, bed makers and high-density planting, Drip Irrigation & Fertigation, crop management technology,Poly Mulch, Insect proof Net with GI pipes, Yellow sticky trap for Pest control
Project contribution by material support for chilli cultivation ASMP technology	Rs. 218,011,840.00
No of Beneficiaries	347 (173Ac)
Present Status	Planting started in 2021, Production continues
Collecting /Processing Centre	Processing centre with the Dryer,
Farmer Company	Registered

Chili cluster in Potuvil, Thirukovil and Damana, Ampara

Main crop	Chili for dry Chili Production
Technology Package given	Hybrid Chili Seeds MI CH HY 1 , bed makers and high-density planting, Drip Irrigation & Fertigation, crop management technology,Poly Mulch, Insect proof Net with GI pipes, Yellow sticky trap for Pest control
Project contribution by material support for chilli cultivation ASMP technology	Rs. 148,605,895.28
No of Beneficiaries (Target)	300
Present Status	Planting started in 2024
Collecting /Processing Centre	Processing centres with 2 Dryers
Farmer Company	Registered

Chilli Cluster in Kaluthavalai, Batticaloa

Main crop	Chili PC1 Variety for green chili production
Technology Package given	Seeds of PC 1 variety, with irrigation facility, Sprinkler 100, crates 200, Rain shelter-10, Nursery tray 2000 Intercultivater-05
Project contribution by material support for chilli cultivation ASMP technology	Rs. 67,449,368.00
No of Beneficiaries (Target)	200
Present Status	Planting done in 2018 March
Harvesting	1st Harvest 2018 November
Collecting /Processing Centre	-
Farmer Company	Registered

Chili Cluster in Talawa, Galnewa & Thirappane in Anuradhapura

Main crop	Chili for dry Chili Production
Intercrop (In) / Rotational crop (Rc)	Rotational crops
Technology Package given	Hybrid Chili Seeds MI CH HY 1 , bed makers and high-density planting, Drip Irrigation & Fertigation, crop management technology, Poly Mulch, Insect proof Net with GI pipes, Yellow sticky trap for Pest control
Project contribution by material support for chilli cultivation ASMP technology	Rs. 386,129,205.88
No of Beneficiaries (Target)	400
Status	Planting started in June 2021, In production since 2021
Collecting /Processing Centre	Processing centres with 2 Dryers, Established in 2023,
Farmer Company	Registered

Chili Cluster in Mahaweli System B, Polonnaruwa

Main crop	Chili, for dry chili production
Intercrop (In) / Rotational crop (Rc)	Rotational crops
Technology Package given	Hybrid Chili Seeds MI CH HY 1, Bed makers,high-density planting, Crop Management technology, Drip Irrigation & Fertigation, Poly Mulch, Insect proof Net with GI pipes, Yellow sticky trap for Pest control.
Project contribution by material support for chilli cultivation ASMP technology	Rs. 257,994,238.40
No of Beneficiaries (Target)	400
Present Status	Completed

Harvesting	Feb-24
Collecting /Processing Centre	Processing centre with the Dryer
Farmer Company	Registered

Chili Cluster in Chavakachcheri- Pilot cluster scaled up in Jaffna

Main crop	Chili, green
Intercrop (In) / Rotational crop (Rc)	Rotational crops
Technology Package given	Drip irrigation systems Poly mulch , insect proof net
No of Beneficiaries (Target)	200
Present Status	Started in 2018 and continuing
Harvesting	2018 August
Collecting /Processing Centre	Processing centre with the Dryer (combined with another cluster)

Chili Cluster in Kandawalai and Karachchi Pilot cluster scaled up in Kilinochchi

Main crop	Chili, for dry chili production
Intercrop (In) / Rotational crop (Rc)	Rotational crops
Technology Package given	Hybrid Chili Seeds MI CH HY 1, Bed makers,high-density planting, Crop Management technology, Drip Irrigation & Fertigation, Poly Mulch, Insect proof Net with GI pipes, Yellow sticky trap for Pest control.
No of Beneficiaries (Target)	300
Present Status	Completed
Harvesting	continues
Collecting /Processing Centre	Processing centers with 2 Dryers (Combined with Jumbo Peanut 2 clusters)
Farmer Company	Registered

Chili Cluster in Vavuniya & Vavuniya South, Pilot cluster scaled up in Vavuniya

Main crop	Chili, for dry chili production
Intercrop (In) / Rotational crop (Rc)	Rotational crops

Technology Package given	Hybrid Chili Seeds MI CH HY 1, Bed makers,high-density planting, Crop Management technology, Drip Irrigation & Fertigation, Poly Mulch, Insect proof Net with GI pipes, Yellow sticky trap for Pest control.
Project contribution by material support for chilli cultivation ASMP technology	Rs. 277,721,007.20
No of Beneficiaries (Target)	300
Present Status	Completed
Harvesting	continues
Collecting /Processing Centre	Processing centre with the Dryer is Established in 2023,
Farmer Company	Registered

Chili Cluster in Buttala, Monaragala & Siyambalanduwa, Pilot cluster scaled up in Moneragala

Main crop	Chili, for dry chili production
Intercrop (In) / Rotational crop (Rc)	Rotational crops
Technology Package given	Hybrid Chili Seeds MI CH HY 1, high-density planting, Drip Irrigation & Fertigation, Poly Mulch, Insect proof Net with GI pipes, Yellow sticky trap for Pest control
No of Beneficiaries (Target)	200
Present Status	Started in 2021
Harvesting	continues since 2021 Dec
Collecting /Processing Centre	Processing centre with the Dryer
Farmer Company	Registered

Chili Cluster in Mahiyanganaya and Rideemaliyadda in Badulla

Main crop	Chili, for dry chili production
Intercrop (In) / Rotational crop (Rc)	Rotational crops
Technology Package given	Hybrid Chili Seeds MI CH HY 1, high-density planting, Drip Irrigation & Fertigation, Poly Mulch, Insect proof Net with GI pipes, Yellow sticky trap for Pest control
Project contribution by material support for chilli cultivation ASMP technology	Rs. 313,704,387.68
No of Beneficiaries (Target)	300 (150 Ac)

Present Status	Started in Feb 2023
Harvesting	In production
Collecting /Processing Centre	Processing centre with a Dryer (combined),
Farmer Company	Registered

Chili Cluster in Mullativu

Main crop	Chili, for dry chili production
Intercrop (In) / Rotational crop (Rc)	Rotational crops
Technology Package given	Hybrid Chili Seeds MI CH HY 1, high-density planting, Drip Irrigation & Fertigation, Poly Mulch, Insect proof Net with GI pipes, Yellow sticky trap for Pest control
No of Beneficiaries (Target)	275 (137 Ac)
Present Status	Started in …….
Harvesting	In production
Collecting /Processing Centre	Processing centre with a Dryer
Farmer Company	Registered

4.2.3 Field Survey Findings on the Project Intervention

A field survey was conducted from 10th November to 14th November 2024 to study the status of adoption of ASMP technology by farmers and its effectiveness on achieving the objective of increasing green chilli production and dry chilli production in the ASMP supported areas. It is also expected to understand the technical and institutional issues that are hampering the overall objective of increasing chilli production for solutions. Focus group discussion were conducted in ASMP site locations in Makulewa in Mahaweli H area, Thirappane in Anuradhapura, and Omanthai in Vavuniya, Kurunduwatta in Kandy and with seed producer group in Galewela, Matale. Focus group discussions, site visits and key informant interviews were used as the method of data collection.

Focus Group Discussion 1

Location: Mahaweli H – Makulewa
Irrigation Block – Canal D
Farming System – maha paddy and yala chilli
Number of Farmers in the Focus Group- 10 farmers (Both ASMP project beneficiaries and non- beneficiaries)

This is one of the traditional chilli growing areas in Anuradhapura district. Farmers used to cultivate mainly MI 2 chilli variety traditionally by producing their own seeds for dry chili production during yala season. Since late 90's many farmers had been abandoning chilli cultivation and some had completely stopped cultivation. When local hybrid MI CH HY 1 & 2 was introduced, they had resumed chilli cultivation and have move to cultivate MI CH HY 1.

ASMP support program initiated activities in the Makulewa area with a group of 400 farmers in 2020. In the ASMP technical package, they had received plastic mulch, drip irrigation kits, fertigation kit, insect proof net and supporting structures to cultivate ½ Ac. With ASMP technical package farmers were given MI CH HY 1 seeds to the market price (Rs. 1300/ 10 g). The beds were prepared and planting was done to increase the planting density to accommodate 13,000 plants per Ac in the raised beds. Due to the new technology and new method of resource management, fertiliser use, water use and labour use dropped significantly. Although farmers were organized with the support of ASMP project staff to cultivate using the new technology for dry chilli production, there wasn't a mechanism to dry the large red chilli stocks farmers harvested and to sell specially during the COVID time. The need for a dryer was first emerged and through the project the first dryer operated with Kerosene was introduced. Farmers Company that was formed with the participation of around 200 farmers took the leadership. A farmer company was registered by the name Rajarata Chili Park. Farmer Company took the responsibility and was able to sell the dry chilli to the market getting relatively a better price for dry chilli. They labeled their product before releasing to the market under their company name. This is the beginning of ASMP dry chilli introduction to the market. Now they have an electric dryer from India installed in the building dedicated to the company. However currently it's operation is halted.

Although the technology was promising and they were able to receive good yields, they are not satisfied with the quality of the materials. The plastic mulch some farmers got through Keels program some years back had been used for 8 seasons, yet the project supplied plastic mulch can only be used for two seasons and they are crushed into pieces in the field and get mixed with soil. They assume the material imported after the foreign exchange crisis was in poor quality. Drip tapes are also in poor quality.

In the first one to two seasons the MI CH HY 1 seeds they got were of very high quality and had received very high yields. Following years they had not received good quality seeds. According to them Kotmale seeds packed in Dankotuwa were the best quality seeds they purchased ever while MahaIlluppallama seeds had 90 % quality seeds and seeds from Batalagoda had 75%. There has been a gradual decline in quality of seeds of MI CH HY 1 and majority of the seeds obtained thereafter more susceptible to the leaf curl complex during the very early stage of the crop and which resulted decline of harvest. The availability of good quality seeds is a real issue. Some

farmers have gone to cultivate Indian hybrid varieties such as Vijaya, newly introduced Rajina hybrid varieties.

Some entrepreneurial farmers have replicated the technology by investing and adjusting their cultivation to fetch a better price for green chilli during the off season in November and December. It is also observed that farmers have engineered new methods to overcome day today problems in their cultivation. Farmers have adopted sprinker irrigation to reduce the heat inside the field covered with insect proof net. To protect the crop from elephant damages electric fences have been setup around many fields and roof huts have been built.

Focus Group Discussion 2

Location: Illuppu Kanniya**,** Thirappane
Irrigation – Rain fed**,** Agro well
Farming System –Maha Upland (Goda Hena) crop rotation with chilli as a crop in the farming system
Number of Farmers in the Focus Group- 10 farmers (ASMP project beneficiaries)

This is also one of the traditional high potential chilli growing areas in Anuradhapura district. Farmers used to cultivate MI 2 chilli variety traditionally and mainly dry chili had been produced during maha season. Farmers had produced their own seeds. Since late 90's chilli cultivation has been declining but continued cultivation mainly for green chilli. In the focus group there were farmers who had cultivated MI 2, Galkiriyagama selection and other imported varieties until the local hybrid MI CH HY 1 & 2 were introduced. Farmers in this area had experience with the some technical elements of ASMP technology introduced. According to them, chilli cultivation for last 10 years had been with less seasonality due to change in rainfall pattern that make it possible to cultivate in both seasons.

In 2022 a chilli cluster in Thirappane was formed with 100 farmers joining the group initially and ASMP support program was initiated. Later another 50 farmers joined the company. The same package of materials and technical knowhow was extended to them through the project. Currently they get seeds from Kadurata seeds from Kotmale Agro Business (Pvt) Ltd at Rs.1700 per 10 g of chilli seeds. One member of the company Nursery management and plants maintained in plastic trays for transplanting is an activity of and others purchase from him. In bed making they are using a special gadget coupled to the 4W tractor to save labour. These field level innovations can be further improved.

These farming communities lack access to extension services. When a disease affecting their crop, it is very remote for them to get the service of an extension officer since the coverage of the

extension area of the respective AI (Yakalla AI) is vast. This season their crop is showing yellowish leaves from the very early stages and they have no idea what remedies they should take. They largely depend on agro-chemical retailer for the extension advice.

Farmers mostly use supplements like Yaramila Plus with drip Irrigations. Farmers complain that drips get stuck when using fertilizers like MOP. A common issue is mouse biting of drip tapes. It is complained that drips get blocked in Thirappane area due to the salinity of water. It caused entire drip system undergoes clogging and leaking. They are also concerned about the declining quality of hybrid seeds.

ASMP installed a heat pump dryer in Puliyankulma in one of the member's premises in April 2024. However the operation is yet to begin.

The best chilli farmer of year 2024 was one of the members of this farmer group. He was able to obtain the highest chilli yield and the highest income from chilli.

Box 1- A Success Lesson from Thirappane

The study was able to obtain information from Mr Bandula, a successful chili farmer, in Puliyankulama of Tirappane in Anuradhapura District. He is a experience farmer who has been cultivated Chili, Pumpkin and Maize since 1996. He joined the ASMP project in 2021 and cultivated chili in a ½ Acre land under the ASMP technology package with high density cropping system. In this method he has practiced crop rotation with chili, sweet melon and long beans, He has used Local hybrid MI CH HY 1 Chili variety introduced by the Mahailuppallama Agricultural Research Institute. The seeds of which he has bought from the ASMP assisted chili seed producers in Galewela in Mathale district. According to him those seeds are of better than the other varieties and the brands available in the market.

During the control of pest and deceases, farmer mentioned that in harvesting huge number of female labors was required. In practically the same teams of labor are involved in harvesting all the farm lands moving from one to another. Therefore, it is hard to control the spread of pest and diseases. Chemical fertilizer manuring is done according to the recommendations and 2000kgs of organic manure and burnt paddy husk is applied to the soil at the beginning. In addition to some plant nutrient mixers like Yaramila, Albert solution are applied to induce the growth.

Harvesting is done up to 7-8 months. The farmer got a harvest of 32500kgs of green chilies from ½ Acre in 2023. The farm gate price ranged he got was Rs 450.00-Rs 1200.00/Kg. Accordingly, he got an income of more than ten million rupees. The technology package provided by the project has assisted this good harvest. He also added that he had obtained a harvest closer to that before he joined the project and he pointed out the fact that there is a clear drop in unit cost due to the complete technical package provided by the ASMP project. He got a presidential award for the high performance and the success of chili cultivation in 2023.

Focus Group Discussion 3

Location - Palamoddai, Omanthai, Vavuniya
Irrigation – Rain fed**,** Agro well
Farming System –Maha Upland (Goda Hena) crop rotation with chilli as a crop in the farming system
Number of Farmers in the Focus Group- 6 farmers (ASMP project beneficiaries)

This is also a traditional chilli growing area in Vavuniya district especially for dry chili production. With ASMP intervention, a farmer company named Living Agro Product (Pvt) Ltd was formed in 2023. There are 300 registered farmers who are also the shareholders of the company. For chilli cultivation they had received the technology and material support to establish ½ Ac. A relatively less yield i.e 15,000 -18,000 kg/Ac is recorded in this areas compared to Anuradhapura for MI CH HY 1. Hybrid seeds have been purchased from the ASMP chilli seed producer Eco Agri Ltd in Dambulla. Their experience with CIC chilli seeds is very negative.

What was experienced when visiting their chilli sites, because of the plastic environment, it has created a very high heat inside the chilli crop chamber.

An electric dryer was installed with a capacity to dry 800-1000kg per day. Additionally other farm machinery and equipment have been given by the project to the farmer company for hiring for farm activities. Through these, registered farmers get benefits. Chilli farmers have entered into an agreement to supply some proportion of their harvest as red chilli for drying. Currently Rs. 150 is paid per kg of green chilli. There are farmers those who are not members of the company get their red chilli stocks to the company drying center for drying. The unit cost of drying 1 kg of dry chilli (nearly 4 kg of green chilli) is Rs 37.50 including profit to the company. They have also grinding machinery installed in the drying center and are planning to sell as chilli flakes and chilli powder. As the appearance of dry chilli pods produced from MI CH HY 1 are not upto the consumers preference, the price capture in the

Focus Group Discussion 4

Location - Doragala Chili Cluster- Kothmale
Irrigation – Rain fed
Farming System –Upland in terraces, crop rotation with chilli as a crop in the farming system
Number of Farmers in the Focus Group- 6 farmers (ASMP project beneficiaries)

Chili cultivation has been implemented in 3 divisional secretariat (DS) divisions Uda palatha, Gaga ihala korale and Nawalapitiya in Kandy district under the ASMP. Afield focus group discussion was conducted in Doragala in the DS division Uda Palatha (Kothmale). Doragala is located in a mountain area 4 Kms away from the Kothmale reservoir (figure 1).

In this area located more than 1000meters high from the sea level, tea cultivations are prominent. There an abundant and marginal tea lands and farmers cultivated traditional vegetable crops such as Beans, Cabbage, Raddish, Carrot and Capsicum on sloppy hilly lands. The harvest is supplied to Dedicative Economic Centers of Dambulla and Katugasthota. Nearly eight kilometers of the road to doragala from kothmale which is in a very bad condition is a main problem to transportation of farmer produce. The chili cultivation also becoming popular in this area.

There are about 340 beneficiary farmers in the project related to chili cultivation including 30 farmers from doragala area. All these farmers have joined the project in 2021 and they have started chili cultivation in March, 2022 with all technical inputs.

In Nawalapitiya DS division, 44 farmers had been selected as a pilot project before the chili cultivation practices commenced. However, according to the information those farmers are not engaged in Chili cultivation at present. From the total number of 340 farmers, about 150 are engaged in Chili cultivation continuously or occasionally.

The farmer producer company started by the project is "*Gagasiri Agro*" in which about half of the farmer community has taken the shareholder status. The company possesses two four-wheel tractors, one chili dryer, two laptop computers, multi media and other office furniture's.

According to the project officers, Doragala farmers have been actively engaged in the cultivation since the beginning of the project compared to the other farmers in the three DS divisions.

At the beginning, every farmer has received a package including 80 grams of MICH-1 seeds, insect nets, mulching materials, and drip irrigation kit.

It was observed that the number of plants that can be planted in ½ an Acre is comparatively lower than that in areas like Anuradhapura and Vavuniya. This was due to the cultivations place in a number of small beds in sloppy hilly lands.

The mulch received at the beginning could be used only for one season.

The 2W and 4W tractors are difficult to use for land preparation and beds making as the beds are on terraces. Therefore, an equipment is connected small 2W tractor engine is used to prepare the land (ploughing) and make beds. Ploughing is done only once, which is followed by adding poultry manure and TSP.

Poultry manure is rather expensive in this area due to the difficult transportation. The price is Rs 450 per 20 Kgs bag.

Key Informant Discussions

Mr Gamini (50+), ASMP Makulewa Farmer Company "Rajarata Chilli Park" – member of Director Board and Secretary

MI 2 – is best suited to dry chilli production, to get 1kg of dry chilli 31/2 to 4 kg of green chilli is required. The taste/pungency and the colour is optimum for local consumer requirement
KA 2 – it is much suited to green chilli
Indian Hybrid Varieties- Farmers can tap a yield of around 12,000- 15,000 kg/ Ac from these varieties
MI CH HY 1 - They received the highest ever chlli yield from this variety. According to him farmer in the area, farmer can get a minimum of 30,000 kg/ Ac if they get good quality seeds. On average farmer can get 22,000-24,000 kg of green chilli under improved technical package and some 18,000 kg/Ac from open field cultivation under traditional method. To get a 1 kg of dry chilli nearly 5 kg of green chilli is requird from yala harvest and 51/2 kg of green chilli from maha harvest.

Farmers are complaining about the quality of F1 seeds currently being sold in the market.

His experience in the first attempt of drying red chilli made it to introduce first dryer in the project. Their cluster got a very high red chilli harvest in their commercial cultivation with the ASMP material support by cultivating MICHHY 1 using new management practices. However there wasn't a mechanism to dry their red chilli harvest although cultivation planned to produce red chilli for drying. The company management got the responsibility to buy the red chill without a proper plan to drying chilli. This need made the project to introduce first kerosene dryer. Later company sold the dry chilli to their company name Rajarata Chilli Park.

Later project introduced more advanced electric power-operated heat pump dryers. Currently company has a Diesel & Electric drier. Nevertheless, currently they are not drying chilli and the dryer is not being properly used.

Mr. Seneviratne (50+), innovative farmer, Makulewa, Thambuththegama Chilli Cluster

Advantages of the ASMP technology compared to traditional method

- High planting density
- Drip Irrigation and fertigation
- Agro chemical cost can be cut down

In installing his automation kit, Ruhuna University supported. He is of the view farmers are ready and willing to accept new technology and innovations. They need support was
DOA – University - Farmer Company

Quality of the seeds is now getting deteriorated. Farmers don't have much faith on the contract seed growers in major companies. Sometimes they tend to behave without any standards due to the high price of seeds.

In order to reduce the heat inside the crop field in addition to drip he has installed a sprinkler irrigation system. When he finds the temperature inside is higher he supply water through the sprinklers.

Mr. Sajith Young farmer leader, Thirappane chilli cluster

He is a young farmer in the Thirappane chilli cluster who is planning his cultivation following the market price. He is currently growing MI CH HY 1 variety with the ASMP technology to get a continuous supply from his field by cultivating in stages. He is of the view that if chilli yield can be increased or if potential yield of MI CH HY 1 can be obtained as they experienced in their initial cultivations, farmer will go for dry chilli production with the excess green chilli. Also if harvesting cost can be reduced dry chilli production can be increased.

4.3 Dry Chilli Production

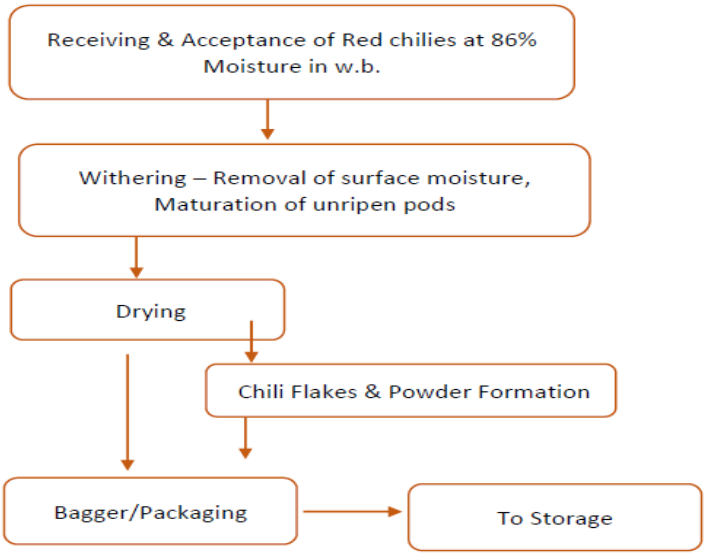
Unfavorable climatic conditions during drying seasons, high labor demand, and the resulting increase in unit costs make dry chilli production less profitable for local farmers. Replacing manual labor with machinery during the drying process to reduce labor expenses and bringing the process of drying to inside premises to avoid unfavorable climatic conditions ASMP introduced dryers in the project with trial and error method first started with a kerosene dryer later replacing with electric powered heat pump dryers to project clusters. Also chili drying involves diffusion process. Thus, the moisture should be removed in a controlled manner with controlled drying parameters i.e., temperature and relative humidity. Therefore to achieve proper drying characteristics use of a dryer is more effective than sun or solar drying.

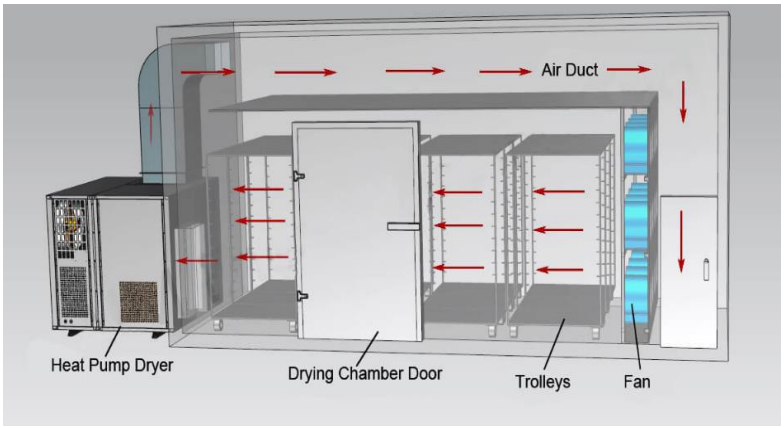
Anuradhapura	Processing centres with 2 Dryers, Established in 2023
Kandy	Processing centre with the Dryer,
Vavuniya	Processing centre with the Dryer is Established in 2023
Jaffna	Processing centre with the Dryer (combined with another cluster)

Kilinochchci	Processing centers with 2 Dryers (Combined with Jumbo Peanut 2 cluster
Polonnaruwa	Processing centre with the Dryer
Ampara	Processing centres with 2 Dryers
Moneragala	Processing centre with the Dryer
Badulla	Processing centre with a Dryer (combined)
Mullativu	Processing centre with the Dryer

Dry chilli production in Vavuniya Processing Center

ASMP supported installing an electric powered heat pump dryer with accessories and setting up a processing center in Vavuniya. The capacity of the dryer is 800-1000kg of red/ green chilli per batch.





Dry chili processing area has been constructed to accommodate receiving of red chilies, withering, drying, packing, and storing.

Table 4: Cost of Dry Chilli Production

	Cost for PUC	
01	Red chilli - 4000 kg x 150.00	600,000
02	Bags	4,800
03	Electricity	13,200
04	Labour cost	20,000
05	Administration cost	4,000
06	Transport (1000kg)	2,000
07	Depreciation PUC assets	16,000
08	Total cost for PUC to produce 1000kg of dry chilli	**660,000**
09	Cost of 1 kg of dry chilli at PUC level	660.00
10	Profit margin (12 %) – PUC	90.00
11	Selling price of PUC to Supplier	**750.00**
12	Value of sale of 1000 kg of dry chilli	**750,000**

Source: Vavuniya Farmer Company Records

Unit cost of drying 1kg of red chilli

1	Total cost for drying 4000kg of red chilli	**Rs.150,000**
2	Unit cost of drying (Rs per 1kg of red chilli)	**Rs. 37.50**

4.4 Farmer Company Model

The organizational structure of the farmer producer cluster is very deterministic in management of common resources, for input sharing, value chain development for improved income and if land consolidation is considered in the long run. How farmers can be organized to achieve a common goal of increasing profitability of chilli farming is of importance therefore to sustainability of up-scaling of technology through the project.

According to the legislative provisions in the country, there are diverse business structures possible to form farmer producer organizations**.**

- The public unlisted company and the private company under the Companies Act No.7 of 2007
- The Agrarian Development Council and the Farmer Organization under the Agrarian Development Act No 46 of 2000
- The Cooperative Society under the Cooperative Societies Law No 5 of 1972 as amended.
- The registered society under the Societies Ordinance No 16 of 1891 as amended
- The Corporation incorporated by the Minister under the Mahaweli Authority Act No 23 of 1979.

Public Unlisted Company (PUC) model has been chosen by the ASMP project in organizing farmers as entrepreneurs to undertake dry chili production on commercial basis. Farmer cluster will initially be registered with Registrar of Company, and in a legal form that allows farmers to associate in a professional manner for commercial activities. For registration with Registrar of Company, the producer cluster will need prerequisites of:

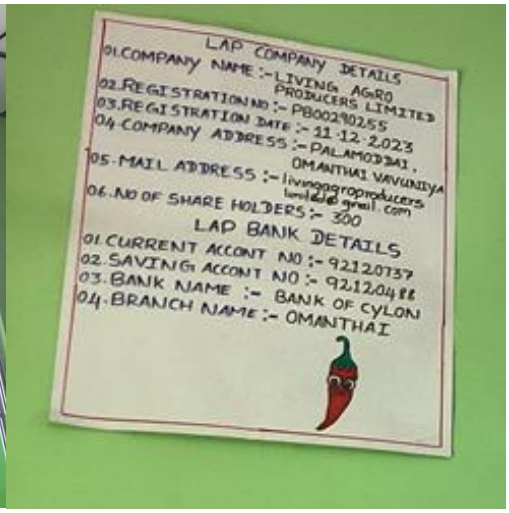
- Constitution and business plan;
- Demonstrated capacity including management executive and staff;
- Board of Directors; and
- Audited financial accounts by certified company secretary.

The ASMP provided multifaceted support, including farmer capacity building, business mentoring, facilitation of company secretary functions, start-up funding, and hands-on business guidance. Additionally, the program focused on enhancing the operational capacity of PUC staff. To ensure the sustainability of PUCs, efforts were made to maintain and strengthen business linkages between farmer clusters and market access facilitated through the PUCs. This was further reinforced by including representatives from various government and private sector entities on the PUCs' boards of directors, fostering a collaborative approach to governance and market integration.

Box 2: Living Agro Product (Pvt) Ltd - Public Unlimited Company in Vavuniya

With ASMP intervention, a farmer company named Living Agro Product (Pvt) Ltd was formed in 2023. There are 300 registered farmers who are also the shareholders of the company. Chilli Farmers in Three AI ranges are members of the company – Omanthai, Maligai, Aushaapitiya

Goovernment officers represent the board of directors – ADO – divisional officer, AG office – Development officer, National Economic Development Authority (NEDA) officer, Wayamba Development Authority officer



Currently, the Public Unlimited Company (PUC) undertakes dry chili production as its primary business activity. Additionally, the PUC operates a sales center located on the Vavuniya-Omanthai main road, offering seeds, agrochemicals, and other inputs for sale. The PUC benefits from an ASMP-supported electric dryer with a capacity of 800–1000 kg per day, as well as farm machinery and equipment provided by the project. These

assets are also made available for hire, generating additional income for the PUC while offering registered farmers affordable access to these resources.

The mechanism for dry chili production involves member farmers who cultivate chili entering into agreements to sell a portion of their green chili harvest to the PUC for drying. Currently, farmers are paid Rs. 150 per kg of red chili. After processing, the dried chili is sold to the market at Rs. 750 per kg from the PUC processing center.

Non-member farmers also have access to the drying facility, where they can get their red chili stocks dried at a cost of Rs. 37.50 per kg of red chili. This cost includes a margin of profit for the PUC.

The PUC has plans to expand its operations into value-added production. It has already installed grinding machinery for producing chili flakes and chili powder and is exploring opportunities to diversify into food drying and other value-added businesses.

As a business entity, the PUC prepares detailed business plans, including forecasts and implementation strategies. It has demonstrated financial growth, currently operating with accumulated cash equity of Rs. 7 million.

4.5 Impact of Project Intervention and Current Status

Scaling Up Technology: Impact of Project Interventions

Project interventions have proven highly impactful in scaling up improved management practices. Farmers have shown a strong willingness to adopt new technologies and have even contributed their own localized innovations to better adapt the technologies to their specific conditions.

Adoption of Improved Management Practices

A significant number of farmers are currently practicing improved management techniques introduced through the ASMP. These practices have yielded notable benefits, such as the introduction of a new local hybrid chili variety that has significantly increased yield. Furthermore, technical packages introduced through ASMP have reduced the unit cost of chili production.

One of the key advantages of these practices is the elimination of seasonality in cultivation. The controlled cultivation environment allows for staggered cultivation, ensuring consistent production throughout the year.

Efficiency of ASMP Interventions

Although the Department of Agriculture (DOA) has recommended improved management practices, the upscaling of these technologies has been constrained by various systemic factors,

including regulatory limitations. In most cases, the upscaling of management practices has occurred primarily through externally funded projects.

A detailed comparison between DOA's extension costs and ASMP administrative and implementation costs on the chilli program has not been conducted. As a result, it is challenging to assess the effectiveness and efficiency of extension efforts in utilizing resources compared to broader administrative expenditures within projects.

Involvement of Young Farmers

Young farmers in project areas such as Anuradhapura, Thirappane, Vavuniya, and Kothmale have actively embraced chili cultivation using the ASMP technical package. They represent a valuable resource for the agricultural sector. However, they require continuous updates to their knowledge and skills to maintain and enhance productivity.

To ensure sustainability, it is vital to:

- Regularly train young farmers.
- Strengthen their links with extension services and research organizations.
- Provide them with access to the latest technologies and innovations.
- Building a Knowledge and Innovation System

The most critical step in sustaining agricultural growth in rural areas is establishing a robust Agricultural Knowledge and Innovation System (AKIS). This system should focus on empowering young farmers with the latest advancements in agricultural practices, ensuring they remain competitive and innovative. Such a system would also facilitate ongoing collaboration between research, extension, and farming communities, fostering an environment of continuous improvement.

Development of Vertically Integrated Chilli Value Chain

The ASMP intervention has demonstrated that a vertically integrated chili value chain—including F1 seed production, commercial cultivation, and dry chili production—is viable under the farmer company model. Farmers have more control over production and marketing than other contractual agreements and therefore farmer empowerment is high. Long-term model if well-managed; farmer companies can grow into independent enterprises. Nevertheless, company needs to bear risks of business operations and higher risk to resilience to market shocks as farmer companies bear business costs. Company requires strong leadership and business skills to avoid risk of mismanagement or financial failures. Quality seed supply and quality processing infrastructure are vital.

5 EFFECTIVENESS OF PRODUCTION UNDER DIFFERENT MANAGEMENT SYSTEMS

Investing in chill cultivation under improved management practices with the introduction of new local hybrid chili variety, it is expected that the cost of cultivation of chilli to come down and national requirement of green chilli and a substantial quantity of national requirement of dry chilli to be met locally. Currently chilli is cultivated mainly in the dry zone districts under different water regimes, different farming system and with different resource management methods. The information gathered from the field survey the unit cost of production of green chilli using MI CH HY 1 under traditional management method and under ASMP technology package is compared and the cost of production of dry chilli with the introduced drying machines is estimated.

Currently chili cultivation is done in all districts in 2 seasons using few production technologies.

- OPV and traditional farming practices
- Both local and imported F1 HCV using traditional farming practices
- LHCV F1 Program with DOA recommendations
- LHCV F1 using ASMP technology package

Three different management practices by farming activity are described in the table below.

1. Management practices introduced and implemented by ASMP
2. Management practices recommended by DOA
3. Traditional farming practices followed by farmers.

When the field level farming practices are considered it transients from traditional to fully implemented ASMP package. To assess the impact of improved management practices on green chilli yield and the unit cost of production, a comparative analysis was conducted between ASMP beneficiary farmers and non-beneficiary farmers who are practicing traditional farming practices. However, the field survey revealed challenges in identifying beneficiary farmers strictly following the ideal ASMP recommendations. Most farmers had modified the prescribed practices to suit their specific field conditions, citing various reasons for these adjustments. While the underlying factors influencing these adaptations are discussed in a separate section, this comparison focuses on the performance of innovative, high-performing ASMP beneficiary farmers relative to non-beneficiary farmers who continue with traditional farming practices.

ASMP technology is a package of management practices recommended considering local and international farming practices. DOA has aslo recommended some practices common to ASMP technology such as drip irrigation with lengthy farm beds still with some differences in laying the drips. DOA also recommends sprinkler irrigation to some localities and Puttlam farmers generally practice sprinkler irrigation, the area where crop rotation for commercial farming is predominant.

Table 5: Resource Use by different management systems of chilli culivation

	Technology Recommended by DOA	Recommended ASMP Technology	Traditional Farmer's Practices in Anuradhapura Yala Irrigated (Cost of Production data of DOA)
Varieties	MI CH HY 1	MI CH HY 1	MI 2, KA2, MI CH HY 1
Nursery Management	In nurseries Seed rate -200 g/ Ac	Using Plastic trays Seed rate -160 g/ Ac	In nurseries - 4-5 man days Seed rate - 580 g/Ac (MI 2, KA2) 200 g/Ac(MICH HY)
Bed Preparation and Planting Density	Land Preparation (1st & 2nd plough and rotary) Preparation of beds & ridges Basal + compost + pit making + transplanting Planting density -16000/Ac	Land Preparation (1st & 2nd plough and rotary) Raised bed (1&1/2")making and mixing compost using machinery Planting density -29000/Ac	Land preparation (4W) – Rs. 25000/Ac (Rotary) Manual Preparation of beds & ridges (16-17 man days Rs 2500 per day + meals) Basal + pit making + transplanting (14-15 man days) Planting density -
Irrigation method	Irrigation - drip/sprinkler irrigation	Irrigation - drip irrigation	Surface irrigation - Once a week until the water release ends, thereafter pump irrigation Water Management-20 man days
Fertiliser Recommendations	Fertilizer application –DOA Recommendation Fertigation (Kg/ Acre) Urea 243 kg TSP 40 kg MOP 61 kg Albert Mixture 32 kg (sprinkler method)	ASMP Fertilizer recommendation based on soil test results. (see Annex) Ex. Polonnaruwa based on soil test Urea 148 Kg P Acid 13 Kg TSP 153 Kg MOP 103 Kg MgSO4 227 Kg	Basal application 100 kg/Ac Top dressing – 3 times In total (MI2, KA2) TSP 69 Kg Urea 73 Kg MOP 60 Kg Chilli mix 245 Kg Manual fertiliser application (11-12 man days) In total (MICH HY) Urea 124 Kg TSP 90.5 Kg Chilli mixture 175 Kg
Mulching and Weeding practices	Straw mulching	Plastic mulching	Manual Weeding and earthing up - 30 man days
Pest and Disease Management	Varietal resistance + Agrochemicals	Varietal resistance + Installation of protective insect-proof net Application of agrochemicals to protective net	Use of Agrochemicals, Varietal resistance (MICH HY1)
Harvesting	Harvesting - 4 months period	Harvesting – 4 to 5 months period	Harvesting 2 ½ months period
Green Chilli Yield	16,000 – 30,000 kg/Ac	Expected Yield -32,000 kg/Ac	Average Yield - 7000 kg/Ac (Based on COP of DOA) commercial – 15000 Kg/Ac

5.1 Cost of Production by different Management Practices

Table 6: Cost of Cultivation of Green Chilii (with ASMP Technical Package)

Producing Areas: Thirappane & Makulewa ASMP Cluster Farmers Practice
Variety – MI CH HY 1
Average Yield – 24,000 Kg/Ac

	Description	Rs/Ac
Variable Cost		
Seed	160g @ Rs.1700/10G	27,200
Fertiliser		
Urea	150 Kg @Rs.8400/50kg	25,200
TSP	50 Kg @Rs.11000/50kg	11,000
MOP	130 Kg @Rs.9000/50kg	23,400
Chilli mixture		
Organic (Poultry manure)		50,000
Agro chemicals		
Nursery		4,000
Crop		43,200
Other Materials	Plastic trays, mulch, sticky tapes	153,000
Machinery power	Land preparation, bed making	45,000
Fuel (Diesel)	60 liters*311	18,660
Labour		
Nursery	2 males & 3 Females	9,800
Land preparation & Bed making	6 males	15,000
Laying mulch+hole making+ Transplanting	10 males & 10 females	41,000
Water management	3 males	7,500
Fertiliser & Agrochemical application	6 males & 2 Females	18,200
Weeding	3 males & 2 female	10,700
Harvesting	@ Rs 30/Kg	720,000
Total Variable Cost		1,222,860
Fixed Cost		
Depreciation		125,260
Interest for Fixed Capital (10%)		69,880
Total Fixed Cost		195,140
Total Cost		1,418,000
Unit cost of Production		59.08

Source: Field Survey, November, 2024

Table 7: Cost of Cultivation of Green Chilii (Traditional method)

Producing Areas: Thirappane
Variety – MI CH HY 1
Average Yield – 15,000 Kg/Ac

	Description	Rs/Ac
Variable Cost		
Seed	200g @ Rs.1700/10G	34,000
Fertiliser		
Urea	100 Kg @ Rs.8400/50Kg	16,800
TSP	100 Kg @Rs.11000/50kg	22,000
MOP		
Chilli mixture	300 Kg @ Rs.8500/50Kg	51,000
Organic (Poultry manure)		50,000
Agro chemicals		
Nursery		4,000
Crop		65,000
Other Materials		-
Machinery power		25,000
Fuel (Diesel)	80 liters	24,880
Labour		
Nursery	2 males & 5 Females	13,000
Land preparation & Bed making	18 males	45,000
Transplanting	2 males & 10 Females	21,000
Water management	20 males	50,000
Fertiliser & Agrochemical application	11 males & 5 females	35,500
Weeding	9 males & 10 females	38,500
Harvesting	@ Rs 30/Kg	450,000
Total Variable Cost		945,680
Fixed Cost		
Depreciation		
Interest for Fixed Capital (10%)		
Total Fixed Cost		
Total Cost		945,680
Unit cost of Production		63.05

Source: Field Survey, November, 2024

5.2 Project Cost benefit Analysis

Unit Cost of Green Chilli (Rs/Kg)			
	Traditional	63.05	
	ASMP	59.08	
	Unit Cost Reduction	3.96	6.28%
Yield Increase (Kg/Ac)			
	Green chilli	9000	60%
Increased dry chilli production		1200	Kg

Reduced Dry Chilli Imports		1200	Kg
@ US$ 2.3/Kg		2760	US $
Reduced fertiliser use (Foreign component)		15100	Rs
Reduced fertiliser imports		50.33	US $
	Reduced FE outflow	**2810.33**	**US $**

Insect Proof Net(Ac)		32400	
Establishment of Drip Irrigation		20980	
Mulch > Micron 30		60000	
		113380	Rs
	Increased FE Outflow	**377.93**	**US $**
Foreign exchange saving		2432.40	US $/Ac
	1000 Ac -----→	2432400	US $
			US $
		2.4324	million

- **Chili imports have declined**

	Import Quantity (tons)	Import Value (US $ thousand)
2019	52,459	82,818
2020	50,733	94,873
2021	50,088	99,060
2022	47,624	112,346
2023	40,055	96,080

- **Labour use has dropped**

Labour required in the traditional method
– 92 man days for farming activities other than harvesting
Labour required with ASMP technology

- 47 mandays for farming activities other than harvesting

Labour use has dropped by nearly 50%

- **Fertiliser use has dropped**

	Traditional Method	ASMP Technology
Urea	100 Kg/Ac	150 Kg
TSP	100 Kg/Ac	50 Kg
MOP		130 Kg
Chilli mixture	300 Kg	

- **Capital requirement has increased**

In the traditional method, farmers only require working capital, which is continuously rolled over during operations. In contrast, the ASMP technology necessitates an initial capital investment for installing infrastructure, representing a fixed cost.

6 POLICY FRAMEWORK FOR OPTIMIZING GREEN AND DRY CHILI PRODUCTION

This section deals with the following consultancy objectives

- Assess the current national requirement of green and dry chili and estimate the total land extent that should be cultivated using ASMP technology to meet the national requirement.
- Assess the most appropriate price level for green and dry chili, in different seasons in different locations to make the chili production, processing, value addition, and marketing, profitable for the farmers/ Farmer companies and other stakeholders.
- Assess the possibility of becoming self-sufficient in green and dry chili, with the desirable land extent, price levels, time frame and policy support. If there is any gap in production, estimate annual import requirement to meet the national demand.
- Identify, policy changes/ policy instruments that the government could use to make the appropriate strategic plan for the profitable and sustainable chili industry.

Although the ASMP intervention aims to lower production costs and promote dry chilli production by realizing the potential yield of local hybrid, its broader implementation depends on various economic, ecological, market and boarder-related factors. Currently only Vavuniya farmer cluster is continuing dry chilli production although ASMP management practices are giving better yields and has reduced unit cost of production. Therefore simulations of market behavior under different scenarios were undertaken to see under what scenario the country can achieve chilli self-sufficiency when the factors that are prerequisites are in place for scaling up the ASMP model.

	Average monthly per person (grams)	Annual consumption per person (grams)	Annual consumption per person (Kg)	Current national requirement (Mt) *@ 22.04 million population*
Dry chilli	76.2	914.4		
Chilli powder	134.96	1619.52		
		2533.92	2.53	**55,848**
Green chilli	142.78	1713.36	1.71	**37,762**

Current national requirement of green and dry chili are generally estimated based on per capita consumption. According to the HIES 2019 statistics, 2023 national requirement of dry chilli and green chilli are 55,848 Mt and 37,762 Mt. In 2019, country had imported 52,459 Mt which has declined to 40,055 Mt by 2023.

A simulation model was developed to find how, in which areas and at what level the ASMP model can be scaled up to realize the potential of local hybrid technology in order to achieve the national requirement. By analyzing the policy, institutional and technical factors, recommendation are drawn.

6.1 An empirical model to simulate market behavior for profit maximization and market integration for optimizing green and dry chili production

In the empirical model it assumes that there are two enterprises; green chilli production and dry chilli production and the choice of the degree of two enterprises is determined by profit maximization subject to land, labour constraints. A wage responsive labour supply function was considered and the relationship was modeled by taking coefficients; base wage rate as Rs.1600 per day and the slope of the supply function as Rs 150 per million mandays by considering the opportunity cost. Yet, capital was not considered as a constraint. In the two enterprises cost of production up to harvesting was considered the same but the yield was assumed to drop in the red chilli harvest as the crop is kept longer in the field before harvesting and therefore harvesting interval spans and the resultant yield is reduced. Labour demand for harvesting is dependent on the yield and the unit labour cost per kg was considered as Rs 30. Labour supply as base wage rate

Green chilli price is determined by demand and supply interaction. A linear demand function was assumed with parameters; intercept of demand function for green chilli (Rs) 500, slope of demand function for green chilli" 250000/ Dry chilli price is given and it is coming in the model as a policy variable.

The model in GAMS

```
Sets
   crop /green, dry/;

Parameters
   yield(crop)     "Yield per unit area (kg)"
   FC(crop)        "Fixed costs per unit area (Rs)"
   LC_base         "Base wage rate (Rs)"
   LC_index        "Wage rate increment per additional unit of labor (Rs)"
```

```
   L(crop)          "Labor required per kg of output"
   P(crop)          "Price of dry chilli"
   DC(crop)         "Drying cost per kg of dry chilli (Rs)"
   Conversion       "Conversion factor from green to dry chilli" /5/
   L_available      "Total labor available (man-days)" /500000/
   a_demand         "Intercept of demand function for green chilli (Rs)" /800/
   b_demand         "Slope of demand function for green chilli" /10000/;

Variables
   A(crop)          "Area allocated for each crop (acres)"
   X(crop)          "Production of each crop (kg)"
   P_green          "Prce of green chilli"
   L_total          "Total labor used (man-hours)"
   profit           "Total profit (Rs)";

Positive Variables A, X, P_green;

Equations
   profit_def          "Profit definition"
   labor_def           "Labor constraint"
   labor_total         "Total labor calculation"
   price_demand        "Green chilli price as a function of demand"
   production_def      "Production based on yield"
   area_constraint     "Non-negativity of area allocation";

* Profit Function
profit_def..
   profit =e=  P_green * X("green") + P("dry") *0.2 * X("dry")
         - sum(crop, FC(crop) * A(crop))
         - (LC_base + LC_index * L_total) * L_total
         - DC("dry") * X("dry");

* Price-Demand Relationship for Green Chilli
price_demand..
   P_green =e= a_demand - X("green") / b_demand;

* Labor Constraints
labor_total..
   L_total =e= sum(crop, L(crop) * X(crop));
```

```
labor_def..
   L_total =l= L_available;

* Production Constraints
production_def(crop)..
   X(crop) =e= yield(crop) * A(crop);

* Area Allocation
area_constraint(crop)..
   A(crop) =g= 0;

Model chilli_profit /all/;
Solve chilli_profit using NLP maximizing profit;
```

Market behavior was simulated under different scenarios;

Scenario 1 – DOA/COP estimated yields with simulations of dry chilli price at Rs.1000, Rs 1100 & Rs.1200 per kg at processing center

	DOA/COP		
Fixed and variable costs up to harvesting per unit area (Rs/Ac)	425,570.50	425,570.50	425,570.50
Drying cost (Rs/kg of red chilli)	50	50	50
Base wage rate (Rs/manday)	1600	1600	1600
Dry chilli price (Rs/Kg)	1000	1100	1200
Green chilli yield (Kg/Ac)	**5000**	**5000**	**5000**
Red chilli yield (Kg/Ac)	**4000**	**4000**	**4000**
Green chilli Area(Ac)	**9157**	8782	8361
Red chilli Area (Ac)		**20499**	**26639**
		29281	**35000**
Production- Green (Mt)	**45787**	**43909.8**	**41804.6**
Production- Dry (Mt)		**16399.4**	**21311.3**
Green chilli Price at Farm gate level(Rs/Kg)	316.85	324.361	332.78
Profit (Rs Mn)	8582.6	9198.5	11260
Per Ac profit	937,218.71	314,143.80	321,714.29

In the scenario 1, profit maximization model was simulated with DOA/COP estimated yields, cost of production and dry chilli prices at Rs.1000, Rs 1100 & Rs.1200 per kg at drying center. Under profit maximization dry chilli production starts when the price of dry chilli is above Rs. 1100/Kg at the drying center. When the price of dry chiili increases to Rs. 1200/Kg, almost the green chilli national requirement will be produced. But only 1/3 of dry chilli national requirement is produced. Under this scenario, more or less non-commercial farming model in some potential areas have been modeled. The group is assumed to have cultivated either OPV varieties or Hybrid and no specific management practices have been adopted.

Scenario 2 – Yields of leading farmers who is adopting traditional management practices with simulations of dry chilli price at Rs. 800 & Rs. 1000 per kg at processing center

	Leading farmers adopting Traditional Methods	
Fixed and variable costs up to harvesting per unit area (Rs/Ac)	495,680.00	495,680.00
Drying cost (Rs/kg of red chilli)	50	50
Base wage rate (Rs/manday)	1600	1600
Dry chilli price (Rs/Kg)	800	1000
Green chilli yield (Kg/Ac)	15000	15000
Red chilli yield (Kg/Ac)	**12000**	**12000**
Green chilli Area(Ac)	3319	2986
Red chilli Area (Ac)	**8604**	**26798**
	11923	**29784**
Production- Green (Mt)	49783	44783
Production- Dry (Mt)	20650	64316
Green chilli Price at Farm gate Rs/Kg	300.87	320.87
Profit (Rs Mn)	12110	20610
Per Ac profit (Rs/Ac)	1,015,694.11	691,982.46

In the scenario 2, profit maximization model was simulated by taking yields and cost of production of a leading farmer who is adopting traditional management practices cultivating MICH HY 1 as a representative farming model. Simulations were done by taking dry chilli prices at Rs.800 & Rs 1000 per kg at the drying center. When the dry chilli price is Rs 800 per Kg, total extent cultivated with profit maximization is 11,923 Ac of which 3,319 Ac under green chilli and 8,604 Ac under dry chilli. These extents will meet the entire green chilli requirement and 1/3 of the dry chilli

requirement. When the price of dry chiili increases to Rs. 1000, entire the green chilli and dry chilli national requirement will be produced. Under this scenario commercial farming model in a potential area has been modeled. Although they are cultivating improved hybrid MICH HY1, they have not adopted the high-tech management practices.

Scenario 3 – Yields of a leading farmer who is adopting ASMP technology package with simulations of dry chilli price at Rs. 800, Rs. 900 & Rs. 1000 per kg at processing center

	ASMP technology		
Fixed and variable costs up to harvesting per unit area (Rs/Ac)	673,400.00	673,400.00	673,400.00
Drying cost (Rs/kg of red chilli)	50	50	50
Base wage rate (Rs/manday)	1600	1600	1600
Dry chilli price (Rs/Kg)	800	900	1000
Green chilli yield (Kg/Ac)	24000	24000	24000
Red chilli yield (Kg/Ac)	**18000**	**18000**	**18000**
Green chilli Area(Ac)	2080	1976	1872
Red chilli Area (Ac)	**6883**	**12947**	**19012**
Total chilli Area(Ac)	**8963**	**14923**	**20884**
Production- Green (Mt)	49919	47419	44919
Production- Dry (Mt)	24778	46611	68444
Green chilli Price at Farm gate(Rs/Kg)	300.32	310.32	320.00
Profit (Rs Mn)	12800	16370	22120
Per Ac profit (Rs)	1,428,149.68	1,096,942.73	1,059,186.96

In the scenario 3, profit maximization model was simulated by taking yields and cost of production of leading farmer who is adopting ASMP technology package cultivating MICH HY 1 as a representative farming model. Simulations were done by taking dry chilli prices at Rs.800, Rs.900 & Rs 1000 per kg at the drying center. When the dry chilli price is Rs 800 per Kg, total extent cultivated with profit maximization is 11,923 Ac of which 3,319 Ac under green chilli and 8,604 Ac under dry chilli. These extents will meet the entire green chilli requirement and 1/3 of the dry chilli requirement. When the price of dry chili increases to Rs. 1000, entire the green chilli and dry chilli national requirement are met. Under this scenario commercial farming model cultivating

improved hybrid MICH HY1 and ASMP introduced high-tech management practices has been modeled.

When the scenario 2 & 3 are compared, the area required to achieve the national requirement is reduced 1/3 and the per ac profit can be increased by 50% at a lower level of protection if improved management practices can be introduced as of ASMP.

6.2 The level of upscaling of ASMP technology and Policy Support

According to the above simulation results, the total land extent required is less than 20,000 Ac achieving the current national requirement of green chilli of 37,762 Mt and 55,848 Mt in potential areas. Protection level can be maintained by setting the dry chili price at Rs.1000 after drying at the processing center. These statistics are under ideal situation and to achieve this ideal situation, following conditions need to be supplemented.

6.2.1 Agro-ecological suitability: Ensuring that the new production model works well in different environmental conditions

While scaling up the ASMP model has proven to be cost-effective, its success is highly dependent on location-specific adaptations to maximize the potential yield of the local hybrid chili variety. Given that chili has traditionally been a dry zone crop, identifying suitable agro-ecological regions is crucial, as dry chili production is more viable in drier areas with lower humidity levels.

Chili was historically cultivated as a Chena (shifting cultivation) crop in the dry zone although it is grown across various agro-ecological zones, including the wet and intermediate zones. The ASMP technology has also been scaled up beyond the dry zone. However, when evaluating the application of ASMP management practices, the yield potential for green chili and the economic viability of dry chili production, the cost-effectiveness of scaling up in wetter regions remains questionable. The study identified that a cluster-based approach to chili cultivation is most suitable for the districts such as Anuradhapura and Northern districts, with Thirappane standing out as one of the agronomically superior locations for chili production. Establishing homogeneous, high-potential chili clusters in districts such as Vavuniya, Mullaitivu, Kilinochchi and Jaffna is recommended. This approach can enhance production efficiency, improve market access, and optimize resource use. Furthermore, field survey findings from the chili cluster in Kandy indicate those investments in improved management practices in wet and some intermediate zones for dry chilli production is not worthy. It was clear that the Nawalapitiya chili cluster is an unsuccessful selection. Therefore, prioritizing site selection and focusing on regions with high agronomic potential is essential for sustainable and cost-effective chili production expansion.

Also, according to the key informant discussions with DOA, the areas that have potential for dry chilli production on commercial basis can be identified as;

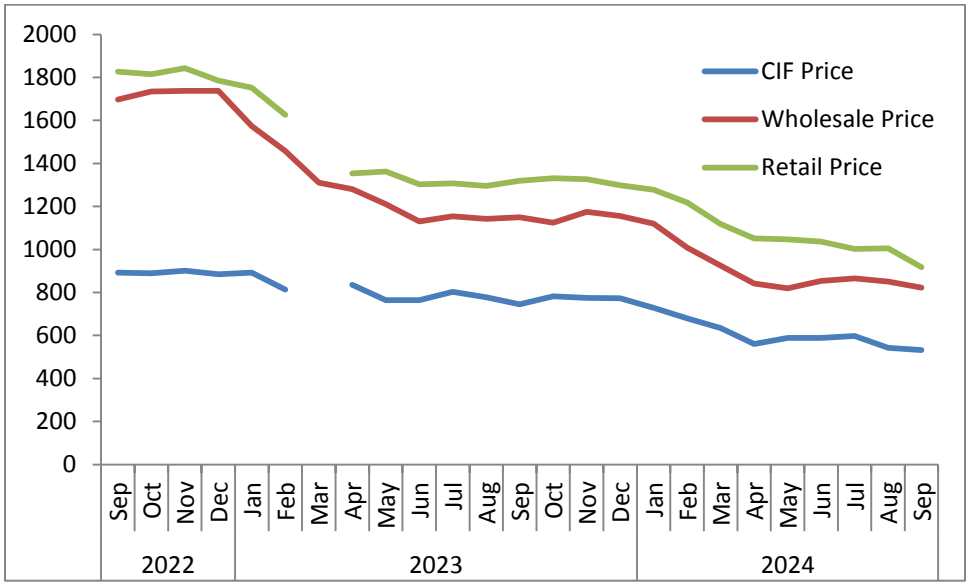
Anuradhapura -	Thirappane, Galkiriyagama
Jaffna, Mullativu, Kilinochchi, Vavuniya	Good soils, suitable for dry chilli production
Puttlam	Kalpitiya
Matale	Dambulla
Kurunegala	Some pockets can be identified

6.2.2 Policy Measures Imperative to promote dry chili Industry

Protection during transition and assessing the level of protection or support needed until the model is fully adopted is an important determinant for successful implementation of chili cluster development program.

According to the CIF price of dry chilli imports and the FOB price of Indian exports to Sri Lanka in the last few years, an increasing trend of parity prices is observed. However, CIF price in Rupee have dropped from 2023 with the appreciation of exchange rate. Therefore maintaining a stable protected price is of significant importance to implement such a development program.

Figure



Sri Lanka Imports from the World and Indian Imports to Sri Lanka: HS Code 090421 Fruits of the genus Capsicum or of the genus Pimenta, dried, neither crushed nor ground.

Table 7: Dry chilli imports from India and from the World

	Sri Lanka Imports from the World (FAO)			**Indian Imports to Sri Lanka (Trademap)**				
	Import Quantity (Mt)	Import Value (US $ '000)	CIF (US $/Kg)	Import Quantity (Mt)	Import Value(US $ '000)	CIF (US$/Kg)	Indian Export Value (US $ '000)	FOB (US$/Kg)
2010	37762	44293	1.173					
2011	42782	82523	1.929					
2012	40666	46129	1.134					
2013	44060	49336	1.120	13,642	49,087	3.598	25,711	1.885
2014	47757	59612	1.248	47,665	59,428	1.247	51,167	1.073
2015	49946	77480	1.551	49,851	75,567	1.516	65,223	1.308
2016	51040	92534	1.813	26,204	89,448	3.414	85,803	3.274
2017	51710	51705	1.000	51,636	51,530	0.998	47,722	0.924
2018	51686	73236	1.417				63,876	
2019	52566	83065	1.580	52,459	82,689	1.576	80,173	1.528
2020	50785	95025	1.871	50,733	94,631	1.865	90,637	1.787
2021	50146	99253	1.979	50,088	98,832	1.973	85,128	1.700
2022	47704	115405	2.419	47,624	111,603	2.343	105,347	2.212
2023	40089	97255	2.426	40,055	92,256	2.303	87,049	2.173

Source: FAO, WTO

Following policies are of relevance for protection during the transition;

Trade and Import Policies

The current tax policy is a special commodity levy of Rs 100 has been imposed on dry chilli imports**.**

- **Tariffs on Dry Chilli Imports:**
  Impose moderate tariffs on imported dry chilli to protect local farmers while ensuring market stability. However, tariffs should be carefully calibrated to avoid consumer price shocks. ASMP technology is supportive of maintaining relatively low dry chilli price as analysed by the model.
- **Non-Tariff Barriers:**
  Introduce quality standards, labeling, and certification requirements for imports to create a level playing field for domestic producers. Price premium for quality can be introduced.

Subsidies and Incentives for Local Producers

- Provide targeted subsidies for chilli farmers to offset production costs, including inputs like seeds, fertilizers, and water-efficient irrigation.
- Offer financial incentives for farmers investing in value-added processing technologies (e.g., solar drying, modern dehydration units).

Price Stabilization Mechanisms

- Introduce Minimum Support Prices (MSP) or guaranteed buy-back arrangements to protect farmers from market price volatility.
- Establish a buffer stock system to manage market oversupply and stabilize prices.

Crop Insurance Programs

- Develop affordable insurance schemes to protect farmers against price crashes caused by market oversupply or unfavorable weather conditions.

6.3 Challenges and Opportunities

6.3.1 Chilli seed production program

MI CH HY1, developed by the Field Crop Research and Development Institute (FCRDI) in Maha Illuppallama, marks a significant milestone in Sri Lanka's F1 hybrid chili seed history. This innovation has led to a substantial increase in potential chili yield, reducing seed costs and making high-quality seeds more accessible to farmers. Throughout the study, it was evident that F1 hybrid seeds are a major determinant of successful chili cluster development.

Table 8: Chili Average Yield by Major Producing Countries (Kg/Hectare)

Country	Dry Chili	Green Chili	Year
India	3265	8578	2023
China	6629	22433	2023
Thailand	3889	13655	2023
Indonesia		9040	2023
Bangladesh	6808	-	2023
Pakistan	2290		2023
Mexico	2003	21261	2023
Sri Lanka		5973	2023

Source: Faostat

When compared to the average chili yield of major producing countries, the potential yield of MI CH HY1 demonstrates exceptional performance. Realizing its full potential could significantly enhance Sri Lanka's national average chili yield. Therefore F1 seed production program should receive the highest priority in the chilli development program which should follow stringent protocols for producing high quality pure F1 seeds.

In addition to the ASMP seed production program, government, private sector and other development projects have supported chilli F1 seed production. Through the ASMP support 400 kg of chilli seeds are produced. Under Hybrid chilli seed production in government seed farms, 365 kg of F1 seeds had been produced in 2021. Under the Saubhagya Crop Development Programme (2021), the hybrid seed production of MI CH HY1 was carried out in fully mechanized poly tunnels within farmers' fields.

Farm	**Tunnel size**	**No. of Tunnels**	**Total Extent**	**Expected seed Yield Kg**
MI	600 sqm	3	1800 sqm	180
Pelwehera	600 sqm	2	1600 sqm	120
	200 sqm	2		40
Ambepussa	250sqm	1	250 sqm	25
Total		**8**	**3650 sqm**	**365**

Dr. K.N. Kannangara, the principal agricultural scientist at FCRDI in Maha Illuppallama and the breeder behind MI CH HY1 and HY2 and the custodian of the MI CH HY1 parental seed lines maintains the national registry of chili seed producers. According to him, Sri Lanka possesses the necessary infrastructure to meet its chili F1 seed requirements, provided that domestic dry chili production is prioritized. He estimates that existing infrastructure funded through various programs can support an annual production capacity of 5,000 kg of F1 chili seeds.

However one of the major observations during the field survey was farmer's concern over deteriorating quality of F1 seeds and the non-availability of quality F1 seeds for cultivation. At the onset of the project, MI CH HY1 seeds distributed to farmers yielded excellent results, creating a high demand for these seeds. However, as private sector suppliers entered the market, the quality of hybrid chili seeds deteriorated, leading to increased susceptibility to pests and diseases. Farmers reported that CIC chili seeds are of poor quality, as they are often sourced from multiple farmers supplying private companies. The other available alternative farmers have gone to cultivate is that imported F1 Rajina which yield some 12,000 kg/acre and cost about Rs. 3,200 per 10g. It is costluy and with a lower yield. Farmers request is for MI CH HY1 F1 seeds in good quality. They have already experienced the yield of good quality MI CH HY1 and farmers expressed concern over this decline and strongly advocated for a government-led seed distribution program through Maha Illuppallama's research institute to ensure seed quality and genetic purity.

To address these challenges, research on chili F1 seed development must be strengthened by enhancing the Field Crop Research and Development Center at Maha Illuppallama. This initiative would help resolve agronomic issues, improve seed quality, and ensure the sustainability of hybrid seed production.

Proposed Interventions for Enhancing F1 Hybrid Seed Production

• Establishing F1 Hybrid Seed Clusters as the Nucleus of Seed Production Companies	• Ensure accountability and develop vertical value chain linkages.
• F1 hybrid chili seed production should be expanded to the most suitable locations, such as Kotmale, Nawalapitiya, and Kahalla, where optimal agro-climatic conditions support high-quality seed production.	• This strategic expansion will ensure better yield performance, genetic purity, and a stable supply of high-quality hybrid seeds for farmers.
• Implementing Complete Monitoring and Supervision of the F1 Seed Production Program	• Strengthen quality control and prevent genetic degradation.
• Developing Testing Tools for Genetic Purity and Hybridity Verification	• Improve seed certification standards.
• Registering Hybrid Chilli Seeds Under the Seed Act	• Ensure legal compliance and quality assurance
• Strengthening Government-Led Seed Multiplication Programs	• Partner with the private sector to meet the growing demand for high-quality hybrid seeds.

6.3.2 Technology related Issues

Technical support is essential alongside material assistance in the adoption process of a new technology. Regular follow-ups are required to ensure that farmers fully realize the benefits of the technology while minimizing risks. A gap exists between the introduced model technology and actual farmer practices—partly due to farmers making adjustments to suit field conditions and partly due to gaps in knowledge transfer caused by weak extension services. During the field survey, several of these issues were identified, highlighting the need for a more effective and continuous support mechanism.

Issues in the drip irrigation system

Emitter clogging is a serious problem in drip irrigation system. Emitter clogging greatly reduces the water distribution uniformity in the irrigated field and which negatively influence crop growth and yield. Water quality is the main factor that causes plugging of emitter. Acid treatment is an effective method for rectification of clogging in which acid is injected in the system with irrigation water for lowering the pH of water. Phosphoric acid (H_3PO_4), sulfuric acid (H_2SO_4) and hydrochloric acid (HCL) can be used for treatment of chemical clogging in drip irrigation system. Phosphoric acid is also a fertilizer source, can be used to lower the pH of irrigation water. It is observed that the widely recommended chemical treatment is Phosphoric acid.

Our study observed that in Chili operational manuals of the ASMP clearly described that the role of Phosphoric acid and the recommendation. But in the field majority of the farmers were not aware of this important technical matter. Operation and maintenance of the drip system was found practically not 'convenient for a farmer due to clogging of emitters and frequent leaking of laterals. Also, it could be subjection to rat damage.

Issues in pest and disease control

One of the important genetic superiority of MI CH HY 1 is its ability for moderate resistance to the leaf curl disease and ASMP introduced insect proof nets and sticky tapes as pest and disease control measures. Although beneficiary farmers had adopted these management practices, pest and disease control is still an issue that cost them substantially. According to the field survey findings it was observed that deteriorating seed quality is partly the cause of the increasing prevalence of pest and diseases and farmers have not followed the management practices ideally.

In addition to the poor follow up by the project, farmers are deprived of being remote from extension service that they have to rely on agrochemical shops for knowhow or trial and error method. The linkage between DOA Strengthening agricultural extension services is essential to bridge the gap between research and farming.

Harvesting related pest and disease transmission

In all chili producing study areas the harvesting is done by women with harvest nearly 50Kgs per day. Rs 30 per kg is paid for every harvested Kg of green chili. In addition, to food and beverages are also provided. Harvesting always takes plays once in 10 days or twice in a fortnight and a higher amount of labor is required in peak harvesting times. Nearly 25 women should be employed in one Acre chili cultivation during the peak harvesting round. Therefore, a large amount of female labor is required to implement this process in a producing area. Consequently, farmers practice a mutual discussion to establish the harvesting team in their farm lands daily. This method causes the spread of pest and deceases as the same work team go

to several farm lands. As this happens continually, application of agro chemicals has become vital.

Environmental issues

Accumulation of Plastic and entering small plastic particle into soil after use of plastic mulch due to fracturing into pieces create new environmental issues.

The ASMP technology package, introduced through the Agriculture Technology Demonstration Park, has yet to receive approval from the Technology Release Committee of the Department of Agriculture (DOA) for widespread adoption to reach the targeted land extent to fulfill the national requirement of chilli. The cost effectiveness of increasing chilli yield by adopting the new management practices was evidenced in the study. Yet, technology related issues that are location specific need to be addressed. Therefore research on chili should be strengthened by facilitating, investing to enhance the capacity of institutions of DOA and incentivizing the research staff, particularly Field Crop Research and Development Institute in Mahaillupallama.

A mechanism to coordinate PUC with institutes of DOA is important for the sustainability of dry chilli production program starting from chilli seed production to commercial cultivation activities of green chilli in the main locations that will be targeted in a national-wide program and the processing of dry chilli. Continuous rapport between extension staff and farmers is needed for solutions to farmer's technical and agronomic issues. From the field survey we found this is an area for which the project has given little importance. Providing extension services tailored to optimising input utilisation and addressing issues related to diseases and insects is dire need according to farmer's response.

To maximize its benefits, Good Agricultural Practices (GAPs) must be effectively disseminated through training and extension programs, ensuring farmers can implement the technology correctly and sustainably.

6.3.3 Value-Chain Development Strategies

Dry chilli production can be promoted by adopting value chain development strategies. The main demand for dry chilli is in the form of chilli powder which is about 2/3rd of the demand. Although green chilli demand is relatively price elastic, red chilli demand is less price elastic. Therefore developing market linkages for dry chilli is relatively practical. Agglomeration of PUCs centered on processing centers to link with the retail chains in Sri Lanka can be an option to vertically integrate the value chain..

	Annual consumption per person (Kg)	Annual consumption per person (%)
Dry chilli	0.9144	36%
Chilli powder	1.61952	64%

Level of pungency and colour are important quality parameters of dry chilli that determines the demand for dry chilli in the Sri Lankan market. Dry chilli produced from MI CH HY1 is relatively pungent and less in red colour which requires attention when processing and value addition.

a) Strengthen PUCs and promote PUC for agglomeration

- to organize to strengthen their bargaining power, share resources, and collectively invest in processing infrastructure.
- to facilitate access to markets, credit, and technical assistance.

Sustainability of PUC as business entity is determined by various factors. Profitability of enterprises undertaken, management issues are important. In every project area, particularly the young generation shows a tendency to take the leading role. Their strength should be used to develop their skills in management of resources to achieve business goals.

b) Invest in Processing Infrastructure

- to develop, cost-effective processing units (e.g., solar dryers, community-based dehydration plants) to reduce the cost of converting green chilli into dry chilli.

c) Enhance Market Linkages

- Create direct market linkages between farmers, wholesalers, and processors through platforms like farmer markets, e-commerce, or contract farming.
- Facilitate partnerships with local and international buyers for value-added chilli products.

  Retail chains like Cargills, Keels, SATHOSA

d) Quality and Branding

- Develop a national branding strategy for Sri Lankan chilli, emphasizing its “residue-free," or "grown under Good Agricultural Practices (GAP)” and introduce quality assurance schemes to differentiate local chilli in the market.

e) Expand Value-Added Product Range

- Support the development of chilli-based products like sauces, pastes, and pickles that cater to both local and international markets, including the Sri Lankan diaspora.

By combining these policy measures with value-chain development strategies, Sri Lanka can enhance the competitiveness of its chilli industry while addressing the challenges of import reliance and market oversupply. These interventions will enable farmers to achieve better incomes and foster a sustainable chilli production system.

Annex 1:

SOIL ANALYSIS REPORT ANURADHAPURA CHILI

SAMPLE CODE	Group	LAB NO	pH	OM	EC	Ca	Mg	K	NH_4-N	P	S	Cu	Fe	Mn	Zn	CEC	Ca/Mg	Ca/K	Mg/K	Ca+Mg/K	Ca Sat.
B G Kumarasinghe	1	B10 428	6.89	2.15	328.0	6.39	2.91	1.41	78.1	126	39	11.1	233.2	119.8	2.7	10.71	2.2	4.5	2.1	6.6	59.7
W G A Kumarasinghe	1	RI 429	7.1	1.08	123.2	4.42	1.96	1.18	55	23	21	11.7	235.4	74.8	1.9	7.56	2.3	3.7	1.7	5.4	58.5
I M Rathnasiri	1	R2 429	6.89	2.29	301.0	8.91	4.44	1.23	78.8	84	36	10.0	207.5	109.5	3.2	14.58	2.0	7.2	3.6	10.9	61.1
W M Senavirathna Banda	1	R3 429	7.17	2.02	125.2	8.83	5.22	0.58	50.6	68	45	12.7	250.9	86.9	2.1	14.63	1.7	15.2	9.0	24.2	60.4
W M Kumarasinghe	1	R4 429	6.97	2.02	175.7	5.77	3.31	0.96	128.7	46	25	10.9	258.9	101.8	2.6	10.04	1.7	6.0	3.4	9.5	57.5
W Chathuranga Lakmal	1	R5 429	6.98	2.02	167.5	6.48	2.91	0.75	132	51	37	10.8	253.2	102.5	2.8	10.14	2.2	8.6	3.9	12.5	63.9
H A Lakshman Jayantha	1	R6 439	7.04	2.55	111.0	6.32	3.65	0.81	54.5	14	45	12.3	229.4	106.0	1.2	10.78	1.7	7.8	4.5	12.3	58.6
A W A Sunil Abesekera	1	R7 429	6.94	1.88	123.1	6.26	2.44	0.76	79.9	13	92	12.1	234.7	115.8	1.3	9.46	2.6	8.2	3.2	11.4	66.2
H Ratnasiri	1	R8 429	6.89	2.42	157.7	7.30	3.47	1.17	55.4	38	45	11.6	251.5	96.0	2	11.94	2.1	6.2	3.0	9.2	61.1
G G S Asanka Jayasinghe	1	R9 429	7.01	1.61	105.6	7.71	4.77	0.79	42.5	91	38	10.8	261.6	99.0	2.1	13.27	1.6	9.8	6.0	15.8	58.1
H P Upul Ranasinghe	1	R10 429	6.88	2.29	193.4	9.03	4.66	0.99	93.1	77	39	12.4	225.6	129.6	2.8	14.68	1.9	9.1	4.7	13.8	61.5
W M A Warnasooriya	1	W1 429	6.8	1.75	271	4.83	2.16	1.12	41.2	200	41	10.4	275.2	77.2	3.3	8.11	2.2	4.3	1.9	6.2	59.6
Chandani Swarnalatha	1	W2 429	6.92	2.29	155.6	6.68	3.37	1.15	121.7	231	48	9.6	255.5	120.9	4.7	11.20	2.0	5.8	2.9	8.7	59.6
S Kanthi	1	W3 429	8.14	1.48	179.8	6.62	4.84	0.84	299.9	40	34	11.7	178.6	113.7	3.0	12.30	1.4	7.9	5.8	13.6	53.8
D Renuka Dilrukshi	1	W4 429	7.37	2.55	124.9	7.11	3.16	0.92	63.5	109	37	11.6	242.7	103.9	3.9	11.19	2.3	7.7	3.4	11.2	63.5
D M C P Rajapaksha	2	W5 429	7.2	2.15	382.0	8.81	3.42	1.08	114.9	58	72	11.3	201.2	113.1	4.5	13.31	2.6	8.2	3.2	11.3	66.2
R A Ariyadasa	2	W6 429	7.18	2.42	95.2	5.92	2.3	1.09	65.4	30	60	12.2	267.7	108.6	2.2	9.31	2.6	5.4	2.1	7.5	63.6
E K M Dharmasooriya	2	W7 429	7.01	1.61	125.6	5.82	2.22	0.72	55.0	62	61	11.4	261.4	79.1	7.8	8.76	2.6	8.1	3.1	11.2	66.4
R M D I Rathgalla	2	W8 429	7.19	2.29	75.4	7.70	2.83	0.5	41.5	52	143	10.5	228.5	102.2	1.7	11.03	2.7	15.4	5.7	21.1	69.8
J M S K Jayasinghe	2	W9 429	7	2.02	108.3	7.43	3.37	1.1	51.1	81	71	10.7	276	85.1	39.6	11.9	2.2	6.8	3.1	9.8	62.4
P G Wijesiri	2	W10 429	6.98	1.21	67.0	5.16	2.02	0.54	58.7	35	52	8.9	246.9	69.2	2.5	7.72	2.6	9.6	3.7	13.3	66.8
W T L Warnasooriya	2	B1 429	6.77	2.29	274.0	7.50	3.56	0.82	99.7	14	67	10.1	230.9	101.6	4.5	11.88	2.1	9.1	4.3	13.5	63.1
W M S K Jayalath	2	B2 429	7.13	2.02	80.6	6.22	2.39	0.75	42.1	14	51	8.5	221.7	77.2	1.4	9.36	2.6	8.3	3.2	11.5	66.5
R M R Ajith	2	B3 429	7	2.02	146.8	7.74	3.46	0.99	83.3	39	55	10.8	210.8	114.2	1.9	12.19	2.2	7.8	3.5	11.3	63.5
B M S Hemantha	2	B4 429	6.98	1.61	150.8	8.2	3.39	1.07	50.8	58	45	1.3	256.7	94.8	35.8	12.66	2.4	7.7	3.2	10.8	64.8
D M Dharmapala	2	B5 439	6.84	1.08	153.6	8.01	3.77	0.66	67.6	56	55	9.5	264.3	68.3	2.2	12.44	2.1	12.1	5.7	17.8	64.4

Interprettion

Large number of sites low in S
Zn extremely low
Ca/Mg very low in all sites
Ca Saturation low in some sites

Fertilization:

N as required by the crop
CaSO4 required for ratios and for S
Foliar applications of Zn

Kg/ Plot/ Application	Initial	Mid	Late
Urea	0.17	1.34	0.78
$CaSO_4$	0.97	0.69	0.97
Application per week	2		
Phosphoric Acid (ml) *Application every two week*	48.4	35.6	48.4
Foliar application of micronutrients is required weekly, especially Zn			

Annex 2: Cost Calculation for Fixed Input Components (Rs?Ac)

Materials	**Initial Cost**	
	UnitCost * Quantity	**Total**
Nursery Trays	140*150	**21000**
Establishment of Insect Proof Net(Ac)		
Insect Net		240000
GI Pipes	4500* 40	180000
Sand & Metal		12000
Cement		10000
Net Railings	1600*10	16000
Rivats, Yans & other		10000
		468000
Establishment of Drip Irrigation		
Drip Tapes		40000
Fertigation Unit		25000
Valves & Sockets		12800
2" Horses		32000
Water Pump		80000
Establishment		20000
		209800
Establishment of Mulch > Micron 30		
Mulch		120000
Establishment		15000
		135000
Yellow Cards	150/Card	
Other	150*80	**12000**

Annex 3: Cultivated Extent in main Chilli growing areas, 2022/23 Maha and 2023 Yala by source (DOA & DCS)

Cultivated Extent (ha)				**Cultivated Extent (ha)**			
	2022/2023 Maha				2023 Yala Season		
DOA		**DCS**		**DOA**		**DCS**	
Total	7836		7386	Total	5308		5265
		Colombo	63			Colombo	35
		Gampaha	144			Gampaha	147
		Kalutara	119			Kalutara	115
Kandy		Kandy	296	Kandy	207	Kandy	258
Matale		Matale	237	Matale	228	Matale	275
Nuwara Eliya	240	Nuwara Eliya	283			Nuwara Eliya	225
		Galle	83			Galle	70
		Matara	97			Matara	108
		Hambantota	398			Hambantota	303
Jaffna	491	Jaffna	419	Jaffna	258	Jaffna	183
		Mannar	123			Mannar	82
Vavuniya		Vavuniya	188	Vavuniya	386	Vavuniya	108
Mullathivu	296	Mullativu	325			Mullativu	134
Kilinochchi	311	Kilinochchi	119			Kilinochchi	63
Batticaloa	582	Batticaloa	174	Batticaloa	353	Batticaloa	161
		Ampara	298			Ampara	132
		Trincomalee	153			Trincomalee	151
Kurunegala	386	Kurunegala	518	Kurunegala	272	Kurunegala	424
Puttlam	**461**	**Puttlam**	**716**	**Puttlam**	**407**	**Puttlam**	**633**
Anuradhapura	**667**	**Anuradhapura**	**1268**	**Anuradhapura**	**384**	**Anuradhapura**	603
Mahaweli areas	**492**			**Mahaweli areas**	**418**	**Mahaweli 'H'.Area**	
	1159				**802**		
Interprovincial DDA areas	551	Polonnaruwa	69	Interprovincial DDA areas	266	Polonnaruwa	60
Badulla	497	Badulla	416	Badulla	255	Badulla	398
Monaragala	635	Monaragala	588	Monaragala	301	Monaragala	356
Other areas	2227	Ratnapura	212	Ratnapura	158	Ratnapura	194
		Kegalle	80	Other areas	1415	Kegalle	47