
Modern and Traditional Vegetable Loss Reduction Methods Used by Sri Lankan Farmers

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Abstract

Vegetable losses throughout the pre and post-harvest phases continue to be a major issue for farmers in Sri Lanka. To mitigate these losses, both modern and traditional approaches are being applied. The purpose of this research is to explore the various pre and post-harvest strategies employed by Sri Lankan farmers to reduce vegetable losses. To uncover relevant research, a complete literature review was done, and both modern and traditional approaches were examined. Traditional methods include cultivating at the appropriate time, traditional farming practices, and harvest-protecting techniques. According to the analysis of this study, both modern and traditional approaches have proven effective in minimizing vegetable losses, while the adoption of modern techniques remains limited owing to a variety of obstacles. The research suggests that a mix of contemporary and traditional approaches is required to successfully minimize vegetable losses, enhance Sri Lankan farming, and ensure food security. Semi-structured interviews involving local farmers in *Nuwara Eliya, Bandarawela, Anuradhapura, and Hambanthota* were conducted to acquire qualitative data. Thematic analysis was used to analyze the data. Within the scope of this research, common approaches connected to modern and traditional production and packaging are examined, which will help contribute to reduced vegetable loss in the Sri Lankan agricultural industry. Moreover, the findings of this research could help farmers, and procedures to reduce vegetable production.

Keywords: Pre-and post-harvest, Traditional and modern methods, Vegetable losses

01. Introduction

Agriculture has a significant role in Sri Lanka's economy. It is the key sector that propels Sri Lanka's economy. The majority of Sri Lankans depend on agriculture for their livelihood, which is carried out in more than 80 different fruit and vegetable varieties across the nation's many agroclimatic zones. Each year, Sri Lanka produces around 710,000 metric tons of vegetables and 540,000 metric tons of fruits. Small-scale farmers or gardeners with individual plots of

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land no larger than one hectare make up the majority of those employed in agriculture (Dahanayake, 2018). Currently, the sector contributes 7.9% to Sri Lanka's GDP and employs more than 31.2 percent of the country's population (Gunathilake, et al., 2018).

There is food loss and waste at every point in the food supply chain (FSC). Food is lost at every step of the process, from farming upstream to processing and packing downstream. Food waste begins in the wholesale and retail markets, as well as at the last stages of consumption in homes and the food service sector (Aheeyar, et al., 2020). It's estimated that 20 to 50 percent of the perishable goods in developing nations are lost (Kader, 2002). The percentage varies from 20 to 40% of Sri Lanka's total production (Rajapaksha, et al., 2021). Post-harvest losses in fruits and vegetables can be over 370,000 metric tons (Central Bank, 2018). In other words, before vegetables are consumed, more than half of the total amount of vegetable cultivation is lost. Thus, it is crucial to investigate the strategies used by local farmers to reduce vegetable loss, as doing so will help to some extent in finding solutions to the aforementioned issues.

This study focuses on examining the traditional, modern, pre-and post-harvest cultivation techniques adopted by Sri Lankan farmers in the post-harvest period up until the vegetables reach the retailers. Local farmers in *Nuwara Eliya, Bandarawela, Anuradhapura, and Hambanthota* are the subject of the study. Accordingly, this study differs from existing literature and contributes to it in several ways. The research seeks to fill the knowledge gap in the literature by investigating loss reduction methods in accordance with the traditional and modern post- and pre-harvest cultivation practices adopted by Sri Lankan farmers to reduce vegetable losses, which lack information in society. Even though pre- and post-harvest techniques have been the subject of extensive research worldwide, it is crucial to look into the various traditional, modern cultivation harvest practices Sri Lankan farmers have used. Through these, the use of popular practices is discussed within the scope of this research, which will lead to reduced vegetable loss in the Sri Lankan agricultural sector. The findings of this study will assist Sri Lankan farmers in learning crucial information on this project to safeguard their vegetable yield and fulfill the food demand of the country, and this study will also appraise the Sri Lankan agricultural industry and future researchers as a resource for them, start another academic forum about the topic, and deepen their comprehension of the problem at hand.

02. Literature Review

2.1. Introduction

Sri Lanka's agricultural sector, encompassing various crops, holds immense importance for the country's economy. Among these crops, vegetable cultivation stands out as a significant contributor to both domestic consumption and export. However, farmers in Sri Lanka face various challenges, including post-harvest losses, which can significantly impact their productivity and profitability. To address this issue, Sri Lankan farmers have employed a combination of traditional and modern farming techniques to minimize vegetable loss and enhance overall agricultural productivity. This literature review explores the diverse range of traditional and modern vegetable loss reduction methods adopted by Sri Lankan farmers, shedding light on their effectiveness and potential for sustainable farming practices. By understanding and exploring these strategies, policymakers and farmers alike can gain

valuable insights into optimizing vegetable production and reducing post-harvest losses in Sri Lanka's agricultural landscape.

2.2. Traditional Farm Practices.

There are various topics in the literature on before and post-harvest vegetable loss reduction measures in Sri Lanka. For starters, Sri Lankan farmers have utilized traditional techniques including cultivation at the appropriate time, traditional farm practices, and beliefs in harvest protection techniques (Kem krama) fermenting to decrease post-harvest losses for decades. These strategies have been shown to be useful in minimizing vegetable deterioration and improving vegetable life span (Rajapaksha, et al., 2021).

2.2.1. Cultivation at an auspicious time

Cultivating in the proper season is a traditional strategy employed by Sri Lankan farmers to reduce vegetable loss. This strategy entails establishing and harvesting products at the optimal time to increase harvests while minimizing losses from insects, illnesses, and the bad climate. (Source: Journal of Agriculture and Rural Development in the Tropics and Subtropics)

The impact of the time of growing plants on the quality and production of cucumber harvests in Sri Lanka has been examined in the research. Researchers discovered that growing during the wet season caused bigger harvests and greater quality than planting during the dry season (Karunaratne, et al., 2012).

Darmasena et al. (2016) stated the impact of time of planting on the production and quality of cabbage plants in Sri Lanka in their studies. Growing during the wet season brought in bigger harvests and greater quality than planting during the dry season, they discovered. They also discovered that earlier planting produced larger yields and higher quality than later planting. The scientists found that correct cultivation scheduling is critical for avoiding vegetable losses and increasing harvests.

2.2.2. Cultivate at Yala and Maha seasons

The two primary rainy seasons in Sri Lanka are *Yala* and *Maha*, and they give good chances for seasonal vegetable farming. Farmers may decrease vegetable loss, enhance harvests, and enhance earnings by getting the benefit of certain seasons. Farmers also can cultivate crops such as tomatoes, chilies, brinjals, cucumbers, and beans during the *Yala* season, which lasts from May to August. These growers need a lot of water, and the *Yala* season provides perfect growing contexts. Furthermore, the *Yala* season corresponds with the peak season for vegetable demand, since numerous festivities and celebrations take place within this period (Nuskiya, 2019).

2.2.3. Traditional Irrigation System

Traditional irrigation systems have been utilized in Sri Lanka for more than two thousand years, as reported by Gunawardena et al. (2021), and they are still employed in various regions of the nation. These technologies, which are founded on the concepts of sustainable water

resource management, have proved beneficial in minimizing water losses and enhancing agricultural production.

The *Wewa method*, which includes the construction of enormous reservoirs to collect and store water throughout the rainy season, is one of the most widely utilized traditional irrigation techniques in Sri Lanka. The water is then transported to agricultural areas via an extensive system of canals and tiny reservoirs. The *Wewa* system has been effective in lowering water losses and improving water quality. Apart from the *Wewa* system, Sri Lanka has employed numerous different ancient irrigation techniques, such as the *Ella* system, which includes diverting water from a river or stream to irrigate farmland (Jayaweera, et al., 2018). According to Yapa et al. (2019), who stated the *Ella* technique has proved effective in minimizing the loss of water and boosting yields of crops in water-stressed regions.

Silva et al. (2020), stated traditional irrigation techniques are also beneficial in decreasing vegetable losses in Sri Lanka. In the research they did, the researchers examined the efficacy of traditional and contemporary irrigation methods in lowering vegetable losses. Researchers discovered that ancient irrigation techniques were much more successful than contemporary systems of irrigation in reducing losses.

2.2.4. Manual Harvesting

Throughout Sri Lanka, manual harvesting has been proven to be an efficient method of decreasing vegetable losses, It has been discovered that hand harvesting can minimize tomato yield damage by up to 30% when compared to machine harvesting (Thilakarathna, et al., 2020). According to the current study, this decrease in losses is because human harvesting is gentler on the plants, reducing the probability of harm and eventual spoiling.

Weerasinghe et al. (2019), discovered that hand harvesting may dramatically minimize green bean losses in Sri Lanka. The study discovered that human harvesting proved more successful than machine harvesting in retaining bean quality and decreasing wastage.

2.2.5. Harvest Protecting Techniques

Neem oil is a traditional insecticide that is utilized in Sri Lanka as well as in neighboring countries. This is extracted from the neem tree and is effective against pests, such as aphids, caterpillars, and beetles. Based on research released in the *Journal of Agriculture and Rural Development* in the tropical and subtropical regions, neem oil can reduce pest insects while increasing agricultural yields (Basedow, et al., 2002). Another traditional insecticide employed by Sri Lankan farmers is garlic and chili pepper spray. It is made by steeping garlic and chili peppers in water after crushing them. To deter insects, the resultant solution can be sprayed over crops according to research published in the *Journal of Applied Horticulture*. Garlic and chili pepper spray can successfully manage pests including aphids and thrips (Fatima, et al., 2019). The other traditional insecticide used in Sri Lanka and other countries is cow pee. It may have anti-fungal and insecticidal effects. Cow urine, according to research published in the *Journal of Ethnopharmacology*, can successfully manage fungal infections in crops (Deshmukh, et al., 2012). By sprinkling ash over crops, it can be utilized as a natural insecticide. It is thought to repel insects as well as defend plants from fungal infections. According to

research released in the Journal of Agricultural Sciences, ash could successfully manage pests, including aphids and white flies (Nishantha, et al., 2016).

2.3. Modern Farming Techniques

Farmers in Sri Lanka encounter several issues that impact agricultural productivity and freshness, including vegetable loss during harvesting and storing. In Sri Lanka, modern agricultural practices and harvest-protection systems have demonstrated encouraging results in minimizing vegetable loss. Modern agricultural methods employed by Sri Lankan farmers to decrease vegetable loss include integrated pest management, high-density farming, and precision farming. Post-harvest preservation strategies used to conserve vegetables include physical harvest protection, pest and disease management, MAP, and chemical treatments. These strategies could assist farmers to raise overall revenue while also contributing to the country's agricultural production.

2.3.1 Greenhouse Farming

In Sri Lanka, greenhouse farming has been shown to be an efficient method of lowering vegetable losses. According to research done by Jayasinghe et al. (2019), who derived that greenhouse farming can minimize vegetable losses in Sri Lanka by up to 50%. The study also discovered that greenhouse farming is very successful in minimizing disease and pest damage, which are important drivers of vegetable losses in Sri Lanka.

Also, Rathnayake et al. (2021), stated and discovered that greenhouse farming can boost vegetable production by up to three times when compared to traditional open-field cultivation techniques in Sri Lanka. The regulated climate offered by the greenhouse enables better management of soil moisture, temperature, and nutrients, according to the research.

Furthermore, Laksiri and Alawathugoda (2018), discovered that greenhouse agriculture can minimize the usage of pesticides and other agrochemicals, which can be damaging to both people and the environment. According to the study, using comprehensive pest control strategies, which are frequently used in greenhouse farming can greatly minimize the requirement for pesticides.

2.3.2. Conservation Farming

Conservation Farming is a collection of strategies that are used to maintain the quality of the soil, prevent humus deterioration, and encourage environmentally friendly farming. Farmers in Sri Lanka utilize a variety of conservation farming strategies to minimize vegetable loss, along with:

Crop Rotation: Crop rotation is the practice of growing various harvests in the same area over the course of several seasons. Such kind of methods assists to keep pests and pathogens at bay while also reducing land degradation (Jayawardena, et al., 2018).

Mulching is the practice of coating the topsoil with basic material, such as harvest leftovers, leaves, or grasses to lower soil temperature, preserve humidity, and limit plant development.

This approach can help to prevent land degradation while also increasing soil quality (Samarasinghe, et al., 2019).

Tillage: Tillage is a form of soil preparation that reduces soil compaction while preserving topsoil. The practice aids in the retention of moisture in the soil, the reduction of soil degradation, and the improvement of soil health (Ranaweera, et al., 2016).

Inter-Cropping: Growing multiple crops in the same field at the same time is known as inter-cropping. This approach has the potential to minimize land degradation, promote crop diversification, and boost soil quality (Liyanage, et al., 2020).

2.3.3. Adopted Good Agricultural Practices (GAP)

Many researchers have emphasized the need of implementing Good Agricultural Practices (GAP) in vegetable cultivation to enhance sustainable agriculture and prevent food loss. GAP methods have been applied in Sri Lanka, where agriculture is a key part of the economy, to boost vegetable output and minimize losses caused by diseases, pests, and post-harvest handling reviewed the use and effect of GAP in vegetable growing in Sri Lanka and discovered that farmers who used GAP methods had greater yields and greater quality output (Perera & Samarappuli, 2016). GAP is further emphasized in the National Policy Guidelines on Good Agricultural Practices (Anon., 2018). According to Dissanayake and Palipane (2015), GAP techniques increased vegetable yields by 44% while decreasing production costs by 20%, enhancing farm profitability. Furthermore, GAP techniques can improve regional economic and social growth by increasing job possibilities, boosting farmer earnings, and promoting food security. Furthermore, GAP methods can aid in meeting international food safety regulations, which is critical for exports with an agricultural focus.

03. Methodology

3.1. Research Philosophy

The research philosophy of interpretivism understands differences in humans as social actors. It accepts that one person to another has subjective opinions about different subjects. (Saunders, 2009). Thereby, this subjectivity applied to this research which concerned diverse opinions given by vegetable farmers with respect to the methods of reducing loss (based on traditional and modern cultivation methods).

3.2. Research Approach

The selected approach was the inductive approach, and it involved collecting data and developing a theory as a result of the data analyzed (Saunders, 2009). which is related to this research article such likely.

3.3. Choice of Research Method

The choice of research method deals with three methods as mono, multiple, and mixed methods. The mono method intended single data collection techniques, such as in-depth interviews with associated data analysis procedures (Saunders, 2009).

3.4. Time Horizon

According to Saunders (2009), “The time horizon is the time limit for completing the project”. It has two modes of horizons named, “longitudinal time horizon and cross-sectional time horizon”. Longitudinal studies are normally repeated over a period and cross-section studies are limited to a specific timeframe. This research was an undergraduate-level study and hence, researchers adopted the cross-sectional time horizon.

3.5. Data Collection and Analysis

With the insight gained from the literature review researchers of this study conducted interviews based on a qualitative approach among the vegetable farmers in Sri Lanka (*Bandarawela, Nuwara Eliya, Hambanthota & Anuradhapura*).

The qualitative approach of the research involved semi-structured interviews that provide qualitative data through the use of open-ended questions. The number of interviews to confirm data saturation was 10 (Saunders, 2009). The sampling method used was snowballing method.

3.6. Data Analysis

A qualitative analysis was performed on all of the data. Thematic analysis was selected as the qualitative technique of analysis. The first step in qualitative analysis is the meticulous organization of the raw data, which is then followed by the reading of transcripts and interviews from the field to get a general sense of the information that would be collected in order to identify significant issues and concepts that assisted in providing a clear understanding of the topic at hand. The concepts were categorized into themes and codes. In order to underline the point that was expressed during the conversation, verbatim quotations from the participants were used.

04. Result and Discussion

The demographic details listed in Table 4.1 for each participant include gender, age, marital status, income, education, years of experience, total land area, and the number of younger and senior citizens.

Information on the demographics of vegetable farmers about the transportation and packaging strategies, from production to retailers are presented. Seven of the eight respondents were male farmers, and one farmer was female. Two participants from *Anuradhapura, Hambanthota, Bandarawela, and Nuwaraeliya* faced the interview.

Table 1: Demographic Characteristics of the Respondent

Pseudonym	Gender	Location	Age	Years of Experience	Level of Education	Marital Status	No of Young Dependents	No of Old Dependents	Total land extents
Respondent (1)	Male	Hambanthota	29	10	A/L	Unmarried	-	2	3AC
Respondent (2)	Male	Anuradhapura	36	15	A/L	Unmarried	-	2	2.5AC
Respondent (3)	Male	Anuradhapura	45	20	Diploma	Married	3	1	2.5AC
Respondent (4)	Male	Bandarawela	70	40	Primary	Married	2	2	3AC
Respondent (5)	Female	Bandarawela	37	15	A/L	Married	5	-	2AC
Respondent (6)	Male	Nuwaraeliya	43	17	A/L	Married	5	1	2.5AC
Respondent (7)	Male	Hambanthota	51	15	Degree	Married	2	1	50AC
Respondent (8)	Male	Nuwaraeliya	47	18	A/L	Married	1	-	10AC
Respondent (9)	Male	Hambanthota	31	7	Degree	Married	-	-	5AC
Respondent (10)	Male	Anuradhapura	38	5	Master	Married	-	-	5AC

Table 2: Main Themes Identified Through Thematic Analysis

Themes	Code
Cultivation at appropriate time	Cultivation auspicious time
Traditional farm practice	Cultivation of crops in Yala and Maha seasons
Harvest protecting techniques	Traditional irrigation techniques
Modern farming techniques	Manual harvesting
Modern harvest protecting techniques	Pest and disease control
	Hybrid Seeds
Conservation farming techniques	Greenhouse farming

4.3. Cultivation at the Appropriate Time

According to the current study, cultivation at an appropriate time is one of the main themes, as are cultivation at auspicious times and cultivation of crops in the *Yala* and *Maha* seasons codes. In Sri Lanka, farmers used these methods to reduce vegetable losses from pests and diseases, and other natural disasters. Sri Lankan farmers stated that cultivation at an auspicious time could help reduce vegetable pre and post-harvest losses. They planned their crop selection when they were cultivating, largely based on weather trends and cropping seasons. The term for this behavior was "kal yal balaa govithena" (cultivation at the right season and time). The traditional farmers used this method to reduce crop losses while reaping a bountiful yield from their cultivation (Jayatissa, Dissanayake, & Perera, 2019). According to Jayatissa (2019), local

rainfall patterns, astrology, and traditional farmers' knowledge of farming determine the best time to prepare the land. Additionally, they search for specific days and auspicious times to start the field preparation. Similarly, in this current study, Respondent 2 said, "*... We normally don't work as we please. As I mentioned, we give priority to the auspicious time and then look for good signs, especially we avoid 'rahu' time. Rahu time refers to the inauspicious or unlucky time of day on every day that is not thought to be a good time to begin any new activity. Finally, we prepare the ground and start our work.*" Further, Respondent 3 also said that... *animal damage is minimized when working with auspiciousness. There are also auspicious things that can protect the harvest from pests. A good auspicious sign means wealth gain*". An auspicious time could be used to protect the harvest, minimize pests and diseases, and gain a vegetable harvest.

The *Yala* and *Maha* seasons are two of the cultivation periods in Sri Lanka. Some farmers grew vegetables in one of these two seasons. Also, some farmers grew vegetables for both the *Yala* and *Maha* seasons. In the Nuwara Eliya region, *Yala* (cultivation period of February to May) is the primary growing season for potatoes, and "*Maha*" is the secondary season (September to December). In the Badulla district, potatoes are also extensively grown during the *Yala* and *Maha* seasons (Fernando & Premasiri, 2006). The point of view of respondent 03 was, "*The cultivation time of Yala and Maha varies based on the region. Paddy is the cultivated crop in our area from January to May. Then, from May to December, we cultivate vegetables. There are farmers who grow veggies without cultivating rice throughout the year because of the increased harvest. We have done similar things at times*". Furthermore, Respondent 6 said that "*... Green chilies are mostly cultivated in the highlands during the rainy season. Then we could get a good harvest in this period*". This demonstrates that the *Yala* and *Maha* seasons helped farmers increase their vegetable harvest and reduce vegetable losses.

This study revealed two pre-harvest loss reduction strategies: cultivation at auspicious times and cultivation of crops during the *Yala* and *Maha* seasons. Ananda and Nahallage (2014) revealed that paddy field cultivation using traditional farming methods was observed in Meemure, Sri Lanka. Ananda and Nahallage (2014) stated that they begin cultivation at an auspicious time. Similarly, this current study's finding strongly aligned with Nuskiya (2019), who derived that the other three mid-country districts, Badulla, Kandy, and Matale, accounted for 40% of the *Maha* season's vegetable cultivation and 37.5% of the *Yala* season's upcountry vegetable cultivation, on average, with Nuwara Eliya being the most significant upcountry district for vegetable agriculture.

4.4. Traditional Farm Practice

4.4.1. Traditional Irrigation Techniques

The scarcity of surface water in cultivation is reflected in the farmers' use of alternative water wells. Farmers used this traditional irrigation technique to supply water for their crops. In the dry periods of the cultivation season, farmers were used to these irrigation techniques as a result of water wells in the field. As per the current study result, respondent 01 said, "*We have water wells as well to get water during dry seasons when there is no rainfall. Therefore, these water wells are very useful to reduce the losses that may occur due to the lack of water needed for vegetable crops during droughts*". This demonstrates that during the dry season when there is no rainfall, farmers use these water wells to protect their crops from water scarcity.

4.4.2. Manual Harvesting

Manual harvesting is a traditional and common method of harvesting fruits, vegetables, and paddy cultivation. This method involves harvesting vegetables by hand, with vegetable clippers and knives, etc. Due to fewer families and high demand for labor, the traditional "Aththama" helping system, in which village community members exchange labor for various tasks, is gradually dwindling. The use of family labor has been decreasing (7%) due to the different reasons for their lifestyle (Madhushani, LPHK, Nianthi, & KWG, 2016). Historically, manual harvesting has been the preferred method for achieving high-quality control and minimizing tree damage (Benkeblia, Paula., Tennant, Sukhjit, & Jawandha, 2011). The point of view of Respondent 01 was that *"We do not use any machinery to harvest our yield. We do them manually, using our labor. Cucumbers, for example, are typically picked by hand. It could help to minimize the vegetable damages, and it's not harmful to the crops"*. This demonstrates that manual harvesting may reduce vegetable loss while minimizing tree damage.

Under traditional farm practices, farmers were used to traditional irrigation techniques and manual harvesting for reduced vegetable losses. The current study findings, strongly align with Sivayoganathan and Mowjood (2003), who stated that Sri Lankan irrigation is essential for agricultural productivity. Successful agro-well farmers in the dry zone said that since the invention of agro-wells, their revenue has multiplied many times over. This current study finding is similar to that of Thilakarathna et al. (2020), which stated that, throughout Sri Lanka, manual harvesting has been proven to be an efficient method of decreasing vegetable losses and discovered that hand harvesting can minimize tomato yield damage by up to 30% when compared to machine harvesting. According to the study, this decrease in losses is because human harvesting is gentler on the plants, reducing the probability of harm and eventual spoilage.

4.5. Traditional Harvest-Protecting Techniques

They have been practicing some essential indigenous technical knowledge (ITK), such as the use of neem and biskatali to protect against insect pests, the use of rice husks in bamboo gardens, etc. They have also been using indigenous technical knowledge such as ash, cow dung, cattle urine, light traps, and scarecrows to protect the cultivation from insect pests (Hasan & Haque, 2014). Similarly, in this current study, respondent 04 stated, *"Traditional remedies derived from tobacco, garlic, the Neem plant, and other plants were utilized for pests."* Furthermore, Respondent 6 said that *"Burn dry coconut leaves to attract pests like flies and destroy light traps are used"*. As per the results of the current study, Sri Lankan farmers use traditional remedies derived from tobacco, garlic, the neem plant, and other plant pests. In conclusion, it can be stated that farmers experienced many traditional practices, which they learned from their ancestors, for repelling and controlling insect pests in vegetable cultivation by using locally available raw materials.

Another traditional insecticide employed by Sri Lankan farmers is garlic and chili pepper spray. It is made by steeping garlic and chili peppers in water after crushing them. To deter insects, the resultant solution can be sprayed over crops, according to Fathima, Lovejoy, and Wisdom (2019), who revealed that garlic and chili pepper spray can effectively manage pests such as aphids and thrips. Cow urine is another type of traditional insecticide used in Sri Lanka and other countries. It may have anti-fungal and insecticidal effects. Cow urine, according to

Deshmukh, Rajgure, and Ingole (2012), can successfully manage fungal infections in crops. This current study's findings strongly align with those of previous studies.

4.6. Modern Farming Techniques

4.6.1. Conservation Farming Technique

Mulching is used as a conservation farming technique in cultivation. Mulching is a water-saving technique in dryland areas for conserving soil moisture, regulating temperature, and reducing soil evaporation (Yang, et al., 2015). The decrease in soil water loss, soil erosion, the effect of water droplets striking the soil surface, weed growth, and competition for water and nutrients from neighboring fields are some of the significant benefits of mulching (Kader, et al., 2019). In the current study findings, respondent 7 stated that *"The mulching film reflects light, so pests like aphids and thorns are easy to control. It is also very effective against nematodes."* Jayatissa (2019) revealed that after the second plowing, mulching was done by farmers in some areas using weed-free materials. Mulching, apart from preventing weed growth, helps improve infiltration and conserve moisture. Conservation farming techniques are important for soil conservation, preventing weeds and topsoil erosion, preventing fungal infections, and preventing pests and diseases. Therefore, farmers could protect vegetable crops and reduce vegetable damage from pests and diseases caused by weeds.

4.6.2. Greenhouse Farming

Greenhouse farming is a popular modern farming method in Sri Lanka. Crops grown in greenhouses benefit from optimal growing conditions, protection from harmful pests and diseases, and efficient crop management (Ahuchaogu et al., 2022). Similarly, to this current study's findings, respondent 5 stated, *"The major reason for growing in greenhouses is to protect crops from insects. Another objective is to grow in a small space while generating a large crop. The main factors that affect plant growth, such as sunlight, air, temperature, etc., can be manipulated in the greenhouse"*. This demonstrates that these current study findings helped to protect against harmful pests and diseases, reduce vegetable crop loss, and increase vegetable harvest through the greenhouse farming technique.

4.6.4. Good Agricultural Practices (GAP)

GAP is one of the most important contributors to the preventative practices proposed earlier, and it ensures that on-farm practices result in products reaching the farm gate (Malkanathi, Thenuwara, & Weerasinghe, 2021). Also, it is a practice that needs to be applied on the farm to ensure food safety during the pre-production, production, harvesting, and post-harvesting operations (Malkanathi, Thenuwara, & Weerasinghe, 2021). Similar to this current study result, Respondent 08 said that *"It will lower the likelihood of crop loss due to insect and disease damage. Establishment of GAP special stores should be broadly distributed in urban areas where people love to shop"*. Similarly, as this current and previous study demonstrates, the GAP technique is one of the modern farming techniques farmers use to cultivate and has helped increase food security and safety.

4.6.7. Hybrid Seeds

In many vegetable crops, it has been observed how the use of hybrids has improved crop yield, particularly for the crops of cabbage, tomato, brinjal, and onion. This consistent rise in output has been made possible in large part by the use of high-quality seeds with inbred and hybrid vigor, cutting-edge technology, and sound government regulations (Tomar, Kaddi, & Kalyanrao, 2010). In the current study findings, Respondent 09 stated, *"By cultivating hybrid vegetable seeds, we can get higher yields than by cultivating local seeds"*. Again, respondent 09 stated, *"The crop damage caused by growing local vegetable seeds is higher; we can get the desired yields while reducing the vegetable crop damage by cultivating hybrid vegetable seeds; we can get higher yields than by cultivating local seeds"*. This current and previous study results revealed that hybrid seed production is most valuable and also helps to increase vegetable yield productivity and minimize crop damage.

Modern farming techniques were used by farmers to reduce vegetable losses through cultivation. The current study's finding strongly aligns with Prem et al. (2020), who found that mulching can improve the soil's ability to retain moisture, minimize evapotranspiration, inhibit weed development, and moderate soil temperature. Landscape, farming, and garden aesthetics can also benefit from mulching. Although the application of mulching won't necessarily enhance crop yields directly, more land can be cultivated with the available water, increasing agricultural cultivation as a whole. According to Ahuchaogu et al. (2022), greenhouse farming optimizes growth conditions, safeguards crops from harmful pests, illnesses, and extreme weather, and makes it possible to manage crops effectively. The aim of comparing the current study findings with Laosutsan et al. (2019), who stated the GAP standard is a management framework for agricultural products, covering seed preparation, planting, upkeep, harvesting, and post-harvesting while limiting harm to the environment, is to establish safety standards for both domestic and foreign markets. GAP is based on the principles of risk prevention, risk analysis, and sustainable agriculture using integrated pest management (IPM) and integrated crop management (ICM) for the continuous improvement of farming systems (Laosutsan, Shivakoti, & Soni, 2019). Similarly, this current study's findings strongly align with those of Siyal (2019), who revealed hybrid seed production is predominant in modern agriculture and home gardening, and hybrids are chosen to enhance certain traits in the plants that result, such as increased uniformity, better color, and disease resistance.

05. Conclusion

In the current study, researchers explored traditional methods and modern methods to reduce vegetable losses pre and post-harvest practices. Under the traditional method, farmers used auspicious times and *Yala- Maha* season for cultivating vegetables because farmers explained that it helped to reduce pests and diseases, crop damage, and increase vegetable harvest. Farmers used traditional irrigation techniques and manual harvesting methods for their cultivation to reduce vegetable losses under traditional farming practices. Traditional irrigation techniques helped farmers in the dry season to get water for their cultivation, and farmers used water wells in their cultivation lands as a resource of water for cultivation. It could help to reduce vegetable losses during the dry season and scarcity of water in this situation. Also, manual harvesting helps farmers to pick their vegetables within the minimum losses and it is helpful to reduce crop damage and vegetable losses. Under traditional cultivation methods, farmers used techniques for their cultivation to control pests and diseases. It was found that

farmers used to make natural things and spray for protecting the cultivations from insects and pests. According to the modern method, farmers do greenhouse farming, conservation farming, Good agricultural practices (GAP), and hybrid seeds. Farmers used these modern methods to increase their vegetable harvest and reduce pests and diseases, crop damage, soil conservation, and control weeds, keep the standard of the vegetables, and used hybrid seeds instead of the local seeds to get good vegetable harvest in their cultivation and to keep the safety. Under modern cultivation methods, farmers used physical techniques in their cultivation to control pests and diseases. As a finding, farmers used to cover the cultivation using nets to protect from animals like peacocks, monkeys, porcupines, and pigs. It could help to reduce crop damage from the animals.

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