Import Ban on Chemical Fertilizers and Other Agrochemicals: Short-Term Impacts on Selected OFCs and Potato Crop

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FOREWORD

In the realm of agricultural policy and practice, in 2021 the controversial decision to ban the import of fertilizer and other agrochemicals brought in both positive and negative dimensions with lasting impacts on the local agriculture and its practices that shed light on the country's economy at large.

This study, focusing on the Short-term Impacts on Selected OFCs and Potato Crop in Sri Lanka, is particularly timely for assessing the consequences of this noteworthy policy change. The ban, aimed at reducing the reliance on synthetic fertilizers and agrochemicals, was a bold step towards bringing in sustainable and ecologically conscious agricultural practices. However, it came under heavy criticism given to many lapses in its implementation process and haphazardness.

In this study, a thorough examination of policy and reality is done on the situation that prevailed in the immediate aftermath of the import ban, particularly about its impact on OFCs and potato cultivations.

This study is not merely confined to a set of data but reveals the associated changes into agricultural practices and its community and the measures that they took to adapt. It unveils the resilience of communities as they seek new pathways and opportunities in the face of transformation. I believe the findings will provide new insights into policymaking, particularly with regard to formulating the national agricultural policy.

Dr. G.G. Bandula
Director/Chief Executive Officer

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EXECUTIVE SUMMARY

In Sri Lanka, Other Field Crops (OFCs) encompass a diverse array of annual field crops cultivated apart from rice. These crops consist of grains such as maize, sorghum, and finger millet; pulses including green gram, black gram, and cowpea; oilseeds like gingely, groundnut, and soybean; as well as condiments comprising chillies and onions. The Dry Zone stands out as the principal production region for OFCs within Sri Lanka. This particular sub-sector holds significant importance in the production of a wide range of food items, which play a pivotal role in ensuring national food security. Due to its elevated consumer demand and substantial profitability, potato has emerged as a significant staple crop in Sri Lanka.

The Government of Sri Lanka implemented Import and Export Regulations No. 7 of 2021 to ban the import of chemical fertilizers and agrochemicals, aiming to promote organic agriculture for financial and environmental sustainability. However, the sudden implementation of the import restrictions caused uncertainty among farmers, leading to a sharp decrease in crop yields and posing a threat to food security. The Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI) conducted a survey comparing two cultivating seasons (2020/21 *Maha* and 2021/22 *Maha*) to assess the effects of the fertilizer policy changes on selected OFCs and potato crop production, household economy, and food security.

The study findings reveal that a substantial proportion of farmers in the sample (91%) are relying on farming activities as their primary source of income. This indicates that the majority of farmers within the OFC and potato crop sector are significantly impacted by the recent agrochemical policy change. Despite the ban on importing chemical fertilizers a notable majority of farmers (74%) resorted to their utilization in the subsequent season, though in non-compliant quantities but in accordance with the available supply. This underscores farmers' proactive efforts to address their fertilization needs and emphasizes the substantial demand for chemical fertilizers within the cultivation. The frequency of applying chemical fertilizers to each crop category has reduced owing to the scarcity of such fertilizers during the restricted period. Consequently, this reduction has had an adverse impact on crop yields through the respective season. A notable proportion of farmers resorted to the informal market as a mean to fulfill the chemical fertilizer requirement, despite the associated higher prices. These results underscore the dependence of farmers on alternative channels to meet their fertilizer requirements during the ban. Farmers experienced significant hardships due to soaring fertilizer prices, inability to supply them on time and in sufficient quantities. Hence, these difficulties have made impacted the crop yield of the farmers. Farmers' perceptions of plant nutrient management vary depending on the type of crop. None of the large-scale onion and potato farmers preferred to use complete organic fertilizers for their cultivations. Only a very small percentage of maize and chili farmers (1% and 2% respectively) preferred complete organic fertilizers. Therefore, farmers may not be ready to adopt fully organic agriculture.

Due to unavailability of fertilizers in sufficient quantities in the market and the challenges faced in obtaining them in time manner, a considerable number of farmers displayed willingness to purchase fertilizers at their market value, without relying on subsidies. This inclination highlights the eagerness of farmers to utilize chemical fertilizers for their crop cultivations.

In response to the policy change, there has been a notable decrease in the frequency of chemical application for pest and disease management across all crop cultivations. Encouragingly, 11 percent of farmers have embraced traditional methods to control pests and diseases in their fields. This statistic serves as a positive indicator that the import ban has facilitated the transition of farmers towards adopting more environmentally friendly approaches. Prior to the Government's promotion of organic agriculture through the import restrictions on agrochemicals, a notable percentage of farmers (26%) had already been engaging in the use of organic fertilizers. This practice was particularly prevalent among the potato farmers (99%). Such findings indicate that a significant portion of farmers were already aware of organic agriculture and its importance. A significant increase of 32 percent in the number of organic fertilizer users compared to the previous season provides substantial evidence that the implemented policy change has facilitated a transformation among farmers, leading them to adopt organic agricultural practices. The implementation of the import ban on chemical fertilizers has motivated farmers to explore various avenues for obtaining organic fertilizers, such as self-production and local resource sharing. This response highlights the importance of continued support and investment on sustainable farming practices.

One of the primary challenges associated with utilization of organic fertilizers is the difficulty in procuring large quantities of such fertilizers at the appropriate time. This indicates the responsibility of the relevant Government institutions to pre-plan and make the necessary arrangements for ensuring the availability of organic fertilizers in sufficient quantities, prior to implementing policy changes of this nature. The import ban on chemical fertilizers and other agrochemicals has resulted in 32 percent of farmers initiating production of organic fertilizers. This development serves as a notable indicator that the policy change has positively influenced and motivated farmers to embrace organic production methods. Scarcity of raw materials stands as a prominent challenge faced by farmers in the production of organic fertilizers. Consequently, it becomes imperative to ensure the provision of appropriate and necessary raw materials at the farm level for the production of organic fertilizers.

Despite the ban on the importation of fertilizers and other agrochemicals, a significant majority of farmers (64%) have not changed their cultivated extent during the restricted season. This finding highlights the farmers' unwavering determination to continue cultivating, regardless of the availability of agrochemicals and future challenges they face. As a means of adapting to the sudden policy change, farmers have resorted to cultivating smaller land plots (<0.5 acres) compared to the previous season. This shift in strategy demonstrates their ability to adjust their farming practices in response to external circumstances.

Despite a relatively small reduction in cultivation extent, a significant productivity loss was observed among 92 percent of farmers in the sample during the import ban, with more than half of the yield loss occurring across all crop categories. Moreover, the majority of farmers attribute the main reason for yield loss to chemical fertilizers and other agrochemical-related issues, leading to the conclusion that the farming community in the country has suffered immensely due to the ban on agrochemicals. The loss of crop yield has resulted in a decrease in the average quantity of sales, storage for household consumption, and future seed requirements across all crop categories, when compared to the previous season. This reduction is evidence to the impact of the agrochemical import ban on the farming community.

Household food security is crucial for a healthy diet and a healthy life. Therefore, 70 percent is classified as food secure having access to food and not experiencing any form of food insecurity. Among OFC and potato farmer households, most frequently consumed food groups during the specified time frame included cereals, vegetables, fats and oils, and sugar. Additionally, protein-rich and dairy food items were infrequently consumed during the same period. The prevailing economic crisis had an adverse impact on the consumption of protein-rich and dairy food items among these farmer households, potentially resulting in an imbalance in their diet and nutrition due to reducing their purchasing power. Food based strategies are employed by the farmer households to maintain their household food security.

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LIST OF ABBREVIATIONS

AI	: Agriculture Instructor
ARPA	: Agricultural Research and Production Assistant
CARI	: Consolidated Approach for Reporting Indicators of Food Security
ECMEN	: Economic Capacity to Meet Essential Needs
FAO	: Food and Agriculture Organization of the United Nations
FCS	: Food Consumption Score
FCS-Nutrition	: Food Consumption Score-Nutrition
FGD	: Focus Group Discussion
GCE	: General Certificate of Education
IFOAM	: International Federation of Organic Agriculture Movements
K	: Potassium
KII	: Key Informant Interview
LCS-FS	: Livelihood Coping Strategies for Food Security
LCSI	: Livelihood Coping Strategies Index
MOP	: Muriate of Potash
MRI	: Medical Research Institute
N	: Nitrogen
OFC	: Other Field Crop
P	: Phosphorus
rCSI	: reduced Coping Strategies Index
TSP	: Triple Super Phosphate
WFP	: World Food Program

CHAPTER ONE

Introduction

1.1 Background

In Sri Lanka, Other Field Crops (OFCs) encompass a diverse array of annual field crops cultivated apart from rice. These crops consist of grains such as maize, sorghum, and finger millet; pulses including green gram, black gram, and cowpea; oilseeds like gingely, groundnut, and soybean; as well as condiments comprising chillies and onions. The Dry Zone stands out as the principal production region for OFCs within Sri Lanka. This particular sub-sector holds significant importance in the production of a wide range of food items, which play a pivotal role in ensuring national food security (Hathurusinghe et al., 2012).

Due to its elevated consumer demand and substantial profitability, potato has emerged as a significant staple crop in Sri Lanka. In 2021, approximately 4,623 hectares of land were dedicated to potato cultivation within the country, resulting in a domestic production of around 75,911 metric tons (Department of Census and Statistics, 2022). Potato cultivation in Sri Lanka predominantly occurs in the upcountry region, with a concentrated focus in the districts of Nuwara Eliya and Badulla. However, Jaffna represents another district where potato cultivation takes place, albeit to a lesser extent.

The enhancement of crop productivity is a primary concern shared by both OFCs and potato-growing farmers. Consequently, they exhibit a heightened sensitivity towards utilization of agrochemicals, including fertilizers, pesticides, weedicides, fungicides, and other chemical inputs towards reaping a bumper harvest. These agrochemicals are vital in facilitating the growth and advancement of crops through provision of essential nutrients, management of pests and diseases, and overall increase of crop productivity.

However, endeavors aimed at elevating crop productivity by applicating chemical fertilizers, pesticides and other agrochemicals received criticism due to disastrous environmental consequences that are accompanied depletion of biodiversity, soil and land degradation, escalated water pollution, and lasting health implications. Research findings further substantiate excessive and inappropriate application of agrochemicals by farmers (Padmajani, Aheeyar & Bandara, 2014).

Given the prevailing circumstances, the Government of Sri Lanka introduced a comprehensive green agriculture policy, effective from the *Maha* 2021 cultivation season. The primary objective of this policy was to attain sustainable agricultural production while safeguarding the environment and human health. A key facet of this policy is to ensure the availability of chemical-free fresh agricultural products to

consumers, thus mitigating potential health risks associated with excessive utilization of various agrochemicals.

Nevertheless, the implications of the green agriculture policy are far-reaching, encompassing consumers, farmers' livelihoods, and individuals who have made investments in the agricultural and related sectors. One of the primary challenges faced by farmers is their unpreparedness to fully embrace organic farming practices. This is primarily attributed to a scarcity of organic fertilizers, limited technical knowledge concerning their production and usage. Additionally, farmers do not have sufficient time to alter their mindset and make a transition from the use of non-organic fertilizers and other agrochemicals, which are comparatively more convenient and yield rapid results, to organic alternatives.

However, despite the government's decision to lift restrictions and permit the private sector to import chemical fertilizers through issuance of licenses, it is timely to investigate the potential impact of this revised policy on the OFCs and potato farming sector in Sri Lanka. Understanding the challenges faced by farmers in transitioning from conventional farming to organic practices is of utmost importance. Conducting a comprehensive study on this subject help fill the information gap with scientific evidence, providing valuable insights to policymakers.

1.2 Rationale of the Study

As reported by the Department of Census and Statistics (2021), agricultural activities occupy over 51 percent of the total land area in Sri Lanka. Moreover, a substantial agrarian population of approximately 8.1 million individuals, distributed among approximately 2.1 million farming households practice agriculture as their livelihood. Consequently, any modifications in the agrochemical policy have direct and indirect socio-economic implications that affect a significant proportion of the population in the country. These impacts extend to consumers, farmers, as well as individuals who have made investments in agriculture and related sectors.

Implementation of the green agriculture policy in Sri Lanka, including the prohibition of agrochemical imports, differs significantly from policy measures implemented by other countries to promote organic farming. While the current import ban is primarily focused on phasing out chemical inputs, it does not adequately incorporate measures that facilitate the adoption of improved organic farming practices as outlined in the principles of the International Federation of Organic Agriculture Movements (IFOAM) [IFOAM, 2014]. Consequently, farmers in Sri Lanka are predominantly transitioning to organic farming practices by default rather than adhering to the specific principles set forth by IFOAM. It appears that relevant stakeholders were not engaged in extensive discussions or adequately taken into account this distinction between default organic conversion and adherence to relevant standards.

Of the total fertilizer use in the country, the OFC and potato crop sector fertilizer consumption accounts for six – nine percent (Department of Agriculture, 2020) signifying the importance of the OFC and potato crop sector. Due to the absence of agrochemical inputs in organic farming, access to nutrients for plant growth is limited and the occurrence of pests and diseases is more difficult to manage, resulting in lower yields than in conventional agriculture. This is well documented for developed countries (Ponisio, 2015), but there is no scientific research on current fertilizer policy change in relative productivity and social and economic condition of the farming community in Sri Lanka specifically.

There has been a notable absence of formal studies investigating the multi-faceted impacts of the new fertilizer policy on farming community within the agriculture sector, particularly with regard to OFCs and potato crop production. Consequently, in order to effectively address the challenges, issues, and potential strategies to overcome them, it is crucial to carefully consider and continually reassess the implementation process, aligning it with the government's objective of promoting green agriculture. A comprehensive research study, with a well-representative survey, was needed to gain a thorough understanding of the current situation. Hence, this research endeavor was designed to examine the effects of the recent fertilizer policy change on agricultural production, as well as direct and indirect consequences on the household economy, food security, and overall well-being of the farming communities involved in OFC and potato crop production sectors.

1.3 Research Questions

1. What are the effects of the fertilizer and other agrochemical import ban on input supply and use in the OFC and potato crop sector?
2. What are the alternatives to fertilizer and other agrochemicals following the import ban, their availability, and accessibility in the OFC and potato crop sector?
3. What was the agriculture production and productivity before and after the import ban in the OFC and potato crop sector?
4. What is the farmers' perception of fertilizer and other agrochemical import ban?
5. How was the household food security affected and what were the coping strategies adopted?

1.4 Objectives

The primary objective of this study is to find out immediate consequences of recent policy changes regarding import restrictions on fertilizers and other agrochemicals, specifically focusing on farming households in OFCs and the potato crop sector.

1.4.1 Specific Objectives:

To assess short-term impact of the import ban on chemical fertilizer and other agrochemicals on;

- Supply and use of agricultural production inputs in the OFC and potato crop sector
- Agricultural productivity and production in the OFC and potato crop sector
- Household food security of farming community involved in OFC and potato crop production

CHAPTER TWO

Methodology

2.1 Conceptual Framework

The study employed a theoretical framework aimed at providing comprehensive insights into the research inquiries posed, namely: (1) the benefits and drawbacks associated with the implementation of the recent green agriculture policy, (2) the attitudes and perceptions of various stakeholders within the agriculture sector (including farmers, traders, consumers, etc.) regarding the adoption and implementation of organic agricultural practices as a substitute for conventional chemical agriculture, and (3) the determination of the most suitable fertilizer policy by considering multiple factors related to synthetic and organic fertilizers, as well as diverse policy approaches. A summarized conceptual framework depicting the key elements of the study is presented in Figure 2.1.

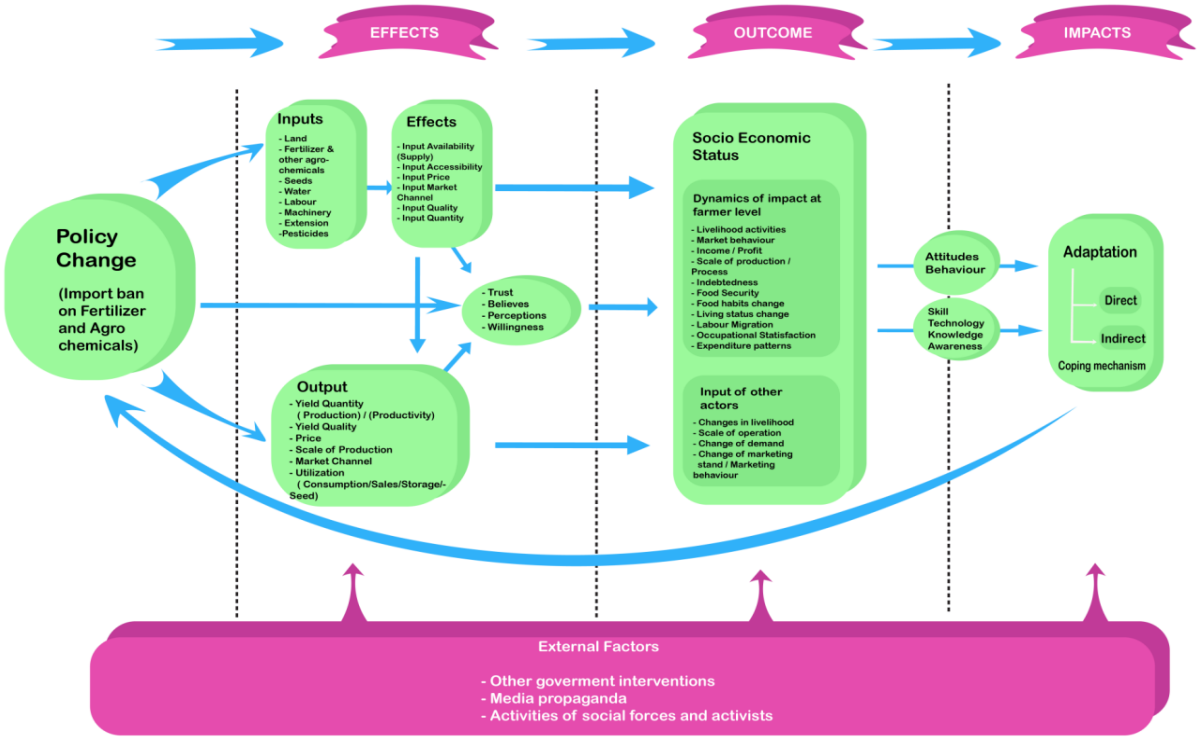
2.2 Sample Selection

Maize, Chilli, and Big onion were chosen as representative crops to encompass the entire OFC sector. Selection of maize, chilli, big onion and potato crops was based on the criteria outlined below:

1. Maize: This crop was selected due to its significant land extent and its crucial role in the animal feed industry. As one of the prominent field crops, it holds substantial importance within the agricultural sector.

2. Chilli & Big onion: The selection of Chilli and Big onion was influenced by their import value within the OFCs. Moreover, these crops are considered politically and socially sensitive, making them relevant in the context of the study.

3. Potato: An essential cash crop that experiences high consumer demand. Its inclusion allows for the examination of its specific dynamics within the agricultural sector.



Source: Based on the literature review

Figure 2.1: Conceptual Framework for the Study

The study covered the entire country by implementing a survey that covered significant crop-growing districts. Due to the absence of a comprehensive national-level database providing information on the number of growers for each crop type in the country, it was determined that the total population of growers was unknown for sample calculation purposes. Instead, the total cultivation area for each crop category in the country was treated as distinct study populations. To determine the appropriate sample size for the survey, considerations were given to the margin of error and confidence level desired for the population of farmers within each segment. By accounting for these factors, the sample size was established to ensure reliable and statistically sound results.

The calculation of the sample size for the study employed the Cochran formula, as outlined by Piran-Qeydari *et al.* (2022). This formula is commonly utilized to determine the sample size required based on the desired level of precision, desired confidence level, and the estimated proportion of the attribute present in the population. It is particularly suitable when dealing with large populations. In line with the objectives of the present study, it was determined that a margin of error of 5 percent and a confidence level of 95 percent would be maintained. These values were selected to ensure a reasonable degree of precision and confidence in the findings.

Sample allocation for each crop category was conducted in a proportional manner among the selected representative districts, taking into account the extent of

cultivation in each district and considering the inherent variability in the cropping systems. This approach aimed to ensure that the sample adequately represented the diversity of agricultural practices across different districts.

At field level, the sample was further distributed proportionately among representative farmer organizations, utilizing a random selection method. This allowed for a fair and unbiased representation of farmers within each organization. The specific locations of the selected samples are provided in Table 2.1, which presents the details of the chosen sample locations.

Table 2.1: Sample Distribution

District	Maize	Chilli	Big onion	Potato	Total
Anuradhapura	131	68	115		314
Moneragala	77	19			96
Kurunegala		39			39
Puttalam		24			24
Hambantota		21			21
Badulla				60	60
Nuwara Eliya				32	32
Matale			117		117
Total	**208**	**171**	**232**	**92**	**703**

Source: HARTI Survey Data, 2022

2.3 Data and Methods of Data Collection

Types of Data

The study employed a combination of secondary data and primary data collected through in-depth interviews to thoroughly examine the pertinent issues at hand. Secondary data encompassed documentary evidence that directly and indirectly pertaining to the analysis of the study objectives. In addition, primary data was collected to gather more precise and specific insights. The primary data collection focused on two distinct periods for comparison: the reference data before the policy change, pertaining to the 2020/21 *Maha* season, and the post-policy data, pertaining to the 2021/22 *Maha* season. This comparative analysis allowed for an assessment of the impacts of policy change. For collection of big onion data, the 2021 *Yala* season and the 2022 *Yala* season were considered.

Data Collection Methods

Questionnaire Survey:

Primary data for this study was acquired through a farm household survey using a semi-structured questionnaire. The survey was conducted using two methods: telephone conversations and field survey with face-to-face interviews. This combined approach was adopted due to fuel supply issues that prevailed in the country during the time of the survey, which necessitated alternative means of data collection.

Focus Group Discussions (FGD):
FGDs were organized, bringing together farmers to engage in discussions pertaining to challenges and issues encountered as a result of the import ban on chemical fertilizers and other agrochemicals. The primary objective of these FGDs was to obtain collective responses and insights from the farming community.

Key Informant Interviews (KII):
The data was gathered through key informant interviews with representatives of Farmer Organizations and ground-level officers, including Agriculture Research and Production Assistants (ARPA) and Agriculture Instructors (AI), who are actively involved at the ground level in the production process.

2.4 Operationalization of Variables

Specific Objective 1: To assess the effects of recent change in policy on import of fertilizer and other agrochemicals on supply and use of agricultural production inputs in the OFC and potato crop sector**.**

Table 2.2: Variable Operationalization for Objective One

Indicators	Measures
Land	Quantitative and qualitative data on • Land extent cultivated • Type of land ownership • Land use
Chemical fertilizer	Quantitative and qualitative data on • Type of fertilizer used • Quantity used • Unit price • Source of supply • Availability (Likert) • Fertilizer usage behaviour • Opinion on cost of fertilizer quality (Likert) • Quality (Likert)
Organic fertilizer availability, use and quality	Quantitative and qualitative data on • Type of fertilizer used • Quantity used • Source of knowledge • Unit price • Source of supply • Availability (Likert) • Level of adequacy for the cultivation (Likert) • Quality (Likert)
Organic fertilizer production and marketing	Quantitative and qualitative data on • Types of raw materials used • Availability of raw materials (Likert) • Quantity produced

	• Quantity sold • Unit price • Sufficiency for self-cultivation • Constraints for production
Other agrochemical (Pesticide, Weedicide)	Quantitative and qualitative data on • Type of other agrochemicals used • Time of application • Quantity used • Unit price • Source of supply • Availability (Likert) • Level of adequacy for the cultivation (Likert)

Source: Based on literature review

Specific Objective 2: To assess the effects of recent changes in policy on import of fertilizer and other agrochemicals on agricultural productivity and the production of OFC and potato crop sector

Table 2.3: Variable Operationalization for Objective Two

Dimensions	Indicators	Measures	Source of Data
Productivity/production before and after import ban	Output Issues in production	Yield per unit of land total production % Yield loss	Farmer survey
Use of harvest before and after the import ban	Utilization	Nature of utilization (consumption /sale/seeds/storage) Quantity of utilization	Farmer survey
Marketing before and after the import ban	Sale	Quantitative and qualitative data on Quantity sold Unit price	Farmer survey

Source: Based on literature review

Specific Objective 3: To assess the effects of recent change in policy on import of fertilizer and agrochemicals on household food security of farming community of OFC and potato crop sector.

Table 2.4: Variable Operationalization for Objective Three

Indicator	Variables/measures	Sources of data
Food Security	FCS -Food consumption score RCSI – Food based Coping Strategies Index LCSI – Livelihood Coping Strategies Index	Farmers Survey

Source: Based on literature review.

2.5 Data Analysis

The collected data was subject to analysis employing descriptive and inferential statistics, utilizing software such as Microsoft Excel, STATA, and SPSS. The outcomes were effectively presented in graphical form, utilizing appropriate tables and graphs.

CHAPTER THREE

Supply and Use of Agricultural Production Inputs

Agricultural inputs play a significant role in determining the yield of crop cultivation. Sustainable use of inputs in agriculture is crucial for achieving efficient food production in a country. This chapter aims at discussing the supply and utilization of agricultural production inputs in maize, potato, chili, and big onion cultivation, comparing the situation before and after the policy change. Special consideration is given to the discussion of inputs such as land, organic and chemical fertilizers, pesticides, weedicides, and labour. Since individual households are the most crucial decision-making units in resource allocation and the production of the household economy, this chapter also makes efforts to relate the basic demographic characteristics of the sample to the supply and utilization of agricultural inputs.

3.1 Demographic and Socio-economic Information of the Sample

Understanding the various demographic and socio-economic factors of the sample is crucial as they can influence farmers' cultivation patterns and preferences. Table 3.1 provides a summary of the demographic characteristics, including gender, age, household size, and education levelof the principal farmers in the sample. It is noteworthy that 92 percent of farmers (N=650), who are primarily engaged in agricultural activities and make decisions regarding agriculture within their families, are male. This indicates dominance of male farmers in the cultivation of maize, potato, chili, and big onion. The majority of farmers in the sample (83%) were 40 years or older, while only 17 percent were below the age of 40-- indicates the lack of youth engagement in agriculture. Furthermore, only a small percentage (3%) of farmers in crop production were above the age of 70, indicating limited involvement of elderly farmers.

The education level of farmers is also an important determinant that enables rational decision-making in agriculture. According to the data, 99 percent of farmers in the sample have received formal education to a varying degree. Notably, more than half (51%) of the farmers have attained secondary education, while 42 percent have passed the GCE ordinary level examination. These findings highlight that the sample farmers possess an average level of education, enabling them to comprehend cultivation practices, pest and disease control, organic fertilizer production, and marketing mechanisms for specific crop varieties.

In general, over half (52%) of the farmer families in the sample consist of three to five members (Table 3.1). This indicates a trend of smaller family units within the agricultural community at present. Additionally, the presence of only three percent of farm families with seven or more members suggests a higher prevalence of nuclear families within the sample. This implies that the sample comprises fewer households with members such as parents, grandparents, and grandchildren.

Table 3.1: Demographic Characteristics of Farmers

Category	Number	Percentage
Gender		
Male	650	92
Female	53	8
Age group		
< 30	9	1
30 – 39	107	15
40 - 49	226	32
50 - 59	230	33
60 - 69	112	16
>70	19	3
Level of Education		
Not attended	5	1
Primary (1-5)	36	5
Secondary (6-11)	359	51
GCE O/L passed	207	30
GCE A/L passed	87	12
Diploma or above	9	1
Household size		
<3	61	9
3=<5	367	52
5=<7	256	36
>=7	19	3

Source: HARTI Survey Data, 2022

While there are other members in the household engaged in income-earning activities, this study focuses solely on the principal farmer for gathering information regarding their primary employment. Table 3.2 provides a summary of the principal farmer's primary employment within the household. Out of the total 703 farmers, 638 (91%) are primarily engaged in full-time crop cultivation activities as their main source of income. Only nine percent of farmers engage in agriculture as a secondary source of income while also pursuing other income-earning activities. Thus, the sample effectively represents the actual farming community involved in the cultivation of maize, potato, chili, and big onion. The second highest primary income source (5.8%) is derived from government sector workers, including pensioners.

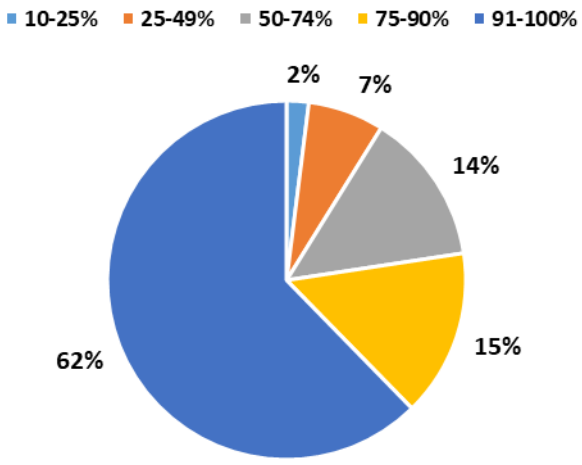
Table 3.2: Primary Employment of Farmers

Primary Employment	Number of Farmers	%
Crop farming	638	90.8
Government Employment	21	3.0
Pension	20	2.8
Self-employed	8	1.1
Skilled labour (carpenter, mechanic etc.)	7	1.0
Private Sector Employment	3	0.4
Agricultural labour (non-skilled)	2	0.4
Non-agricultural labour (non-skilled)	2	0.3
Animal Husbandry	1	0.1
Monthly allowance from relatives	1	0.1
	703	100

Source: HARTI Survey Data, 2022

The aim of obtaining information on the percentage of agricultural income to the total income of the household was to comprehend the economic impact of agriculture on farm families. Figure 3.1 presents the findings indicating that 77 percent of farmers in the sample (N=545) reported agricultural activities contributing 75 percent or more to the total income of their households. This result strongly suggests that the majority of farmers in the sample are fully engaged in agricultural activities as their primary source of income through crop cultivation.

Particularly, of the total sample, 62 percent of households reported that agricultural activities accounted for 91 to 100 percent of their total income. Moreover, more than half of the farmers (59%) in the total sample (N=415), relied entirely on agriculture (100%) as their primary source of income for their livelihoods. Consequently, any incidents or disruptions occurring in the agricultural sector exclusively impact the livelihoods of these farmers.



Source: HARTI Survey Data, 2022

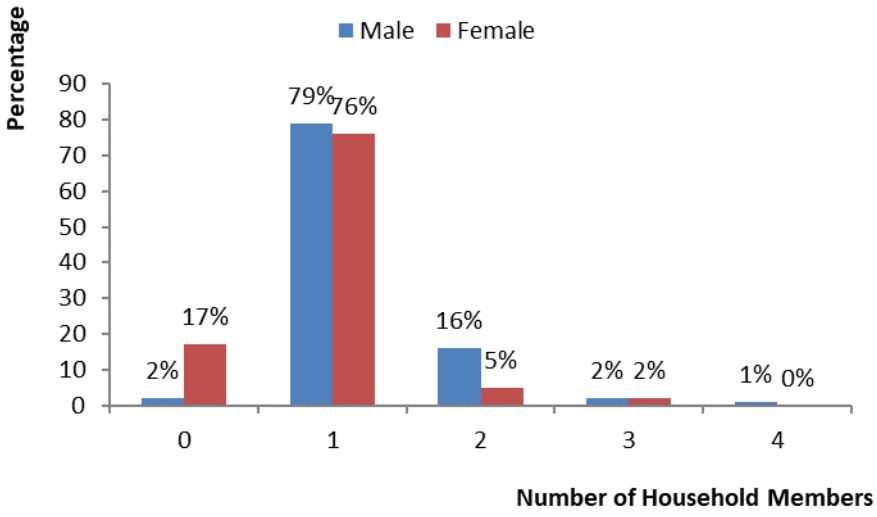
Figure 3.1: Percentage Contribution of Agriculture to Household Income

Table 3.3 provides further insight into the contribution of agricultural activities to household income, specifically categorized by different crops. It is evident that big onion cultivation has made a significant contribution to the household income of farm families compared to other crops. Approximately, 86 percent of households reported a contribution of 75 percent or more to their total income from big onion cultivation. The second highest contribution (79%) to the total income was observed in households engaged in chili cultivation under the category of 75 percent or more. When considering all crops together, nearly half or more than half of the households in each category reported a contribution of 91 to 100 percent from agricultural activities to their total family income.

Table 3.3: Contribution of Agriculture to the Total Income of Household by Crop Category

Share of Agriculture	Percentage of Farmers				
	Maize	Potato	Chilli	Big onion	Total
10-25%	1	4	2	2	2
25-49%	10	12	5	3	7
50-74%	19	12	14	9	14
75-90%	21	13	12	14	15
91-100%	49	59	67	72	62
Total	**100**	**100**	**100**	**100**	**100**

Source: HARTI Survey Data, 2022



Source: HARTI Survey Data, 2022

Figure 3.2: Engagement of Household Members in Agriculture

The farming community in the agriculture sector has been facing significant challenges such as rising wage rates for hired agricultural workers and widespread labour scarcity (Karunagoda, 2004). To mitigate these issues to a certain extent, employment of family labour in farming activities plays a crucial role. Figure 3.2 depicts the involvement of household members in agricultural activities. Of the total

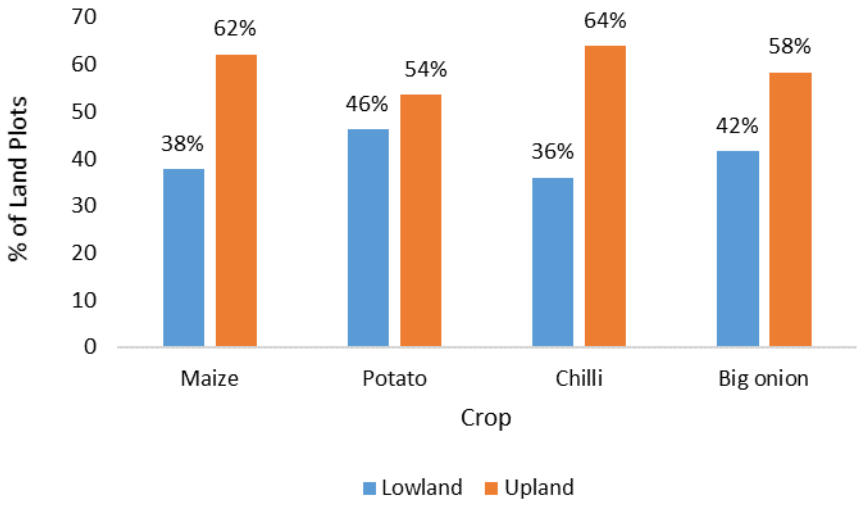
sample, there were 13 households (2%) that did not have any male labour available for agricultural activities due to reasons such as illness or death. It is evident that the majority of households (79%) had only one male worker engaged in cultivation, indicating limited participation of male labour in farming activities.

The number of female labourers within the family was significantly lower compared to male labourers. In the total sample, 17 percent of households reported not having any female labourers, while the majority (76 percent) had at least one female family member engaged in agricultural activities. In many cases, it was observed that parents were the key individuals involved in agricultural activities, while the children were often engaged in non-agricultural work.

3.2 Land Use

Land serves as a critical input in agriculture. To gain insights into farmers' land assets, inquiries were made regarding land availability, extent, and ownership patterns. The majority of maize farmers (88%), chilli farmers (89%), big onion farmers (89%), and potato farmers (67%) reported owning or cultivating more than one land plot during the last 2021/2022 *Maha* season.

3.2.1 Land Type



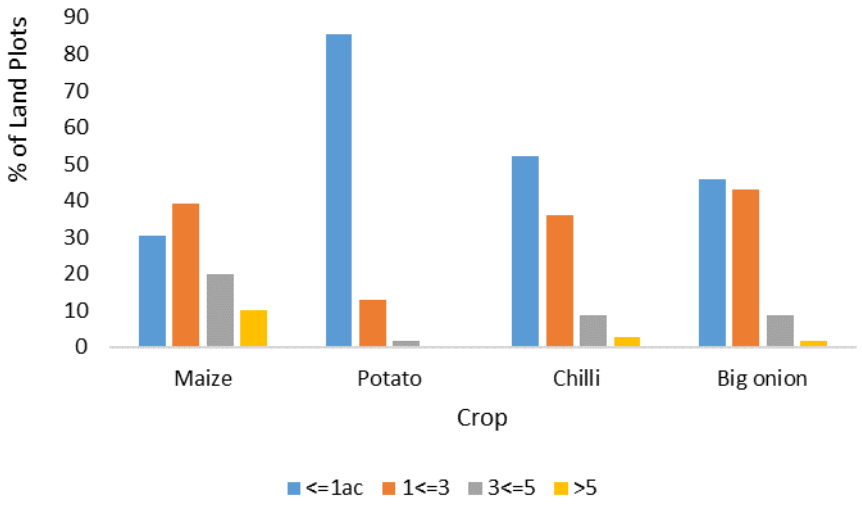
Source: HARTI Survey Data, 2022

Figure 3.3: Percentage of Land Plots by Types

Figure 3.3 displays the percentage distribution of land plots by types, namely uplands and lowlands. It is notable that all farmers have a larger number of uplands compared to lowlands. The uplands are primarily utilized for the cultivation of upland crops such as vegetables, other field crops (OFCs), and home gardening. Among different crop categories, chilli farmers own the highest proportion of uplands, while potato farmers possess the lowest percentage of uplands.

3.2.1 Land Extent

For presentation purposes, the land plots owned or cultivated by each farmer were categorized into four main categories: <=1 acre, 1<=3 acres, 3<=5 acres, and >5 acres. Figure 3.4 illustrates distribution of land plots by crop type for each farmer. The graph highlights that potato farmers possess the highest number of land plots with an extent of <=1 acre, indicating that the potato farmers concentrated in hill country areas like Badulla typically have smaller land parcels compared to the other farmers who largely practice farming in the Dry Zone districts. Conversely, maize farmers own the largest land plots (>5 acres) as they generally engage in cultivation on larger plots. It was observed that potato farmers do not have any land plots larger than five acres.

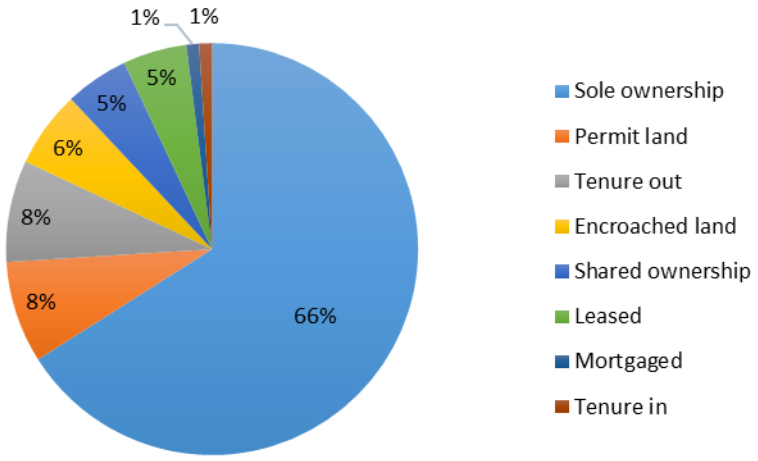


Source: HARTI Survey Data, 2022

Figure 3.4: Percentage Variation of Land Plots by Extent Categories

3.2.3 Land Ownership

A study conducted by Weerahewa *et al.* (2021) suggests a positive correlation between land tenure security and increased investment in land, reduced degradation, and higher land productivity. Generally, individuals with resource entitlement exhibit a stronger interest in sustainable resource management. To investigate any relationship between land use patterns and ownership before and after the policy change, information on the type of ownership for all lands used by farmers was gathered. Figure 3.5 provides a summary of the ownership of different land categories, shedding light on the distribution of land ownership in relation to land use patterns.



Source: HARTI Survey Data, 2022

Figure 3.5: Ownership Pattern of Lands

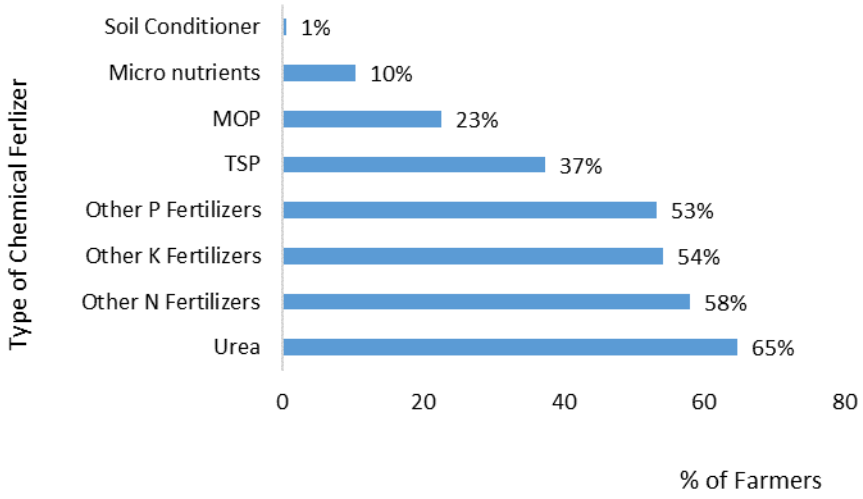
Based on the data, predominant ownership pattern among the total farmers was sole ownership, comprising 66 percent of the total land plots. The second most prevalent ownership pattern was for permit and tenure out lands. Additionally, a significant number of land plots were found to be encroached by farmers. Among various crop types, maize farmers had the highest number of encroached and permitted lands compared to other crops. Conversely, potato farmers had the highest number of leased lands.

3.3 Supply and Use of Chemical Fertilizers after Import Ban

The use of chemical fertilizers has been widely acknowledged as crucial for achieving high crop yields in agriculture, serving as a key input. The primary objective of this study is to examine the impact of policy changes on the importation of chemical fertilizers, with specific emphasis on understanding how farmers adapt to these restricted conditions. By analyzing the dynamics of chemical fertilizer utilization and evaluating farmer performance within the framework of these new policies, this study aims to provide valuable insights into the challenges and opportunities associated with transitioning towards more sustainable and environmentally friendly agricultural practices.

3.3.1 Application of Chemical Fertilizers

In spite of the ban on the importation of chemical fertilizers, a substantial number of farmers (N=517 & 74%) utilized those during the 2021/2022 *Maha* season. This observation highlights that, despite the restricted conditions farmers maintained a strong dependence on chemical fertilizers for their crop cultivation activities.

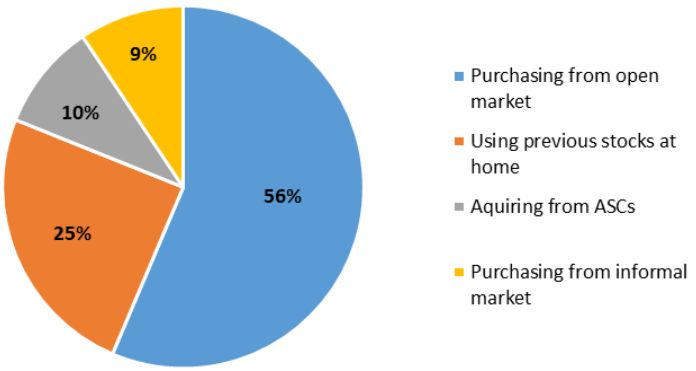


Note: Multiple responses allowed
Source: HARTI Survey Data, 2022

Figure 3.6: Types of Fertilizers Applied after the Import Ban

As depicted in Figure 3.6, a notable percentage of farmers used chemical fertilizers despite the import ban. Urea emerged as the most commonly utilized fertilizer, with 65 percent of farmers applying it during the previous 2021/2022 *Maha* season. Other nitrogen fertilizers, namely Ammonium Sulphate and Ammonium Nitrate, were also widely used, with 58 percent of farmers incorporating them into their practices. Likewise, other potassium and phosphorous fertilizers were employed by 54 percent and 53 percent of farmers, respectively. Analyzing the breakdown of crops, it is evident that big onion farmers exhibited higher propensity to use chemical fertilizer compared to farmers cultivating other crops. A significant proportion of farmers (73%) continuing to use chemical fertilizers despite the import ban emphasizes the greater demand for such inputs in crop cultivation and underscores their perceived significance by farmers.

3.3.2 Mode of Supply of Chemical Fertilizers



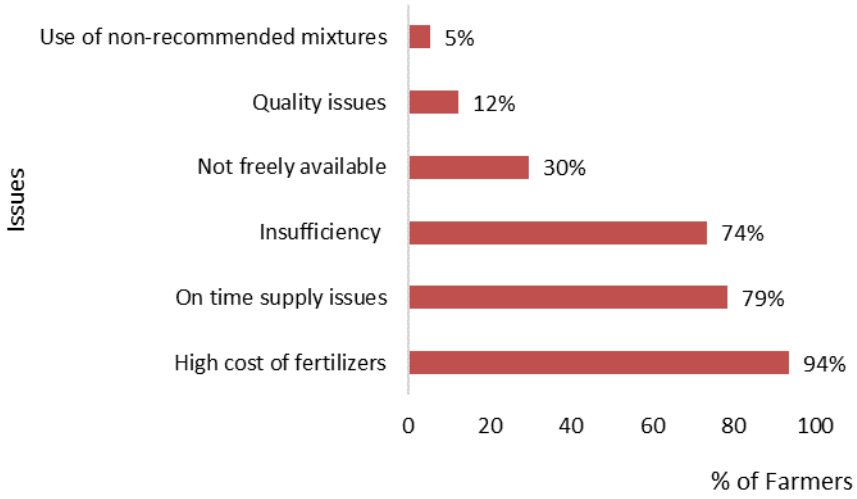
Source: HARTI Survey Data, 2022

Figure 3.7: Mode of Supply of Chemical Fertilizers during the Import Ban

As illustrated in Figure 3.7, the majority of farmers (62%) procured chemical fertilizers from the open market. According to their responses, they were compelled to purchase these fertilizers at higher prices compared to previous periods. It was observed that certain farmers had a tendency to excessively purchase chemical fertilizers in advance of the policy change. Consequently, they utilized the surplus fertilizers (27%) stored at their homes for their cultivations during the 2021/2022 *Maha* season amidst the fertilizer issue. Additionally, some farmers opted to purchase chemical fertilizers from Agrarian Services Centers (ASC) in their respective hometowns. Notably, prevalence of informal markets for chemical fertilizers was widespread across all study areas, with farmers acquiring fertilizers from these vendors at significantly higher price ranges.

3.3.3 Issues in Using Chemical Fertilizers during the Import Ban

During the import ban on chemical fertilizers, farmers faced numerous challenges and difficulties in procuring and utilizing these inputs. Based on the responses of farmers who applied chemical fertilizers (N=517) during the import ban, the following issues were raised:



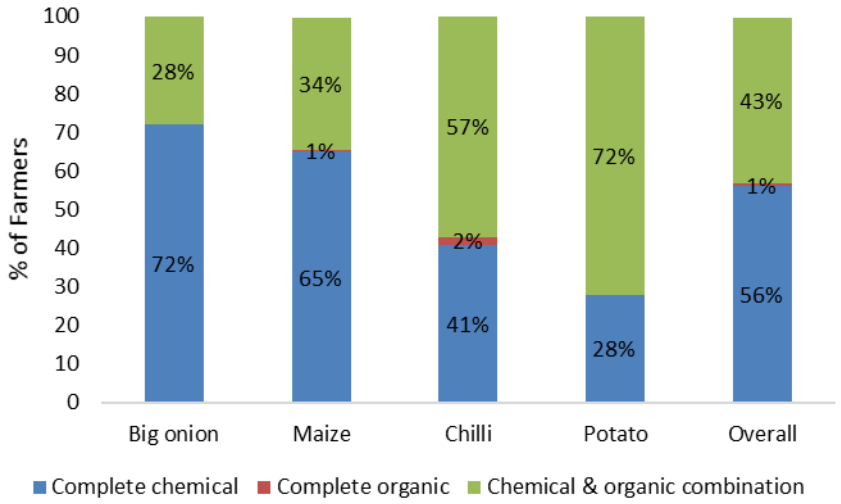
Note: Multiple responses are allowed
Source: HARTI Survey Data, 2022

Figure 3.8: Issues in Using Chemical Fertilizers during the Import Ban

Figure 3.8 indicates that, the high cost of fertilizers was the most significant issue faced by farmers during the import ban, with a staggering 94 percent of the farmers reporting it as a problem. Timely supply issues and inadequate stocks of fertilizers were also significant concerns of farmers. In certain areas, farmers encountered difficulties in obtaining fertilizers as they were not readily available. Notably, quality issues and the use of non-recommended mixtures were reported by a smaller percentage of farmers, with 12 percent and 5 percent, respectively.

3.3.4 Farmers' Perception on Plant Nutrient Supply

As per Figure 3.9, despite the Government's aim to transform the entire country into organic farming, only one percent of farmers expressed willingness to utilize organic fertilizers exclusively in crop production. The majority of farmers, accounting for 56 percent, preferred using chemical fertilizers, while 43 percent favoured a combination of organic and chemical fertilizers. The crop breakdown data further revealed that a majority of potato (72%) and chilli farmers (57%) opted for a mix of organic and chemical fertilizers, whereas big onion (72%) and maize farmers (65%) predominantly relied on chemical fertilizers to provide plant nutrition. These findings underscore the varying preferences and attitudes of farmers towards fertilizer usage in crop cultivation.



Source: HARTI Survey Data, 2022

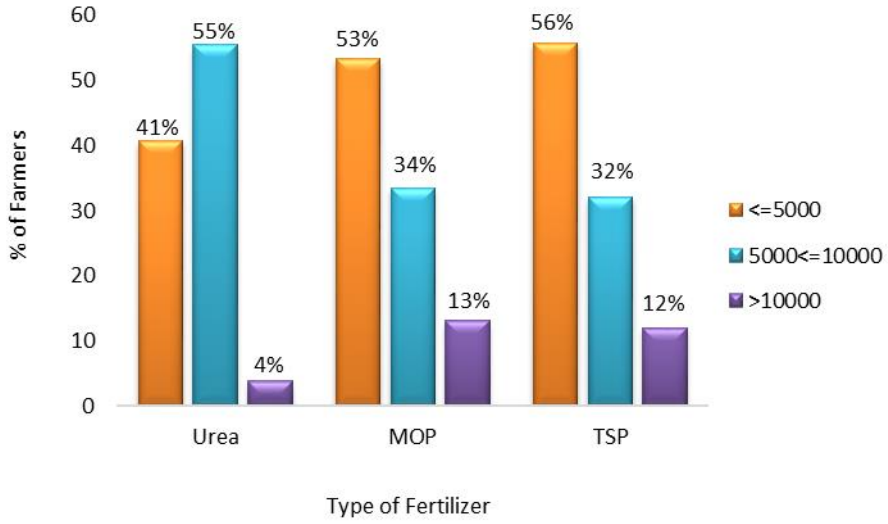
Figure 3.9: Farmers' Perception on Plant Nutrient Supply

The farmers were asked about their preference on ways of producing the fertilizer subsidy with high prices and low availability of chemical fertilizers during this deficit times. The results showed that majority of farmers (66%) preferred good quality chemical fertilizers at market price. However, a considerable percentage of farmers (31%) expressed willingness to receive the subsidy as an in-kind assistance. Only a small percentage of farmers (3%) sought cash grants instead of subsidies or in-kind assistance. Overall, the survey highlights the varying needs and preferences of farmers in times of crisis, and the importance of providing support in multiple forms to cater to their diverse requirements.

3.3.5 Farmers' Willingness to Pay for Chemical Fertilizers

During the period of import restrictions and high fertilizer prices, farmers were surveyed about their willingness to pay for three main chemical fertilizers: Urea, Triple Super Phosphate, and Muriate of Potash. The findings of the survey suggest

that farmers are willing to pay different prices for different types of chemical fertilizers. Specifically, more than half of farmers expressed willingness to pay between Rs.5000-10000 per 50 kilograms of urea, indicating a relatively high demand for nitrogenous fertilizer. On the other hand, for MOP and TSP, the majority of farmers preferred a lower price range of less than Rs.5000 over urea. Due to the scarcity of fertilizers and the challenges faced in finding them when needed, many farmers were willing to purchase fertilizers even at a higher price.



Source: HARTI Survey Data, 2022

Figure 3.10: Farmers' Willingness to Pay for Chemical Fertilizers

3.4 Pest and Disease Management after Import Ban

Pest and disease management is a critical aspect of crop cultivation, as it is essential to ensure successful harvest. The import ban on agrochemicals has had a direct impact on the control of pests and diseases in the crop cultivation of the study sample. The findings show that 80 percent of farmers used available chemicals to control pests and diseases in their crop cultivations during the restricted period. Among them, the majority of farmers (66%) purchased agrochemicals from the open market at a very high price range. Similar to chemical fertilizers, some farmers stored excess chemicals at home and used them during the import restrictions (19%). Other farmers have relied on chemicals which purchased from informal market (15%).

Despite applying certain chemicals, farmers faced several issues in managing pests and diseases and controlling weeds due to non-availability of recommended pesticides, weedicides, and other relevant chemicals in sufficient quantities and accepted qualities. The high cost of chemicals was the key issue they encountered in pest and disease management (64%). During the restrictions, farmers were unable to apply the correct chemicals in the recommended quantities, and they had to spend more time searching for low-cost alternatives. However, there was high incidence of pest attacks, diseases, as well as weed problems in their crop lands during the import restrictions. Eleven percent of farmers adopting traditional methods to

control pests and diseases in their fields is a positive indicator that the import ban has facilitated the transition of farmers towards more environmentally friendly methods.

3.5 Usage of Organic Fertilizers

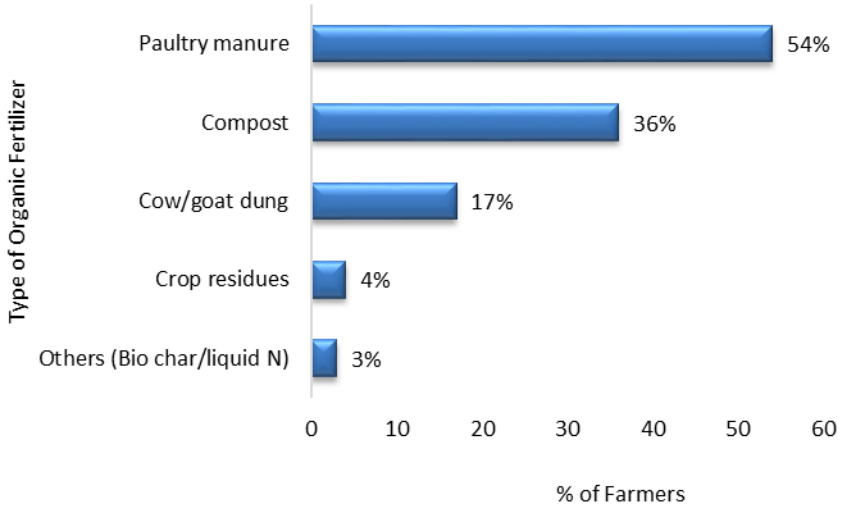
3.5.1 Application of Organic Fertilizers before the Import Ban

Organic fertilizers are natural nutrient sources that are environmentally friendly, however, rarely used in commercial crop cultivation. The application of organic materials to the soil aids in the development of soil structure and texture, thereby contributing to improved agricultural practices. As part of the Government's efforts to promote organic agriculture, the implementation of import restrictions on agrochemicals was initiated. Prior to imposition of these restrictions, 26 percent of farmers had already utilized organic fertilizers in their farming practices. Notably, potato farmers demonstrated the highest adoption rate of organic practices, with an overwhelming majority of 99 percent choosing to incorporate organic fertilizers. In contrast, maize farmers had the lowest percentage of adoption, with only five percent utilizing organic fertilizers. This disparity highlights the varying levels of acceptance and adoption of organic practices among different crop cultivators.

Farmers had diverse motivations for the application of organic fertilizers in their agricultural practices. The predominant purpose identified among the majority of farmers (53%) was the desire to improve soil conditions and enhance fertility levels. This signifies a notable emphasis on adopting sustainable farming approaches that prioritize soil health. Interestingly, a quarter of farmers believed that organic fertilizers directly contributed to increase in crop yields. Instead, many farmers chose to utilize organic fertilizers to maintain optimal soil moisture levels, recognizing the importance of moisture retention for crop growth and development. This highlights the multifaceted reasons behind farmers' decisions to incorporate organic fertilizers into their farming strategies.

3.5.2 Types of Organic Fertilizers Used before Import Ban

The data presented in Figure 3.11 reveals that prior to policy implementation, the most commonly used organic fertilizer was poultry manure. Among the four crop categories, the highest percentage of farmers using poultry manure to provide organic substances to the soil was among potato farmers, with 87 percent of them using this type of fertilizer. The second most commonly used organic fertilizer was compost, accounting for 36 percent of the overall usage. Cow dung or goat dung was used by 17 percent of the sample, while crop residues such as, paddy straw, and green manure were used in much smaller amounts compared to the other types of organic fertilizers.

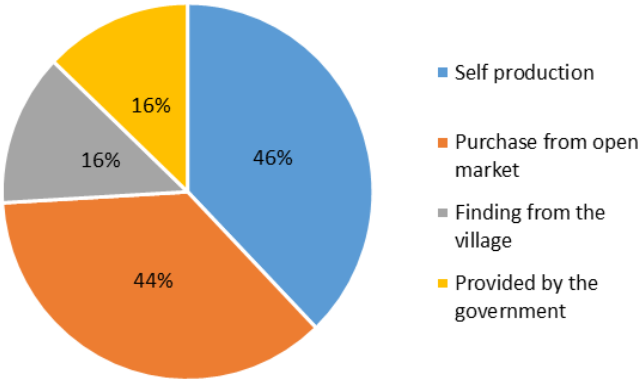


Note: Multiple responses are allowed
Source: HARTI Survey Data, 2022

Figure 3.11: Types of Organic Fertilizer Used before Import Ban

3.5.3 Supply of Organic Fertilizers after the Import Ban

Figure 3.12 reveals the various sources of organic fertilizers acquired by farmers following the import ban. An overwhelming majority of farmers (46%) resorted to self-production of organic fertilizers, indicating a shift towards greater self-sufficiency and willingness to invest in sustainable farming practices. Purchase from the open market was the second most common source, accounting for 44 percent of the acquired organic fertilizers. A smaller percentage of farmers were able to obtain organic fertilizers by finding those within their own villages (16%), highlighting the importance of local networks and resource sharing. The Government also played a role in providing organic fertilizers to farmers (16%), indicating commitment to supporting sustainable agriculture and local farmers. Overall, the data suggests that the import ban on chemical fertilizers has encouraged farmers to explore a range of options for acquiring organic fertilizers, including self-production and local resource sharing, while also indicating a need for continued support and investment in sustainable farming practices.



Note: Multiple responses are allowed
Source: HARTI Survey Data, 2022

Figure 3.12: Mode of Acquiring Organic Fertilizers after Import Ban

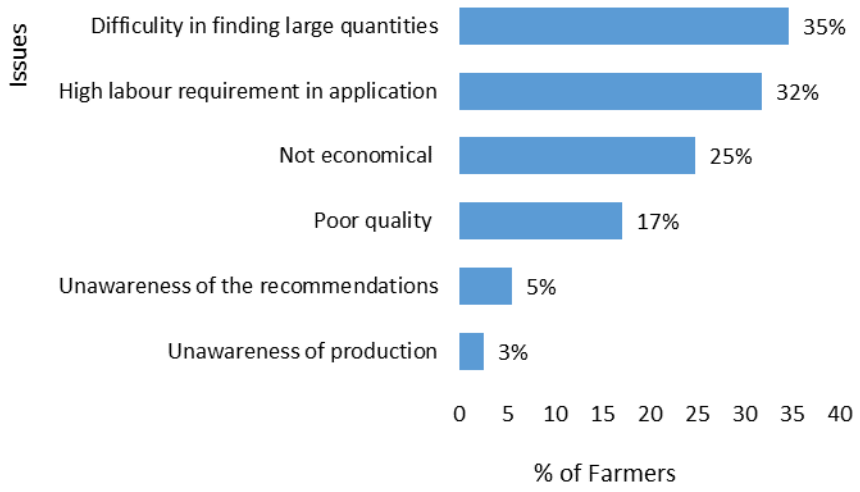
3.5.4 Issues in Using Organic Fertilizers after the Import Ban

While the use of organic fertilizers has numerous benefits, including improved soil health and reduced environmental pollution, there are also several challenges associated with their use. In this context, the study examined some of the issues with using organic fertilizers despite the Government's push to enhance organic agriculture.

As depicted in Figure 3.13, one of the major issues is the difficulty in finding large quantities of organic fertilizers. This is due to a lack of production or limited availability of the materials needed to make organic fertilizers. Another challenge is the high labour requirement in applying organic fertilizers, which could make it difficult for farmers to adopt this practice on a large scale.

Additionally, poor quality organic fertilizers account for a significant portion of the issues, with 17 percent of respondents indicating that the quality of available organic fertilizers is not satisfactory. This could be due to inadequate production processes or lack of knowledge among farmers about how to produce high-quality organic fertilizers. Another major concern is the poor economic viability associated with using organic fertilizers, with a quarter of respondents indicating that the cost of organic fertilizers is prohibitive. This could be due to the relatively low nutrient content of organic fertilizers, which can result in decreased crop yields compared to synthetic fertilizers.

Furthermore, five percent of respondents indicated a lack of awareness of recommended usage rates for organic fertilizers. This could lead to over or under-application, which can have negative impacts on crop growth and yield. Eventually three percent of respondents indicated a lack of awareness about the production process of organic fertilizers, which could be a result of inadequate education and training programmes for farmers.



Note: Multiple responses are allowed
Source: HARTI Survey Data, 2022

Figure 3.13: Issues in Using Organic Fertilizers after Import Ban

3.5.5 Organic Fertilizer Production Subsidy

When the import restrictions of agrochemicals were inforce, the Government implemented measures to encourage farmers to produce organic fertilizers. This was achieved by offering subsidies to organic producers. The main goal of this programme was to foster and enhance the production of organic fertilizers locally. Out of the total sample of 703 farmers, only 15 percent reported receiving the subsidy for organic fertilizer production during the import ban. Among the various farming groups, potato farmers had the lowest percentage of recipients, accounting for only three percent. In contrast, the highest proportion of the subsidy, amounting to 21 percent, was received by chilli farmers.

Farmers who were granted the organic fertilizer production subsidy were classified into three categories based on the amount they received. Among the total sample (N=703), 31 percent of farmers received a subsidy of Rs.5000 or less, while 39 percent received subsidies ranging between Rs.5000 and 10,000. Only 30 percent of farmers received subsidies exceeding Rs.10,000. The highest amount of subsidy received by an individual farmer was Rs.20,000.

3.5.6 Government In-kind Assistance for Fertilizer

The Government's decision to provide in-kind assistance to farmers during the fertilizers import restrictions is a commendable initiative. However, the results of the study indicate that there were several shortcomings in the implementation of this assistance programme. The fact that only 27 percent of farmers received the fertilizer alternatives distributed by Government institutions. Moreover, the disparity in the distribution of fertilizer alternatives, with only seven percent of

farmers receiving Nano Nitrogen fertilizers, raises questions about the fairness of the state-run distribution process.

Fifteen percent of farmers being dissatisfied with the quantity of fertilizers they received is a call for concern. Additionally, the delay in the distribution of fertilizers, which has affected 41 percent of farmers, is highly distressing. Timely distribution of fertilizers is critical for the growth of crops, and the delay may have had a detrimental impact on the crop yields.

It is also surprising to note that only 54 percent of farmers who received the in-kind assistance were able to successfully utilize the fertilizer alternatives. Others were not satisfied with the quality of the alternatives distributed and they have not received it in time to apply them on crops cultivated. Overall, while the Government's effort to provide in-kind assistance to farmers is a positive step, more effective planning and implementation is needed to ensure that the assistance reaches all farmers in a fair and timely manner, and that they receive adequate guidance on how to utilize it effectively.

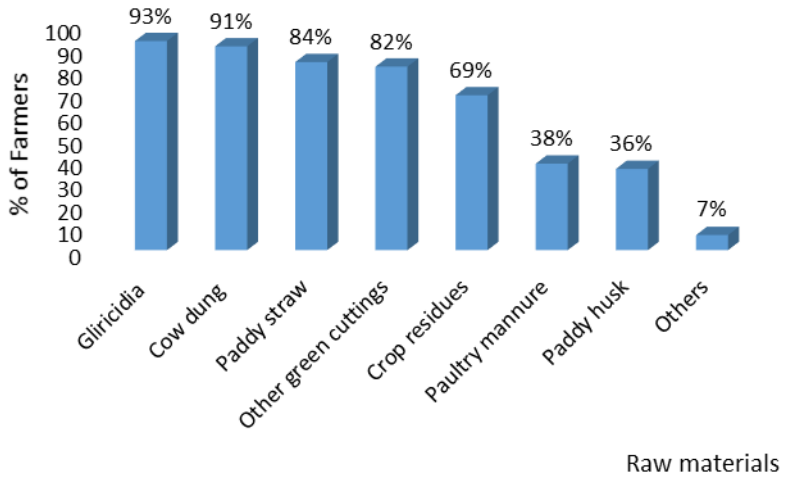
3.5.7 Production and Usage of Organic Fertilizers

Based on the data, it was observed that 32 percent of farmers have recently started producing organic fertilizers at household level following the implementation of the import ban of chemical fertilizers and other agro-chemicals. This development is encouraging as it signifies a positive trend wherein farmers are embracing sustainable agricultural practices and seeking alternatives to chemical fertilizers.

3.5.7.1 Organic Fertilizer Production Quantity

Variations in the quantity of organic fertilizers produced by farmers have been observed, with the production ranging from a minimum of 20 kilograms to a maximum of 200,000 kilograms per season. On average, farmers have produced approximately 1,627 kilograms of organic fertilizers per season. Analyzing the quantity produced, it can be inferred that 43 percent of farmers have exceeded 500 kilograms of organic fertilizer production, while 19 percent of farmers have surpassed 1000 kilograms of organic fertilizer production within a single crop production season. However, there is a cause for concern as only 55 percent of the farmers who engaged in organic fertilizer production were able to generate a sufficient quantity for their own crop cultivation. Furthermore, a mere three percent of farmers have managed to sell the organic fertilizers they produced to their neighbours within the villages.

3.5.7.2 Raw Materials Used for Organic Fertilizer Production

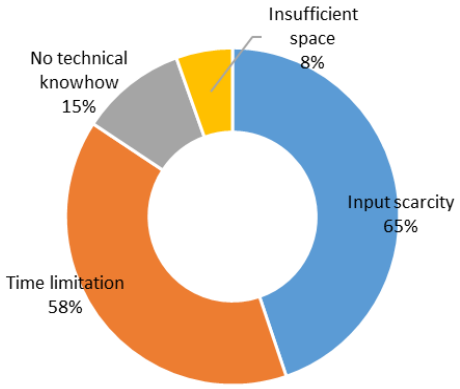


Note: Multiple responses are allowed
Source: HARTI Survey Data, 2022

Figure 3.14: Different Raw Materials Used for Organic Fertilizer Production

The data presented in Figure 3.14 highlights the diverse range of ingredients and raw materials utilized by farmers in organic fertilizer production. Gliricidia emerges as the most commonly used raw material, widely accessible in almost all residential areas of farmers. Cow dung follows as the second most frequently employed material, with 91 percent of farmers utilizing it. Paddy straw and other green cuttings, such as banana stems and Salvinia plants, also rank highly as popular raw materials, employed by 84 percent and 82 percent of farmers, respectively. Crop residues, encompassing leaves, stems, and other plant parts remaining after harvest, find use among 69 percent of farmers. Surprisingly, poultry manure is utilized by only 38 percent of farmers, despite its rich nitrogen content. Additionally, seven percent of farmers employ other raw materials, including Dolomite and Rock Phosphate, which are mineral-based and contribute essential micronutrients for plant growth.

3.5.7.3 Issues in Producing Organic Fertilizers



Note: Multiple responses are allowed
Source: HARTI Survey Data, 2022

Figure 3.15: Issues in Producing Organic Fertilizers

The production of organic fertilizers poses significant challenges for farmers. Throughout the production process, they face various issues, with the scarcity of inputs or raw materials being the most prevalent, accounting for 65 percent of the challenges reported. Finding an adequate supply of raw materials within close proximity to their residential areas proves to be a substantial obstacle, often requiring farmers to travel long distances to acquire them. Moreover, there is a time constraint in producing large quantities, exacerbated by the shorter time period imposed by import restrictions.

The farmers' feedback regarding these challenges indicates that the production of high-quality organic fertilizer demands more time than what is typically available. As a result, they express frustration due to the inadequate time available to produce the desired quantity of organic fertilizers. Additionally, many farmers lack knowledge and expertise to produce organic fertilizers of satisfactory quality, which further contributes to their dissatisfaction with the end product. Lastly, some farmers encounter limitations in terms of available space, making it impractical to produce organic fertilizers on a larger scale.

CHAPTER FOUR

Impact of Fertilizer and other Agrochemical Import Ban on Input Usage and Agricultural Production

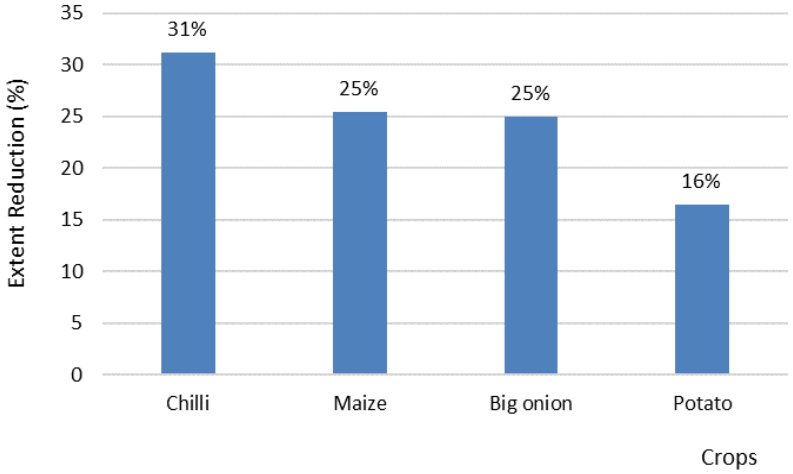
This chapter examines the effects of the ban of fertilizer and other agrochemicals on agricultural input usage and crop production. It focuses on the ways in which farmers employ various agricultural inputs, including land, chemical fertilizers, organic fertilizers and pesticides both before and after the ban, and how these patterns have changed. The productivity of crops is particularly sensitive to agrochemicals, so the Chapter seeks to analyze the productivity changes for each crop under two scenarios to better understand the impact of the policy change on crop production in the study area. Additionally, this chapter highlights key issues that arose during crop production as a result of the restrictions on agrochemical imports.

4.1. Change of Land Use after Policy Change

The study involved a single land plot that cultivated the same crop in both seasons before and after the policy change. It was assumed that all other factors that could potentially affect crop production remained constant during the two seasons, with the only change being the use of chemical fertilizers and other agrochemicals.

4.1.1. Change of Cultivated Extent

Overall, 36 percent of farmers stated that the extent of crops cultivated was reduced after the policy change. The total cultivated extent declined by 26 percent compared with the previous season. According to the results the extent reduction of all crops shows a significant change compared to the previous season. As depicted in Figure 4.1, Chilli has experienced the largest reduction (31%) of extent (t_{171}= - 6.1012; P (0.000) <0.05) followed by Maize (t_{208} = - 7.0963; P (0.0000) < 0.05), and Big onion (t_{232} = - 8.1928, P (0.0000) < 0.05), both of which have decreased by 25 percent. Among the four crops, Potato has experienced the smallest reduction in cultivated extent, with a decrease of 16 percent (t_{92} = - 3.3582, P (0.0011) < 0.05).

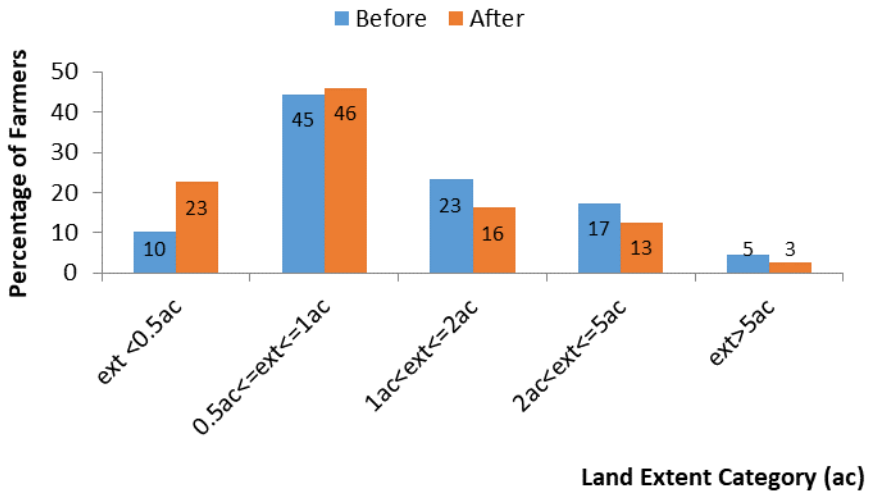


Source: HARTI Survey Data, 2022

Figure 4.1: Percentage Reduction of Cultivated Extent by Crops after Import Ban

4.1.2 Percentage Change of Farmers by Cultivated Extent after the Import Ban

According to the data presented in Figure 4.2, it is evident that the extent of cultivated land that is more than one acre has decreased following the implementation of import restrictions. Conversely, smaller land categories, which are less than an acre, have increased after the import restrictions were put in place. For example, the number of lands that belong to the category of less than 0.5 acres has increased by 54 percent after the import restrictions. These findings highlight that farmers have shifted towards cultivating smaller areas due to issues with the supply of fertilizers and other agrochemicals.



Source: HARTI Survey Data, 2022

Figure 4.2: Percentage Change of Farmers by Cultivated Extent after the Import Ban

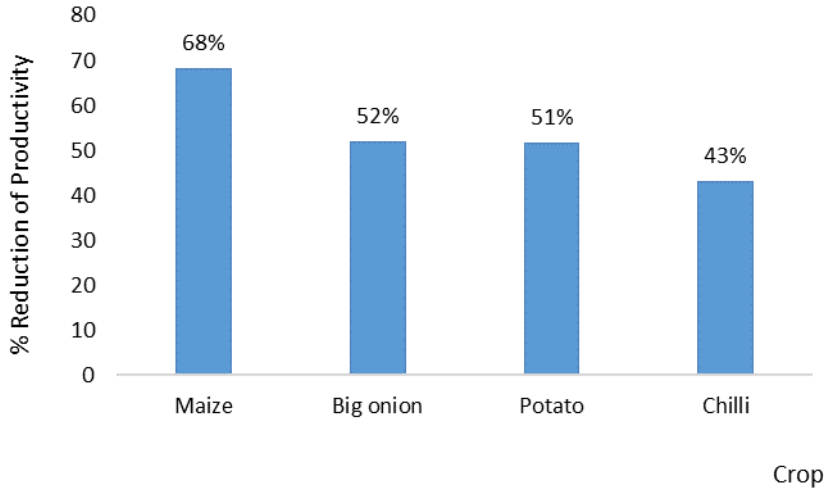
4.2 Impact of Import Ban on Crop Productivity

The productivity of crops is known to be highly sensitive to the use of fertilizers and other agrochemicals. The optimal supply of these inputs, in the correct quantities and during the appropriate time period, is essential for maintaining high crop yields. The recent ban on the import of fertilizers and other agrochemicals has had a significant impact on crop productivity.

4.2.1 Change of Average Crop Productivity

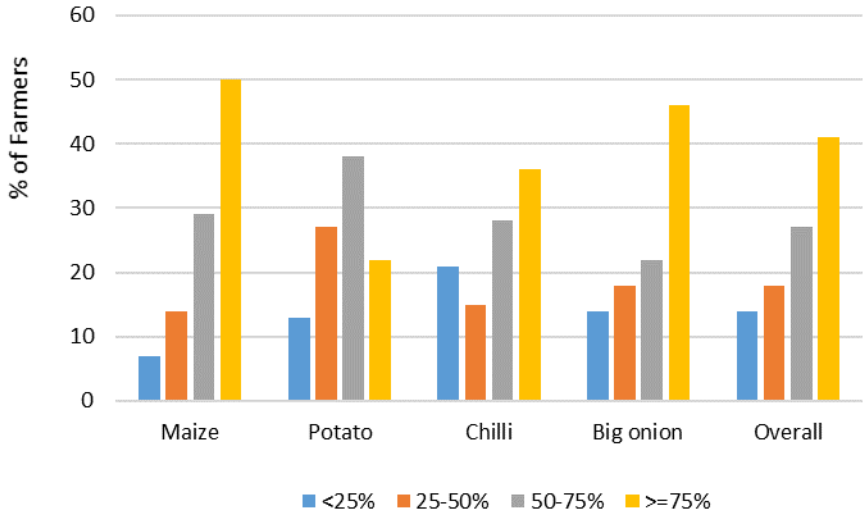
As depicted in Figure 4.3, it is evident that the average productivity of each crop has significantly decreased as a percentage, following the implementation of import restrictions on fertilizer and other agrochemicals. The data reveals that during 2021/2022 *Maha* season, all four crops experienced substantial losses in crop yield. Maize farmers were the hardest hit, experiencing a 68 percent reduction in their yield (t_{-208}= -24.3108; P (0.0000) <0.05). Meanwhile, big onion (t_{232} =-19.5531; P (0.0000) < 0.05) and potato (t_{92} = -6.424; P (0.0000) <0.05) farmers suffered nearly

more than 50 percent yield loss, and chilli (t_{176} = -10.5749; P(0.0000) < 0.05) farmers experienced a 43 percent loss. These findings demonstrate the severe impact that import restrictions can have on crop productivity, with potentially devastating consequences on farmers and their livelihoods.



Source: HARTI Survey Data, 2022

Figure 4.3: Reduction of Average Crop Productivity following the Import Ban



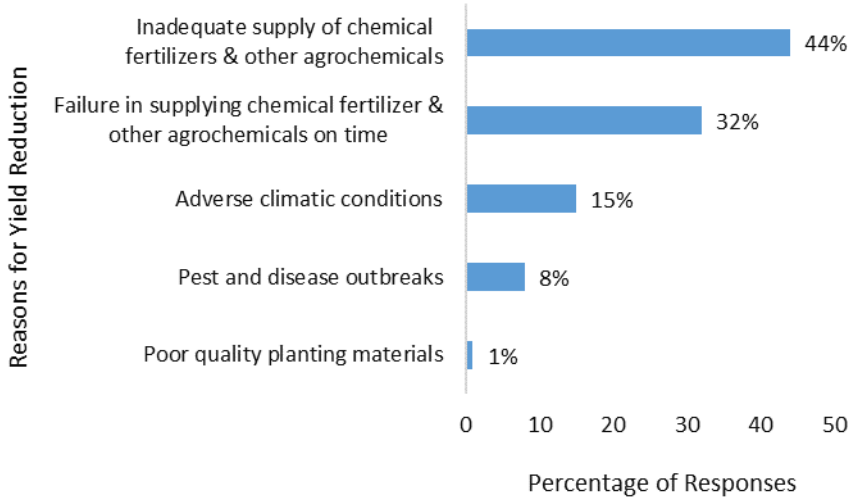
Source: HARTI Survey Data, 2022

Figure 4.4: Percentage Variation of Famers by Productivity Loss Categories

Figure 4.4 provides additional details on the yield losses experienced by each farmer, taking various categories of productivity reduction into account. Based on the data presented, it is evident that with the exception of potato, the majority of farmers across all other crops have experienced yield losses of over 75 percent. Notably, more than half of the farmers reported each crop they cultivated suffered a yield reduction of more than 50 percent.

4.2.2 Main Reasons for Reduction of Crop Yield

According to the data presented in Figure 4.5, the primary cause of yield reduction was attributed to issues with chemical fertilizers and other agrochemicals, accounting for 76 percent of the cases. The insufficient supply of chemical fertilizers and agrochemicals, particularly Urea, MOP, and TSP, has played a crucial role in contributing to this problem. In various districts, farmers faced challenges in obtaining the necessary quantity of chemical fertilizers, which compelled some of them to use alternative fertilizers intended for different types of crops, such as plantation crops. While a few farmers managed to source fertilizers from distant locations, the availability was limited in quantity. As a result, their primary concern revolved around acquiring a sufficient amount of Urea for promoting vegetative growth.



Source: HARTI Survey Data, 2022

Figure 4.5: Main Reasons for Yield Reduction during 2021/2022 *Maha* Season

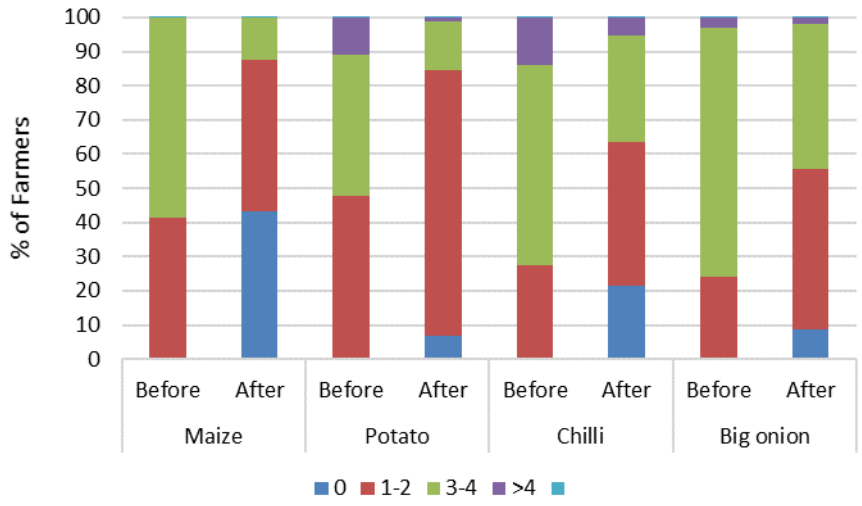
The second prevalent reason for yield reduction, accounting for 32 percent of the cases, was the untimely supply of chemical fertilizers. Timely application of chemical fertilizers at the appropriate growth stage of the plants is crucial for attaining optimal results. Unfortunately, in the sample population, a majority of farmers were unable to apply the fertilizers in a timely manner, despite managing to acquire them under challenging circumstances. This failure to adhere to proper timing had a significant detrimental effect on crop yields, further reduction in overall productivity.

The third primary factor contributing to yield reduction, accounting for 15 percent of cases, was adverse climate conditions, a recurring challenge in agriculture. Prolonged periods of drought and excessive rainfall resulted in crop losses for some farmers. Another significant reason, as reported by eight percent, was pest and disease problems. The imposition of import restrictions on other agrochemicals, including pesticides and weedicides, indirectly contributed to an escalation in crop damage and yield loss caused by pests and diseases as well as weeds.

Among the responses regarding the reasons for yield reduction, one percent of them were associated with poor quality planting materials. Some farmers opted to reuse seeds and planting materials from previous seasons for cultivating crops in subsequent seasons, which occasionally resulted in the growth of unhealthy and low-quality plants. Furthermore, instances were reported where planting material distributors/traders supplied substandard planting materials, thereby leading to reduced yield.

4.3 Changes of Chemical Fertilizer Usage after the Import Ban

In order to assess the impact of a new policy on the application of chemical fertilizers, utilization of various types of chemical fertilizers in crop cultivation was examined. Under normal circumstances, the majority of farmers applied 3-4 different types of chemical fertilizers. Urea, MOP, and TSP emerged as the most commonly used fertilizers. However, prior to implementation of the import ban when chemical fertilizers were plentiful, it was observed that potato and chilli farmers had applied more than five different types of fertilizers.



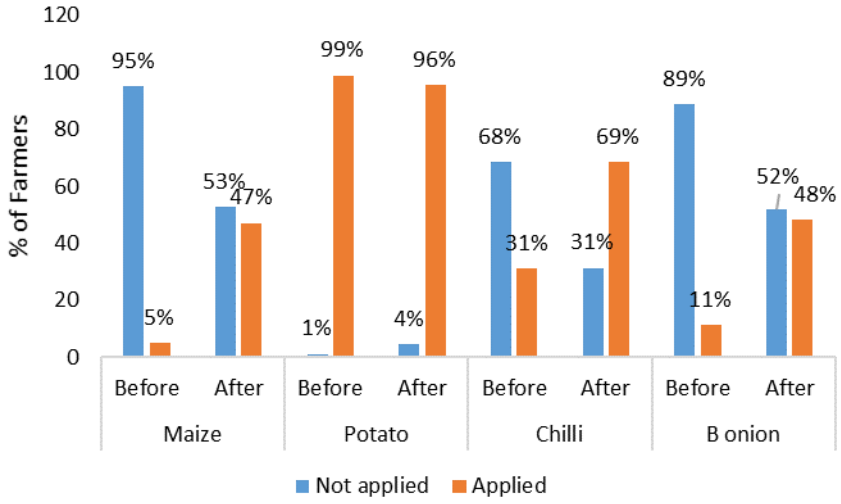
Source: HARTI Survey Data, 2022

Figure 4.6: Percentage of Farmers by Frequency of Application of Chemical Fertilizers Before and After the Import Ban

The data indicates that maize farmers exhibited the lowest frequency of chemical fertilizer usage following the implementation of the import ban (Figure 4.6). Consequently, a certain percentage of farmers in each crop category refrained from utilizing any form of chemical fertilizers on their crops. Specifically, 43 percent of maize farmers and 22 percent of chilli farmers did not apply chemical fertilizers to their cultivations. Conversely, a relatively small proportion (7%) of potato farmers encountered difficulties in applying chemical fertilizers during the period of restrictions.

4.4 Changes of Organic Fertilizer Usage After the Import Ban

Overall, there has been a notable increase of 32 percent in the usage of organic fertilizers compared to the previous season. The findings indicate that prior to the implementation of import restrictions, maize farmers exhibited the lowest usage of organic fertilizers compared to other farmers (Figure 4.7). However, it is worth highlighting that application of organic fertilizers by maize, chilli, and big onion farmers witnessed significant increases of 42 percent, 38 percent, and 37 percent, respectively, in comparison to the previous season, except for potato farmers. Before the policy change, 99 percent of potato farmers utilized organic materials in their cultivation. However, this percentage decreased by three percent following the policy change, possibly due to limited availability of organic materials in the area resulting in by increased demand.



Source: HARTI Survey Data, 2022

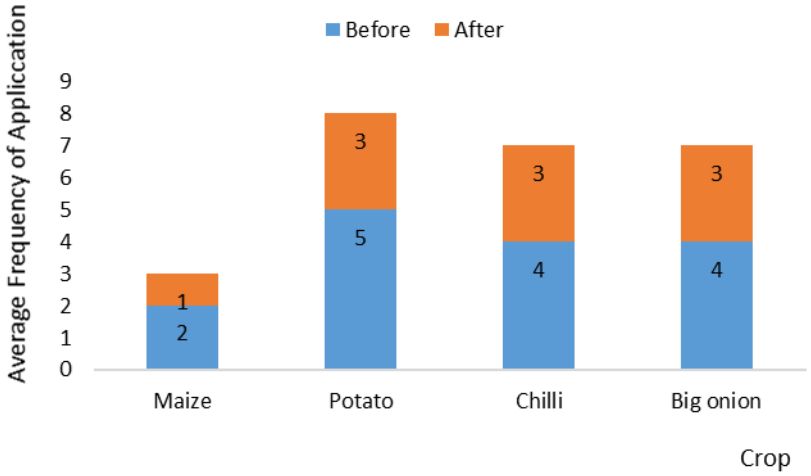
Figure 4.7: Percentage of Farmers by Organic Fertilizer Usage Before and After the Import Ban

4.5 Change of Pest and Disease Management Practices after the Import Ban

Proficient management of pests and diseases in crop cultivation holds a paramount significance, as it directly influences the overall yield. This research study aims to evaluate the frequency of chemical application for pest and disease control during both normal and restricted seasons. Figure 4.8 presents a visual representation of the average frequency of chemical application for pest and disease management before and after the implementation of the policy change.

The findings clearly indicate that subsequent to the policy change, there has been a noticeable decrease in the frequency of chemical application for pest and disease management across all crop cultivations. This decline can be attributed to the insufficient availability of required quantities of chemicals during critical time periods necessary for effective pest and disease management. The restricted access to

essential chemicals has emerged as a key factor contributing to the reduction in the frequency of pest and disease management practices.



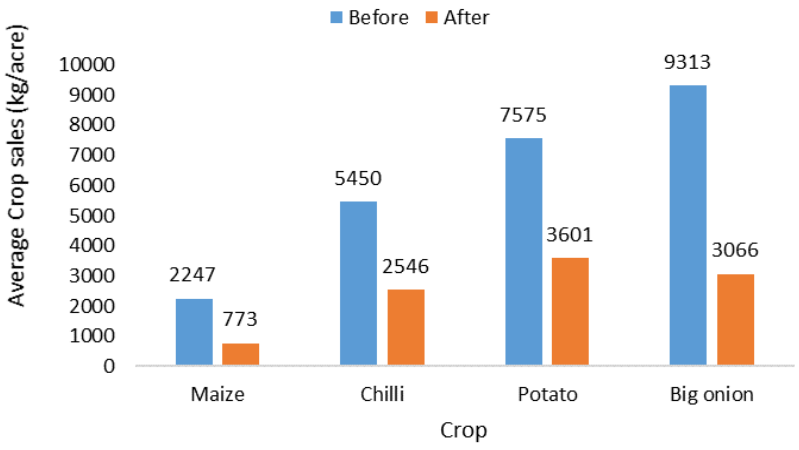
Source: HARTI Survey Data, 2022

Figure 4.8: Change of Average Frequency of Chemical Application for Pest and Disease Management after the Import Ban

4.6 Crop Sales after the Import Ban

4.6.1 Change of Crop Sales

The study attempted to analyze the impact of the policy change on agrochemicals on crop sales by comparing the sales figures before and after the implementation of the import ban. Figure 4.9 presents the changes in average crop sales per acre for each crop following the ban. The data unequivocally demonstrate a decline in sales across all crop categories, in contrast to the previous season when an adequate supply of agrochemicals was available.



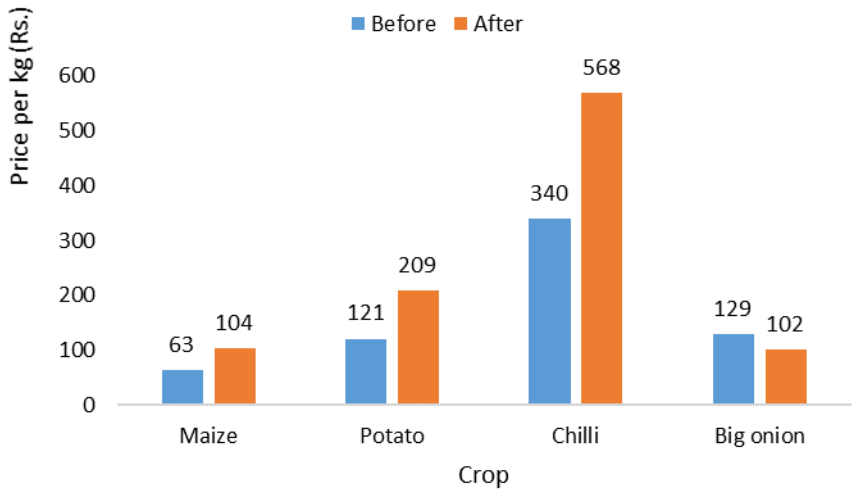
Source: HARTI Survey Data, 2022

Figure 4.9: Change of Average Crop Sales after the Import Ban

Significantly, the most substantial reduction in sales was observed for big onion, which experienced a decline of 67 percent. Similarly, maize sales also witnessed a significant decrease of 66 percent compared to the previous season. The primary factor contributing to the reduction in crop sales is reduced production resulting from the policy change on fertilizers and other agrochemicals.

4.6.2 Changes of Price of Crops Sales

Figure 4.10 portrays the average values of the largest cash transactions conducted by farmers for their crop sales, both before and after the policy change. The depicted data clearly demonstrate a substantial increase in crop prices following the implementation of import restrictions on agrochemicals, with the exception of big onions. This upward trend can be attributed to the reduced supply, resulting from lower production compared to the previous season. Notably, potato farmers appear to have reaped greater benefits from their crops, experiencing a remarkable 73 percent increase in the unit price of potatoes compared to other crops.



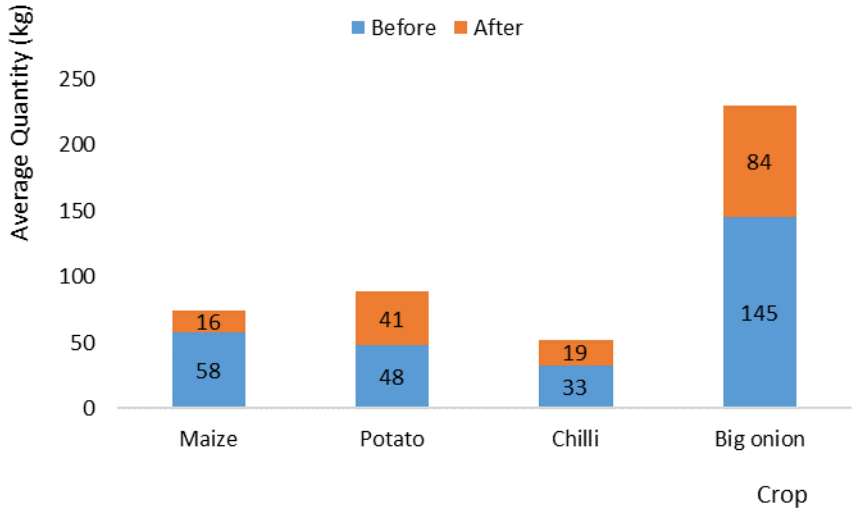
Source: HARTI Survey Data, 2022

Figure 4.10: Change of Crop Sales Price after Import Ban

4.7 Storage of Harvest during the Import Ban

4.7.1 Change of Storage of Harvest for Household Consumption

Figure 4.11 presents an illustration of the changes in the average stored quantities of crops designated for household consumption following the implementation of import restrictions. The data displayed in the figure clearly indicates a notable decrease in the stored quantities across all crop categories subsequent to the policy change. This decline can primarily be attributed to a decrease in crop production.

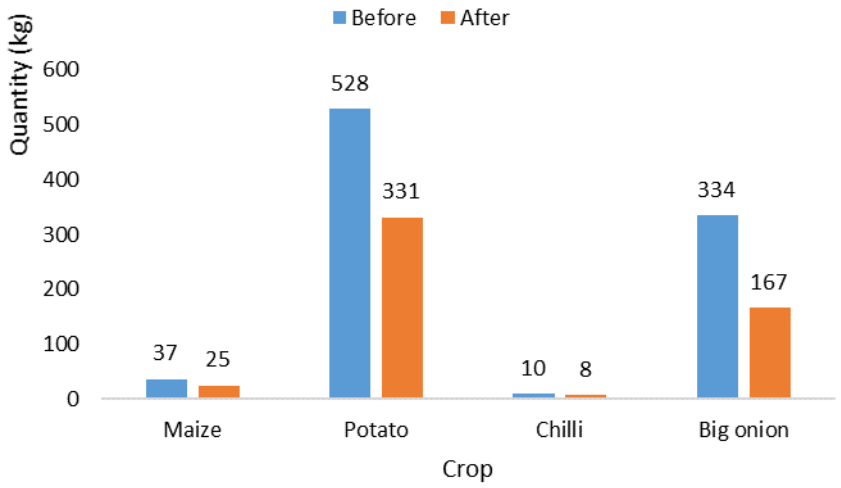


Source: HARI Survey Data, 2022

Figure 4.11: Changes of Average Quantity of Harvest Stored for Household Consumption after the Import Ban

4.7.2 Change of Storage of Harvest for Seeds Requirement in Future

Figure 4.12 portrays variations in the average quantity of harvested crops stored by farmers for seed requirements. Figure 4.12 illustrates a decrease in the storage of yield for seeds during the 2021/2022 *Maha* season as compared to the preceding season. The diminished crop production has compelled farmers to allocate a reduced quantity of their yield for future seed necessities. Particularly noteworthy is the fact that big onion farmers have stored the smallest quantity of harvest for mother bulbs during the period of import ban, in comparison to other crops. The stored quantity for big onions (mother bulbs) has witnessed a reduction of 50 percent, followed by potatoes (37%), maize (32%), and chili (20%).



Source: HARTI Survey Data, 2022

Figure 4.12: Change of Average Quantity Stored for Seeds after Import Ban

CHAPTER FIVE

Household Food Security

Household food security is a critical factor in attaining nutritious diet that leads to healthy life. Hence this chapter explains the food security measuring indicators utilized by the World Food Programme (WFP) that assess the adequacy of household's current food consumption such as food consumption score, food consumption score-nutrition, reduced coping strategies index and livelihood scoping strategies index with respect to OFC farmer households.

5.1 Food Consumption Score (FCS)

The Food Consumption Score (FCS) developed by the WFP in 1996, measures the current food consumption of households which contributes to the food security. Household's dietary diversity, food frequency and relative nutritional importance of different food groups are required to estimate the FCS which is a composite score It is calculated using data of the frequency of consumption (in days) over a recall period of 7 days (WFP VAM Resource Centre, 2021a).

5.1.1 Steps of Constructing Food Consumption Score (FCS)

Step 1: Respondents were asked to mention the frequency of consumption of food items in days over a period of past 7 days.

Step 2: Food items are grouped into 8 standard food groups with assigned weights excluding condiments (Table 5.1).

Step 3: Then the consumption frequency of each food group is multiplied by with an assigned weight of respective food group which is based on its nutrient content.

Table 5.1: Food Groups and Weights

Food Items	Food Groups	Weight
Maize, maize porridge, rice, sorghum, millet pasta, bread and other cereals	Cereals and Tubers	2
Cassava, potatoes and sweet potatoes		
Beans, Peas, groundnuts and cashew nuts	Pulses	3
Vegetables and leaves	Vegetables	1
Fruits	Fruit	1
Beef, goat, poultry, pork, eggs and fish	Meat and Fish	4
Milk yogurt and other diary	Milk	4
Sugar and sugar products	Sugar	0.5
Oils, fats and butter	Oil	0.5
Condiments	Condiments	0

Source: WFP, 2008

Step 4: Those values are summed to estimate the FCS.

$$FCS = a_{staple}x_{staple} + a_{pulse}x_{pulse} + a_{veg}x_{veg} + a_{fruit}x_{fruit} + a_{animal}x_{animal} + a_{sugar}x_{sugar} + a_{dairy}x_{dairy} + a_{oil}x_{oil}$$

FCS Food consumption score

*x*i Frequencies of food consumption = number of days for which each food group was consumed during the past 7 days (7 days was designated as the maximum value of the sum of the frequencies of the different food items belonging to the same food group)

*a*i Weight of each food group

Step 5

Determine the household's food consumption status based on the following thresholds.

Threshold Level	Profiles
0-28	Poor Food Consumption
28.5-42	Borderline Food Consumption
>42	Acceptable Food Consumption

Source: WFP, 2008

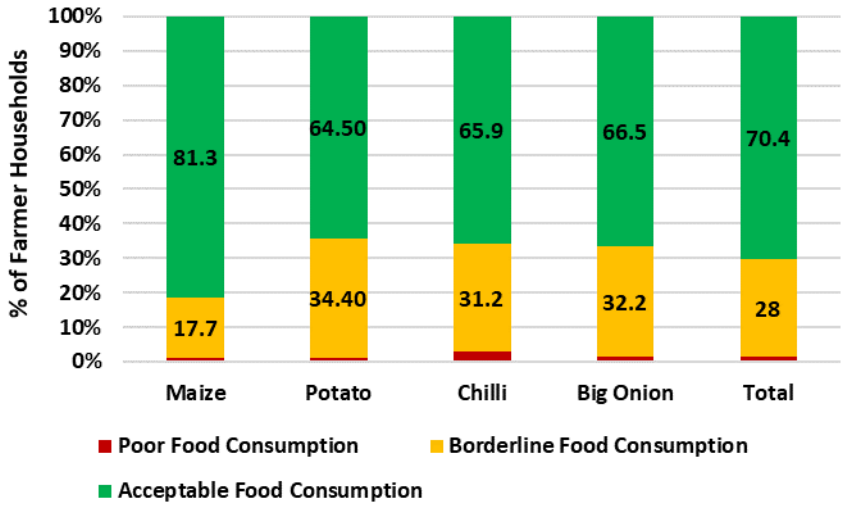
5.1.2 Food Consumption Score Categories of Farmer Households

Figure 5.1 presents the FCS figures for the study sample who cultivated OFCs in selected districts. Overall, nearly 70 percent of farmer households are categorized into acceptable food consumption profile since the estimated FCS values are greater than 42. This finding reflects that these OFC farmers were not struggling with prevailing food crisis with respect to food consumption. Further, 28 percent of the total sample have borderline food consumption which suggests that they may be experiencing some level of food insecurity and struggling to access adequate food to meet their nutritional needs.

WFP (2022) found that a majority (60.4%) of individuals have an acceptable level of food consumption while a significant percentage (30.8%) have borderline food consumption. However, a small percentage (8.8%) of individuals have poor food consumption by end of August 2022. These figures are largely similar with the study findings except the figure of poor food consumption.

The data also reveals that in maize farmer households, 81 percent have acceptable food consumption, which is higher than the overall percentage of acceptable food consumption in the total sample. This suggests that maize farmers may have better access to nutritious food. On the basis of a research study on the household food security, the Medical Research Institute (MRI) (2022) stated that 97 percent of the households are in acceptable level of food consumption at national level whilst 3

percent of households are in borderline level and merely 0.1 percent of households belong to the poor food consumption category.



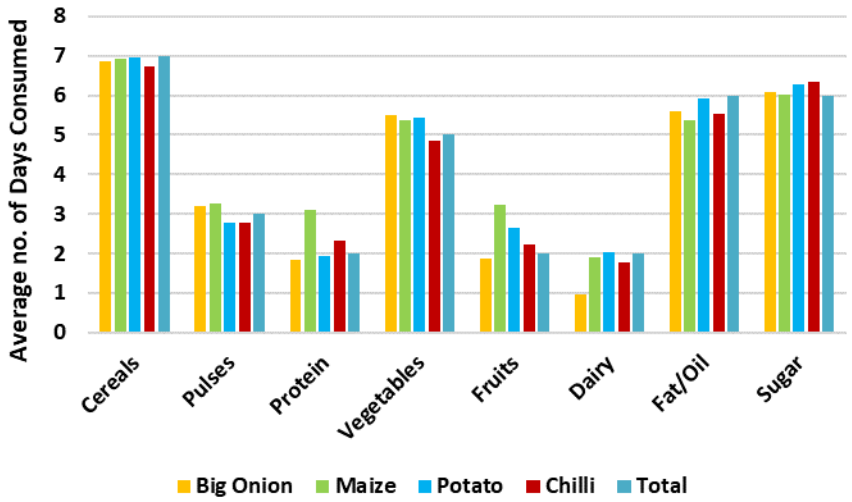
Source: HARTI Survey Data, 2022

Figure 5.1: Food Consumption Score of the Farmer Households

It is noteworthy to mention that food consumption can be influenced by various factors such as income, education, access to healthcare and cultural factors. For instance, households with higher income and education levels may have better access to nutritious food and a better understanding of healthy eating habits. Additionally, cultural factors such as food preferences and traditional dietary practices can also affect food consumption.

5.1.3 Consumption of Different Food Groups

According to the WFP (2008), there are eight food groups cereals, pulses, protein based food, vegetables, fruits, dairy products, fat/oil and sugar. As presented in Figure 5.2, average number of days consumed of cereals (7days), vegetables (5 days), fat/oil (6 days) and sugar (6 days) are quite higher numbers compared to dairy products (2 days), protein products (2 days) and fruits (2 days) of the total sample. Average number of days consumed of protein based products and dairy products have declined during the reference period due to price escalations in the economic crisis.



Source: HARTI Survey Data, 2022

Figure 5.2: Consumption of Different Food Groups by Crop

As stated in WFP (2022), on average, households in Sri Lanka consume animal protein less than three days a week within a seven-day period. Similarly, the consumption rate of fruit and dairy products has been gradually decreasing every month since June 2022.

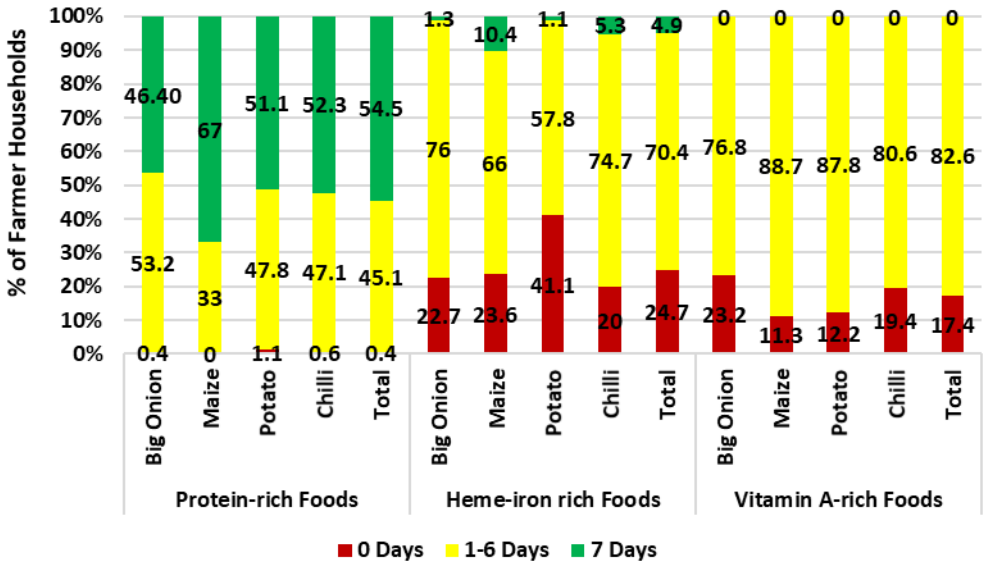
Further, WFP (2022) revealed that cereals (6.9 days) and vegetables (5.9 days) are the most frequently consumed food groups, followed by fat (4.4 days) and pulses (3.5 days). However, consumption of proteins (2.4 days), fruits (1.8 days) and dairy products (0.5 days) are relatively low, with dairy products being the least consumed food group. As stated in the above paragraphs, study findings are more or less similar to the findings of WFP (2022) with slight fluctuations.

5.2 Food Consumption Score – Nutrition (FCS-Nutrition)

Food Consumption Score-Nutrition (FCS-Nutrition) is a measure of adequacy of households of key macro and micro nutrients rich food groups. This indicator comprises of frequencies of consumption of protein-rich, Heme iron and Vitamin A-rich foods over the past seven days prior to the survey. Following food groups have been identified under three main categories when using constructing FCS-Nutrition.

- Protein rich foods - pulses, dairy products, flesh meats, organ meats, fish and egg.
- Heme iron-rich foods - flesh meats, organ meats and eggs
- Vitamin A-rich foods – dairy products, organ meats, eggs, orange vegetables, dark green leafy vegetables and orange fruits.

Figure 5.4 elaborates the Estimated FCS-Nutrition Figures of the Study Sample.



Source: HARTI Survey Data, 2022

Figure 5.3: Consumption of Macro and Micro Nutrient Rich Foods by Crop

The least percentage of the total farmer households (0.4%) has never consumed protein-rich foods over the past seven days prior to the survey while none of the farmer households consumed vitamin A-rich foods ever. The rising cost of protein-rich foods, such as eggs, meat, lentils, and milk has made such foods inaccessible to low-income individuals and groups, vulnerable populations such as children, the elderly, pregnant women and lactating mothers are at risk of food and nutritional insecurity.

Nearly a quarter of the total farmer households has never consumed heme iron-rich foods seven days prior to the survey. Heme-iron is a type of iron that is found in animal-based foods such as meat, poultry, and fish. It is more easily absorbed by the body compared to non-heme iron found in plant-based foods such as beans, lentils, and spinach. Iron deficiency can lead to anemia. In order to address this issue, it may be necessary to increase access to heme-iron rich foods.

However, majority of the sample (70%) has consumed heme iron-rich foods whilst nearly 83 percent of the farmer households has sometimes opted for vitamin A-rich foods. Despite of majority being dependent on heme iron-rich foods and vitamin A-rich foods, more than half of the farmer households (54%) has consumed protein rich foods daily. These findings would cater to the demand of information for the designing of nutrition sensitive programme in highly threatened areas in the country.

5.3 Coping Strategies Employed during Food Shortage

As per the definition of WFP (2021b), the reduced Coping Strategies Index (rCSI) is used to compare the hardships faced by the households during food shortage. This index measures the frequency and severity of the food consumption behaviours the

households had to engage in due to food shortage in the seven days leading to the survey.

This index measures behavioral strategies that people apply when they cannot access enough food or when they predict a decrease in food security. The rCSI has several applications. It is used to provide quick current status indicator of the extent of food insecurity that leads to immediate programmatic decision making. Further, rCSI used to monitor the impact of interventions including food aid on household food insecurity particularly in emergencies. It has also been used in the monitoring process as a food insecurity early warning indicator as an indicator of long term changes in food security status (TANGO International, 2008).

5.3.1 Steps of Constructing reduced Coping Strategies Index (rCSI)

Step 1
Coping behaviours - obtaining the list of coping strategies.

Step 2
Frequency - counting the frequency of strategies.

Step 3
Severity - categorizing and weighting the strategies.

Table 5.1: Weights of Coping Strategies in rCSI

During the last 7 days, were there days (and, if so, how many) when your household had to employ one of the following strategies (to cope with a lack of food or money to buy it)?	**Severity Weight**
Relied on less preferred, less expensive food (rCSILessQlty)	1
Borrowed food or relied on help from friends or relatives (rCSIBorrow)	2
Reduced the number of meals eaten per day(rCSIMealNb)	1
Reduced portion size of meals(rCSIMealSize)	1
Reduction in the quantities consumed by adults/mothers for young children(rCSIMealAdult)	3

Source: WFP, 2021b

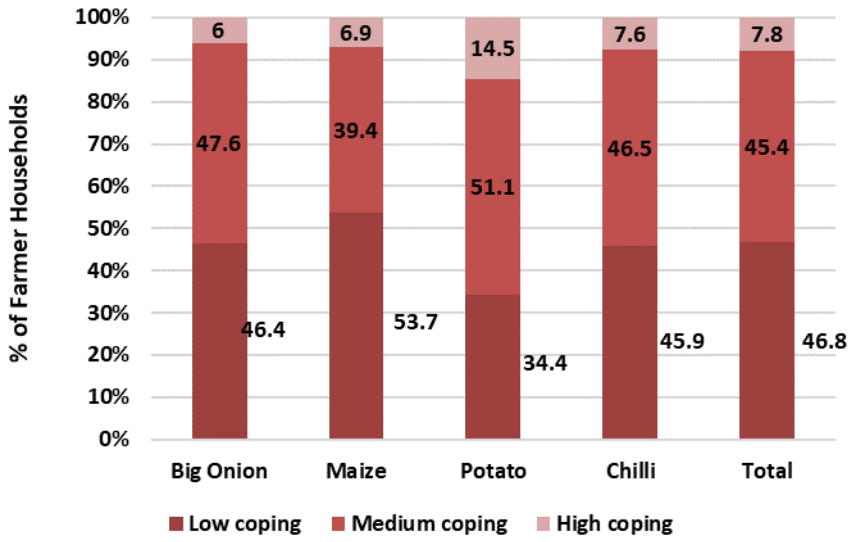
Step 4
Scoring - combining frequency and severity for analysis.

```
rCSI=sum(rCSILessQlty*1,rCSIBorrow*2,rCSIMealNb*1,rCSIMealSize*1,rCSIMealAdult*3)
```

5.3.2 rCSI Categories of Farmer Households

In the sample, most of the farmer households have “0” for rCSI value that implies less food insecurity (more food security) than higher rCSI values in the sample. The

highest value in the sample for the rCSI is 42 and it reflects the highest food insecurity (less food security) compared to "0" rCSI value in the same sample. Further, it is possible to mention that two farmer households can have the same value for rCSI, but both are using different strategies to cope with food insecurity leading to maintaining the equal level of food security. The rCSI is categorized into three groups: low (0-3), medium (4-18), and high (19 and above).



Source: HARTI Survey Data, 2022

Figure 5.4: rCSI of Farmer Households by Crop

Figure 5.4 indicates that the least proportion of the study sample, eight percent is highly dependent on coping strategies to have food on the table. This implies that they are facing certain level of food insecurity and may not have consistent access to sufficient and nutritious food to meet their dietary needs. Another 45 percent of the households is relying on medium-level coping strategies, suggesting that they are also facing certain challenges in accessing sufficient and nutritious food. Only 47 percent of the households reported low-level coping strategies, which suggests that they are well equipped to manage their food needs without relying much on coping strategies.

It is noteworthy that food insecurity can have severe consequences on the physical and mental health of individuals and communities. Therefore, understanding the coping strategies used by individuals and communities can help identify the gaps in food security and the resources needed to address the issue. In addition to that, these findings are more or less similar to the finding of the WFP (2022) where 79 percent of the population is dependent on food based coping strategies.

5.3.3 Food based Coping Strategies Employed

Table 5.2 presents the coping strategies employed by the sample farmer households in order to have food on the table. The following table indicates that a significant

proportion of the sample, 66 percent, consumed less preferred and less expensive food to manage their food needs. This may suggest that they were facing financial constraints or limited access to nutritious food. Consuming less preferred and less expensive food may lead to a lack of variety in the diet, which can impact the nutritional quality of the diet and overall health.

Additionally, 22 percent of the sample households has limited the portion sizes of meals to manage their food needs. This strategy may help control the quantity of food consumed, but it may not be sufficient to ensure that the individual's nutritional needs are met. Despite of adapting various strategies, efforts are needed to address the root causes of food insecurity and ensure that everyone has access to healthy and affordable food.

Table 5.2: Food based Coping Strategies Employed by Farmer Households

Coping Strategy \ Crop	Percentage of Farmer Households				
	Big Onion	Maize	Potato	Chilli	Total
Less preferred and less expensive food	21.1	19	11.3	15.2	66.6
Borrow food	6.8	3.3	2.4	3.7	16.2
Reduce the number of meals eaten	2.3	2.8	1.3	1	7.4
Limit the portion size of meals	7.6	6.8	4	3.6	22
Restrict the adult consumption	6.3	3.3	3.3	4.1	17

Note: The sum of the percentages of farmer households exceeds 100 due to multiple coping strategies employed by farmer households.

Source: HARTI Survey Data, 2022

As stated in the study by the WFP (2022), around eight in ten households are regularly adapting food based coping strategies. Nearly 78 percent of its sample households relied on less preferred food, 49 percent has limited their portion size and 39 percent has reduced the number of meals taken.

5.4 Food Security Status

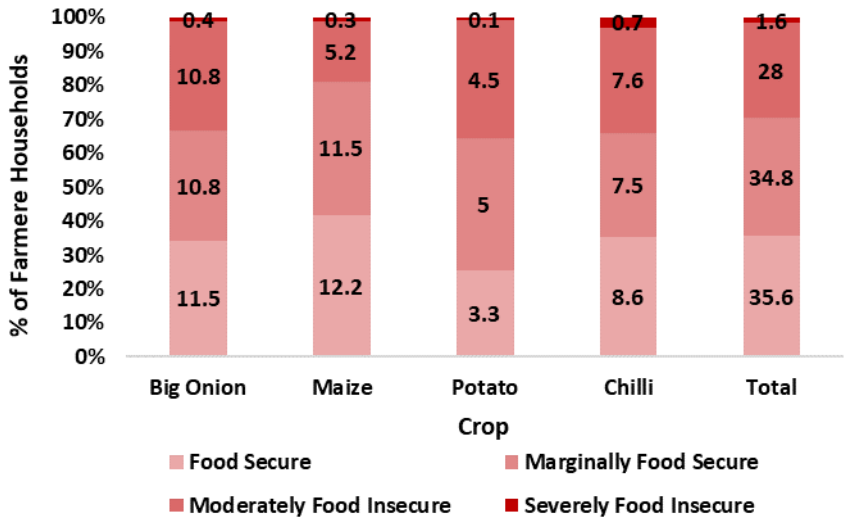
Food security is one of the prominent topics in Sri Lanka as well in the world nowadays due to rapid rising of food inflation. Food and Agriculture Organization of the United Nations (FAO) (1996) defined food security as “food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food, that meets their dietary needs and food preferences for an active and healthy life”. Three pillars of food security come under food availability, food accessibility and food utilization.

WFP (2021c) developed a reporting method of food security indicators as an aggregate named Consolidated Approach for Reporting Indicators of Food Security (CARI). It facilitates to aggregate various food security indicators into composite index which enables to report the overall food security status of the population.

Further, CARI allows to assess availability and accessibility of food by determining the adequacy of household's current food consumption (Current Status domain) whilst the coping capacity (Coping Capacity domain) by economic vulnerability and livelihood coping strategies. Coping capacity reflects the capability of a household to sustain the food consumption over time. Current Status domain is being estimated using Food Consumption Score (FCS) and reduced Coping strategies Index (rCSI). Coping Capacity domain is estimated using Livelihood Coping Strategies for Food Security (LCS-FS) and Economic Capacity to Meet Essential Needs (ECMEN). Food Security Console or CARI Console has been divided into four categories namely; 1. Food Secure, 2. Marginally Food Secure, 3. Moderately Food Insecure and 4. Severely Food Insecure (WFP, 2021c).

5.4.1 Food Security Status and Current Status Domain of CARI Console for the Sample

FCS and rCSI are combined to estimate the current status domain in CARI Console. Figure 5.6 presents the current status domain in CARI Console for the OFC farmers covering four crops. Figure 5.6 further reflects how the sample farmer households are distributed among the four standard categories of food security. Majority (35.6%) of the sample lies under the food secure category. This category was built using acceptable food consumption of FCS and rCSI below four. The minority of the sample (1.6%) comprises of severely food insecure category.



Source: HARTI Survey Data, 2022

Figure 5.5: Food Security Status of Farmer Households by Crop

The farmer households in the sample were not affected by the food inflation currently being experienced by the nation. Nearly 70 percent of the sample comes under the food secure categories, which supports the above fact. However, as stated in WFP (2022), Sri Lanka has a food insecurity rate of over one-third (37%) of its population. This finding is somewhat similar to study sample finding (29.6% of food insecurity).

Out of the total population, 16 percent is classified as food secure, which means that they have enough access to food and are not experiencing any form of food insecurity. In addition, 33.8 percent are moderately food insecure, indicating that they often face limited access to food and may be forced to adapt food based coping strategies (WFP, 2022). Further, WFP reports that as of July 2022, 6.3 million people are moderately acute food insecure, while 66,000 people are severely acute food insecure based on the CARI methodology (WFP and FAO, 2022). It is required to scale up food assistance via in kind or cash to vulnerable groups in the society, expand the national nutrition programmes conducting and ensuring the continuation of school meals programmes. Consequently, it leads to enhancing the food security of the population while ensuring the nutritional requirement and health secured nation.

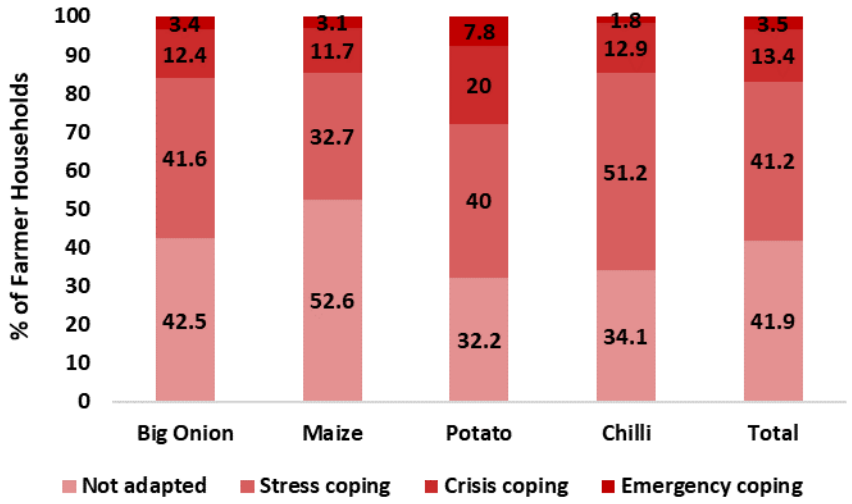
5.5 Livelihood-Based Coping Strategies

WFP (2021d) introduced an indicator named Livelihood Coping Strategies Index (LCSI) under the coping capacity domain of CARI console of food security. It is a tool that helps reveal how well households can handle not having enough food or money to buy food over a period of time and whether they can overcome difficulties in the future. The LCSI is estimated by revealing about how they have dealt with financial difficulties and loss of assets in order to manage food shortages.

5.5.1 LCSI Categories of Farmer Households

A significant portion of the farmer households is not employed coping strategies (41.9%). A smaller percentage (13.4%) of farmer households are equipped to handle crisis situations, and an even smaller percentage (3.5%) is capable of handling emergency situations (Figure 5.6).

These findings reveal that a substantial number of farmer households may struggle with managing stress in their daily lives. This can lead to a range of negative consequences, including decreased productivity, physical and mental health problems and difficulty in maintaining positive relationships. Further, findings are highlighting the importance of developing effective coping strategies for managing stress, crisis, and emergency situations. It is essential to prioritize mental health and wellbeing to ensure that farmer households can navigate the challenges they face with resilience and confidence.



Source: HARTI Survey Data, 2022

Figure 5.6: LCSI of Farmer Households by Crop

According to the findings of WFP and FAO (2022), approximately 23 percent of households are resorting to crisis or emergency livelihood-coping mechanisms that significantly affect their ability to generate income. This finding is more or less similar to the findings of this study revealing as crisis coping strategies; 13.4 percent and emergency coping strategies; 3.5 percent. In essence, the goal of any food or cash assistance programme should be to reduce the reliance on livelihood strategies in general and ideally prevent the adaptation of crisis and emergency strategies.

5.5.2 Livelihood based Coping Strategies Employed by Farmer Households

There are several livelihoods based coping strategies employed by households named; stress coping strategies, crisis coping strategies and emergency coping strategies. Table 5.3 presents them in detail for the study sample. The figures indicate that a considerable proportion of farmer households are encountering economic hardships in relation to acquiring food. Almost half (46.3%) of those surveyed depleted their savings to buy food, while approximately one-quarter (24.8%) relied on credit to purchase both food and non-food products. Furthermore, around one-fifth (20.6%) of farmer households had to sell their household assets or goods, apparently to finance food purchases.

Similarly, WFP (2022) stated that people are turning more frequently to livelihood-based coping mechanisms such as obtaining loans or accruing debt in order to manage the challenges of insufficient food. Further, WFP (2022) found that 46 percent of respondents resorted to borrowing from banks, lenders or pawning goods, while 37 percent had to cut down their expenses on education and health. In addition, 38 percent of the respondents had to use their savings and or skip payments on debts to have food on their table.

Table 5.3: Livelihood based Coping Strategies Employed by Farmer Households by Severity

Severity	Strategy	% of Total Farmer Households
Stress	Spent savings due to lack of food	46.3
	Purchased food/non-food on credit	24.8
	Sold household assets/goods	20.6
Crisis	Withdrew children from school due to lack of food	0.4
	Reduced expenses on health (including drugs) or education	12.3
	Sold productive assets or means of transport	3.6
Emergency	Sent HH members to eat elsewhere	0.3
	Mortgaged/Sold house or land	3.2

Note: The sum of the percentages of farmer households exceeds 100 due to multiple coping strategies employed by farmer households.

Source: HARTI Survey Data, 2022

CHAPTER SIX

Conclusions and Policy Implications

6.1 Conclusions

1. The study findings reveal that a substantial proportion of farmers in the sample (91%) are relying on farming activities as their primary source of income. This indicates that the majority of farmers within the OFC and potato crop sector are significantly impacted by the recent agrochemical policy change.

2. The findings demonstrate that, despite the ban on importing chemical fertilizers a notable majority of farmers (74%) resorted to their utilization in the subsequent season, though in non-compliant quantities but in accordance with the available supply. This underscores farmers' proactive efforts to address their fertilization needs and emphasizes the substantial demand for chemical fertilizers within the cultivation.

3. Frequency of applying chemical fertilizers to each crop category has reduced owing to the scarcity of such fertilizers during the restricted period. Consequently, this reduction has had an adverse impact on crop yields during the respective season.

4. A notable proportion of farmers resorted to the informal market as a mean to fulfill the chemical fertilizer requirement, despite the associated higher prices. These results underscore the dependence of farmers on alternative channels to meet their fertilizer requirements during the ban.

5. Farmers experienced significant hardships due to soaring fertilizer prices, inability to supply them on time and in sufficient quantities. Hence, these difficulties have made impacted the crop yield of the farmers.

6. Farmers' perceptions of plant nutrient management vary, depending on the type of crop. None of the large-scale onion and potato farmers preferred to use complete organic fertilizers for their cultivations. Only a very small percentage of maize and chili farmers (1% and 2% respectively) preferred complete organic fertilizers. Therefore, farmers may not be ready to adopt fully organic agriculture.

7. Due to unavailability of fertilizers in sufficient quantities in the market and the challenges faced in obtaining them in time manner, a considerable number of farmers displayed a willingness to purchase fertilizers at their market value, without relying on subsidies. This inclination highlights the eagerness of farmers to utilize chemical fertilizers for their crop cultivations.

8. In response to the policy change, there has been a notable decrease in the frequency of chemical application for pest and disease management across all crop cultivations. Notably, 11 percent of farmers have embraced traditional methods to control pests and diseases in their fields. This is a positive indicator that the import ban has facilitated the transition of farmers towards adopting more environmentally friendly approaches.

9. Prior to the Government's promotion of organic agriculture through the import restrictions on agrochemicals, a notable percentage of farmers (26%) had already been engaging in the use of organic fertilizers. This practice was particularly prevalent among the potato farmers (99%). Such findings indicate that a significant portion of farmers were already aware of organic agriculture and its importance.

10. A significant increase of 32 percent in the number of organic fertilizer users compared to the previous season provides substantial evidence that the implemented policy change has facilitated a transformation among farmers, leading them to adopt organic agricultural practices.

11. The implementation of the import ban on chemical fertilizers has motivated farmers to explore various avenues for obtaining organic fertilizers, such as self-production and local resource sharing. This response highlights the importance of continued support and investment on sustainable farming practices.

12. One of the primary challenges associated with utilization of organic fertilizers is the difficulty in procuring large quantities of such fertilizers at the appropriate time. This indicates the responsibility of the relevant Government institutions to pre-plan and make arrangements to ensure the availability of organic fertilizers in sufficient quantities, prior to implementing policy changes of this nature.

13. The import ban on chemical fertilizers and other agrochemicals has resulted in 32 percent of farmers initiating production of organic fertilizers. This development serves as a notable indicator that the policy change has positively influenced and motivated farmers to embrace organic production methods.

14. Scarcity of raw materials stands as a prominent challenge faced by farmers in the production of organic fertilizers. Consequently, it becomes imperative to ensure the provision of appropriate and necessary raw materials at the farm level for the production of organic fertilizers.

15. Despite the ban on the importation of fertilizers and other agrochemicals, a significant majority of farmers (64%) have not changed their cultivated extent during the restricted season. This finding highlights the farmers' unwavering determination to continue cultivating, regardless of the availability of agrochemicals and future challenges they face.

16. As a means of adapting to the sudden policy change, farmers have resorted to cultivating smaller land plots (<0.5 acres) compared to the previous season. This shift in strategy demonstrates their ability to adjust their farming practices in response to external circumstances.

17. Despite a relatively small reduction in cultivation extent, a significant productivity loss was observed among 92 percent of farmers in the sample during the import ban, with more than half of the yield loss occurring across all crop categories. Moreover, the majority of farmers attribute yield loss to lack of chemical fertilizers and other agrochemical-related , leading to the conclusion that the farming community in the country has suffered immensely due to the ban on agrochemicals.

18. The loss of crop yield has resulted in a decrease in the average quantity of sales, storage for household consumption, and future seed requirements across all crop categories, when compared to the previous season. This reduction is evidence to the impact of the agrochemical import ban on the farming community.

19. Household food security is crucial for a healthy diet and a healthy life. Therefore, 70 percent is classified as food securehaving access to food and not experiencing any form of food insecurity.

20. Among OFC and potato farmer households, most frequently consumed food groups during the specified time frame included cereals, vegetables, fats and oils, and sugar. Additionally, protein-rich and dairy food items were infrequently consumed during the same period. The prevailing economic crisis had an adverse impact on the consumption of protein-rich and dairy food items among these farmer households, potentially resulting in an imbalance in their diet and nutrition due to reducing their purchasing power.

21. Food based strategies are employed by the farmer households to maintain their household food security. Around 66 percent of farmer households opted for less expensive and less preferred food items to meet their dietary requirements, indicating possible financial constraints or restricted availability of nutritious food.

6.2 Policy Implications

- Need to conduct an in-depth study and engage in a bottom-up analysis involving all stakeholders in the agriculture sector prior to policy planning, particularly regarding the transition to organic agriculture.
- Adopting a gradual and phased approach towards reducing the use of fertilizers and other agrochemicals, rather than making an immediate and non-phased decision to fully switch to organic fertilizers.

- Implementing a gradual reduction in subsidies on chemical fertilizers is suggested as a formal approach.
- Implementing a comprehensive and strategic approach that combines conventional and organic farming systems in a balanced and well-planned manner to achieve sustainable agriculture practices.
- Development of recommendations for application of organic fertilizers on different crops.
- Prioritizing the provision of sufficient organic fertilizers and raw material to meet the demand before implementing the policy change.
- Providing farmers with adequate advice, instructions and training on the preparation of organic fertilizer.
- Establishing mechanisms for ongoing research and monitoring of organic farming systems to continuously improve and optimize organic practices, addressing emerging challenges and opportunities in the field.
- Provide extensive training and capacity-building programmes for farmers to enhance their knowledge and skills in organic farming practices, including soil management, crop rotation, composting, and natural pest control methods.

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