YANGON UNIVERSITY OF ECONOMICS
DEPARTMENT OF APPLIED ECONOMICS
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A STUDY ON FARMERS' IMPLEMENTATION OF GOOD AGRICULTURAL PRACTICES ON POTATO PRODUCTION IN KALAW TOWNSHIP, SHAN STATE

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EMPA - 19 (19th BATCH)

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A thesis submitted as a partial fulfillment towards the requirement for the degree of Master of Public Administration (MPA)

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This is to certify that this thesis entitled **"A STUDY ON FARMERS' IMPLEMENTATION OF GOOD AGRICULTURAL PRACTICES ON POTATO PRODUCTION IN KALAW TOWNSHIP, SHAN STATE"**, submitted as a partial fulfillment towards the requirements for the degree of Master of Public Administration has been accepted by the Board of Examiners.

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ABSTRACT

The study analyzes good agricultural practices on potato production in Kalaw Township, Shan State. The study intends to assess current situations of good agricultural practices in potato production and to examine good agricultural practices for potato farmers in Kalaw Township, Shan State. The study uses a descriptive method based on primary data and secondary data. The survey data is collected from 100 potato farmers with a structured questionnaire. The study shows the post-monsoon potato is the main source of income in the study area. According to the potato farmers, the income generated from potato cultivation has been increasing in the last three years. Most of the potato farmers have applied good agriculture practice from non-governmental organization and township department of agriculture. Most of the potato farmers are willing to attend GAP operational training properly than other trainings. Organic pesticide making and applying training supports the implementation of organic food and GAP certification process as well. It is, therefore, essential for the improvement of awareness towards Good Agriculture Practice among farmers.

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LIST OF ABBREVIATIONS

ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
BOP	Bottom-of-the-pyramid
CSO	Central Statistical Organization
DoA	Department of Agriculture
FAO	Food and Agriculture Organization
GAP	Good Agriculture Practices
RBT	Resource-Based Theory
SMEs	Small and Medium Enterprises
VR	Valuable and Rare
WHO	World Health Organization

CHATPER I
INTRODUCTION

1.1 Rationale of the Study

Myanmar is currently experiencing a pivotal and transformative period due to its political reforms and the opening of its market. Strengthening and expanding the agricultural sector through the promotion of farming as a business is essential for fostering self-sufficiency. This strategy has been acknowledged by the authorities as a cornerstone for economic stability and the generation of rural employment opportunities.

Agriculture is the majority of the backbone of Myanmar's economy supporting the majority of the population. Approximately 67% of the people are farmers residing in rural regions, with their agricultural activities fueling the sector. In Myanmar, agriculture holds significant importance, contributing to 21% of the Gross Domestic Product (GDP) and accounting for 10 to 15% of total export earnings during the fiscal year 2019-2020. Additionally, almost 50% of the population makes their living from farming and raising animals, with families using a variety of income-generating techniques (CSO, 2022).

Mango, pomelo, honeydew, watermelon, avocado, chile, tomato, onion, cabbage, potato, several kinds of beans, sesame, peanut, rice, and coffee are among the top 15 most consumed and exported crops in Myanmar. In Myanmar, the agriculture industry is vital to the country's economy, employing around 53% of the working population. Approximately 70% of people living in rural areas depend on this industry as their main source of income. It is essential for Myanmar to implement strong practices in Good Agricultural Practices (GAP) similar to its neighboring countries to ensure the production of safe agricultural products while preserving the environment and the well-being of farm workers.

Myanmar has three destined seasons such as a rainy season, a winter season and a summer season. Shan State is the major potato producing region, contributing 89% during the monsoon and 45% during the winter to the national potato production (DoA,

2022). The mountainous areas of the Shan State are the leading potato production areas in Myanmar. Potatoes are the third most important single food crop for human consumption globally (Devaux, Goffart, Kromann, Polar & Hareau, 2021). According to the Food and Agriculture Organization (FAO), over one billion people consume potatoes in various ways, including in India and China (Devaux, Goffart, Kromann, Polar & Hareau, 2021). Myanmar ranks third in potato production in the Great Mekong Sub-region (Soe Soe Lwin, 2012).

Currently, there are many kinds of potato varieties still cultivated in Myanmar and they also play the main role of household food in the diet plan. In Myanmar, potato is cultivated not only for food security but also as a cash crop for farmers, especially in Shan State. The primary potato-growing areas in Myanmar include Kalaw, Heho, Aungban, Pintaya, Pinlaung, Nyaung Shwe, and Naung Cho Townships in Shan State (Soe Soe Lwin, 2012). Potatoes are now a key culinary crop for the ethnic population in Southern Shan State and a major source of income for many ethnic farmers.

The main potato varieties found in Shan State include Marki, Carolus, and China varieties. Local farmers cultivate potatoes not only for local consumption but also for international trade. Potatoes are considered a profitable crop in the domestic market, attracting both consumers and traders. With a total of 31,000 hectares dedicated to potato production in Shan State, farmers have the opportunity to plant different potato varieties multiple times a year. Potatoes play a crucial role in the economy of Shan State, being one of the most significant cash crops for farmers. Despite a slight increase in the average potato yield in Myanmar, recent trends have shown a decline. Additionally, the production costs continue to rise (Annette, Koen & Nang, 2016). Potatoes are widely purchased by consumers in the local market and are utilized in various culinary dishes.

Potato is used in making the traditional meals and it is a must for some famous foods in Shan State. Therefore, the aim of the study is the farmers implementation of good agricultural practices on potato production in Kalaw Township, Shan State. Good agricultural practices in this context refer to the regulations and methods used in on-farm production and post-production processes, with the goal of maximizing agricultural yield while also considering economic, social, and environmental sustainability. These practices include using certified seed, proper land preparation, weeding and hilling, crop rotation, integrated pest, disease, and weed management, as well as fertilizer application, use of manure, and appropriate spacing. By adopting good

agricultural practices, farmers can potentially increase their potato yield and sell their produce in the market, leading to higher income.

1.2 Objective of the Study

The objectives of the study are to assess current situations of potato production and to examine good agricultural practices for potato farmers in Kalaw Township, Shan State.

1.3 Method of Study

The study used a descriptive statistics method with primary data and secondary data. Primary data is collected from potato farmers with a structured questionnaire. Secondary data is obtained from the publications of Kalaw Township Department of Agriculture, Heho Potato Farmers Association, Kalaw Township General Administration Department, Central Statistical Organization, Food and Agriculture Organization, libraries and websites.

1.4 Scope and Limitations of the Study

The study focuses the farmers' implementation of good agriculture practice on potato production in Kalaw Township, Shan State. The scope is limited to conducting a survey on 100 potato farmers in the study area. This study did not cover all potato farmers and the potato production business in Myanmar.

1.5 Organization of the Study

There are five primary chapters in the research. The first chapter provides an overview of the study's scope and limitations, organization, goals, methodology, justification, and organization. The second chapter reviews the literature on the value of agricultural commercialization, best practices in agriculture, and earlier research. An summary of potato growing in Myanmar may be found in Chapter 3. The fourth chapter examines how farmers in Kalaw Township, Shan State, are using effective agricultural techniques to produce potatoes. Chapter 5 concludes with recommendations and conclusions.

CHATPER II
LITERATURE REVIEW

2.1 Importance of Agricultural Commercialization

Agricultural commercialization is often seen as a vital step towards economic progress and advancement in many developing nations that heavily rely on agriculture (Timmer, 1997). Jayne, Haggblade, Minot, and Rashid (2011) argue that the initial step in structural transformation is the promotion of smallholder-led agricultural growth and commercialization. The process of smallholder commercialization plays a key role in the structural transformation journey, as it is believed by many development experts to be the primary pathway from a partially subsistence-based agricultural society to a more varied and food-secure economy with improved overall living standards (Jayne, Haggblade, Minot, and Rashid, 2011).

Rahut, Castellanos, and Sahoo (2010) advocated for the promotion of improved living standards through commercialization, asserting that it enables greater involvement of individuals and impoverished households in both domestic and international economic exchange, leading to increased average farm incomes and reduced income inequality. This aligns with the perspective of Sharp and Samuel (2007) that transitioning to commercial farming is not solely about moving from subsistence to market-oriented practices, but rather about striving for improved welfare outcomes for smallholder farmers (Rahut, Castellanos, and Sahoo, 2010).

The commercialization process empowers smallholders to take part in the market for both inputs and outputs. Okezie, Sulaiman, and Nwosu (2012) have suggested that the commercialization of agricultural systems leads to a greater emphasis on market activities in farm production, a transition from non-traded inputs to purchased inputs, and the gradual replacement of integrated farming systems with specialized enterprises.

Commercialization is being seen more and more as the way forward for agriculture, as subsistence farming may not be a sustainable activity that guarantees household welfare and food security in the future (Pingali, 1997). Supporting this idea,

Dorsey (1999) suggested that commercialization has the potential to increase household income because of its advantages over subsistence farming. The ability of commercialization to connect the input and output sides of the market is also acknowledged.

Pingali (1997) asserted that that the adoption of modern technologies in the commercial sector stimulates the input aspect of production, leading to the progress and enhancement of technological advancements. The integration of modern technology subsequently leads to increased productivity and market entry. Commercialization also plays a role in the emergence of new services, intermediation, and value addition. These services encompass a dynamic financial sector offering credit, insurance, business consultancy, and other related services.

The welfare effects or impact of agricultural commercialization on welfare have been recognized to encompass enhancements in farm household income, employment, health, and nutrition (Jaleta, Gebremedhin, and Hoestra, 2009). These effects can be classified into first, secondary, and third orders (Jaleta, Gebremedhin, and Hoestra, 2009). First order effects primarily consist of income and employment impacts that directly influence household welfare, while second order effects involve health and nutrition factors, typically dependent on the income level achieved through the current degree of commercialization. Third order effects (higher order) refer to the macro-economic and environmental impacts that extend beyond the household level. Though the process of commercialization impacts on the smallholder farmer in various ways, Jaleta, Gebremedhin, and Hoestra, (2009) surmised that the benefits of agricultural commercialization are believed to surpass any negative effects that may arise from the process.

Agricultural commercialization can be viewed in two ways: an increase in the proportion of output sold, or an increase in the use of purchased inputs per unit of output (Jaleta, Gebremedhin, and Hoestra, 2009). Essentially, agricultural commercialization can manifest as a rise in marketed surplus on the output side, or as an increase in the use of purchased inputs on the input side. Essentially, agricultural commercialization involves a transition from subsistence farming to a more intricate market-oriented production and consumption system, which results in the strengthening of the connections between input and output sides of a market (Jaleta, Gebremedhin, and Hoestra, 2009).

A number of factors have been recognized as influencing agricultural commercialization. These factors can be categorized as either long-term or short-term and can either support or hinder the commercialization process (Fischer, and Qaim, 2012). Long-term factors include population growth and rural infrastructural development (Barrett, 2008). Research indicates that population growth may lead to an increase in the amount of marketable surplus, while other studies suggest that rural infrastructure plays a role in agricultural commercialization by affecting prices, technology diffusion, and the efficient use of inputs and outputs (Barrett, 2008).

While households with limited food production relative to their consumption needs are anticipated to have lower levels of commercialization. However, revenues generated from selling agricultural products can greatly aid in acquiring inputs, leading to enhanced productivity and ultimately boosting commercialization (Tollens, 2006). Recent scholarly research highlights that transaction costs incurred by farmers when engaging in market activities also play a crucial role in determining the level of agricultural commercialization (Kirui, Okello, and Nyikal, 2012).

2.2 Measure of Good Agricultural Practices

To avoid crop contamination, a farmer who follows sound agricultural practices takes proactive steps to regulate food safety. Four categories exist for GAP measures: environmental dangers, soil supplements, water quality, and health and hygiene.

(i) Health and Hygiene

Harvesting, sorting, and packing fresh fruits and vegetables requires a significant amount of human effort. Workers should avoid handling fresh produce if they exhibit symptoms like diarrhea, vomiting, or an abrupt yellowing of the skin or eyes. These symptoms may indicate a foodborne illness (Camire, Kubow & Donnelly, 2009). Hand washing is a must for anybody handling food, especially before starting work, during breaks, and especially after using the toilet. While ensuring the availability of suitable sanitary facilities may present difficulties, keeping hand washing stations and restrooms supplied, clean, and conveniently accessible is essential to avoiding product contamination.

(ii) Water Quality

Water has several uses both before and after harvesting, including irrigation, pesticide application, crop washing, container cleaning, drinking, and personal hygiene. Fruits and vegetables that come into touch with surface water from ponds, streams, or rivers pose a greater danger to food safety. In general, ground or well water is a safer alternative, but frequent testing and well inspections are required to make sure the wells are undamaged and not located in places where runoff from storms or floods is likely to occur. Since municipal water complies with government safety regulations, it is the safest supply. Which kind of water to use and how much danger there is depends on the time and application technique (Riungu, 2011). For example, when using overhead irrigation or when harvest time draws near, it is best to choose a safer water source since the plant's edible portions are more likely to come into touch with the water just before harvest. After collection, water should be free of human infections. Add a sanitizer to the water if there are worries about its safety.

(iii) Soil Supplements

Healthy soils support a vast array of microorganisms, most of which are harmless to humans. These microorganisms play a vital role in breaking down organic matter into essential nutrients that plants can easily absorb. However, using animal manure as a soil amendment or nutrient source can pose a contamination risk. It is essential to consider that all untreated manure carries microorganisms that may lead to human illness. Therefore, it is crucial to follow proper manure handling and application practices (Riungu, 2011). To minimize risks, it is advised to wait a minimum of 120 days between applying raw manure to fields where fresh produce is grown and harvesting the crops.

Alternatively, incorporating it into the soil during the fall of the preceding year is an even better practice as prolonged exposure to the elements can significantly decrease pathogen levels. It is advisable to use established aerobic composting methods when utilizing animal manures, as this will raise internal temperatures to above 130F for at least 5 days. To guarantee consistent heat distribution, the pile should be turned multiple times. Additionally, it is essential to keep raw and partially composted manure away from areas where crops are grown and to prevent runoff after heavy rain or flooding.

(iv) Field and Packinghouse Hazards

Agricultural facilities are not sterile settings, and there are many ways for contamination to occur from many sources, such as harvesting implements, packaging materials, storage spaces, and transportation. Farmers should take precautions to keep wild animals away from their crops and be on the lookout for any possible contamination from nearby properties, such as junkyards, hazardous waste sites, and livestock operations (Fisher and Qaim, 2012). It is essential to keep harvest bins and containers in a way that protects them from possible sources of contamination and to give them a thorough cleaning before each use.

2.2.1 Resource-Based Theory of The Firm

The resource-based theory (RBT) has gained prominence in the area of strategic management since Barney's (1991) groundbreaking work (Barney, Ketchen, and Wright, 2011). According to the hypothesis, a corporation may gain a competitive advantage if its immovable resources are valued and rare (VR).

Bottom-of-the-pyramid (BoP) markets are thought to offer 'interesting and fertile areas for organizational research' (Bruton, Filatotchev, Si, and Wright, 2013). The environment allows us to investigate the fundamentals of RBT in BoP markets and respond to Karnani's (2007) call to focus on income-generating prospects rather than solely considering the poor as consumers.

Kimhi (2010) provides evidence of the value of supporting rural entrepreneurship, citing its positive effects on income distribution and growth in revenue. Olthaar, Dolfsma, Lutz, and Noseleit (2017) investigate the difficulties encountered by small farmers in environmentally and institutionally challenging situations, whereas Cucagna and Goldsmith (2017) investigate how primary producers deploy strategic resources in the early stages of a global value chain. According to their research, small farmers that make use of strategic resources do better than those who don't.

Different resource endowments among competing companies result in variations in performance results or competitive advantages. Comparative resource advantages exist, according to Ireland, Hitt, and Sirmon (2007). Amit and Schoemaker (1993) distinguish between capabilities and resources, characterizing resources as stockpiles of accessible components that the company owns or controls. Generally

speaking, these resources fall into four categories: financial assets, human capital, technical capital, and physical capital (Amit and Schoemaker, 1993).

Capabilities of firms are defined as their ability to use, integrate, improve, configure, and/or apply resources in an efficient manner. Usually, these skills are developed in certain functional areas, including marketing's brand management, production's operations management, and continuous innovation in products and processes (Helfat and Peteraf, 2003).

Comparable inputs and outputs are what set apart commodity production (Gereffi, Humphrey, & Sturgeon, 2005), but firm heterogeneity is the foundation of the RBT. According to Maspaitella, Garnveska, Siddique, and Shadbolt (2017), there is variation in the performance of commodities producers despite their relative homogeneity in terms of resource and capability use. Producers of commodities must strategically allocate their resources and competencies according to the possibilities and dangers they face in the market.

2.3 Good Agricultural Practices for Potato Production

It is becoming standard procedure for both importing countries and local customers to need certification for the use of good agricultural practices in food manufacture and distribution due to the rising demand for safer and higher-quality food items (ADB, 2020). In light of this, the Association of Southeast Asian Nations (ASEAN) has created a uniform framework for good agricultural practices related to the planting, gathering, and handling of fresh produce after harvest. The goal of the ASEAN GOOD AGRICULTURE PRACTICE is to reduce or eliminate hazards to worker welfare, the environment, food safety, and superior product quality. However, the adoption and use of such approaches have been hampered by the false perception of excellent agricultural practices. Some people think that the requirements for excellent agricultural practices are restricting and impeding farmers' ability to carry out their farming operations (Thindisa, 2014). The creation of a secure and long-lasting food production system that benefits producers and consumers alike is the essential tenet of good agricultural practices. Maintaining the right of consumers to affordable, hygienic, and nutritious food requires this safe manufacturing system. Additionally, there are a lot of chances for small and rural farmers to actively participate in the mainstream market system due to the continued growth of supermarkets in Asia and the growing emphasis on direct sourcing from farms (Reardon, Timmer & Minten, 2012).

Supermarkets have also argued that reducing the number of marketing middlemen may reduce distribution costs, thereby transferring these savings to farmers.

Farmers use good agricultural practices to maximize crop output, reduce expenses, and protect the environment throughout the production and post-harvest phases (Wollni, Lee & Janice, 2010). Soil and water management are fundamental components of excellent agricultural practices that enable farmers to adjust to changing weather patterns (Delgado, Groffman, Nearing, Goddard, Reicosky, Lal, Kitchen, Rice, Towery, & Salon, 2011). Practices including hand weeding, low tillage, and seedbed incorporation of agricultural waste help to assist natural resource conservation (Issahaku and Abdulai, 2020).

Increasing potato yields via the use of efficient agricultural techniques might improve sustainability in the production of potatoes and support livelihoods. To improve agricultural sustainability, different farming systems may use these techniques, which include integrated pest management, conserving soil and water, and managing fertilizer properly (Kassie, Jaleta, Shiferaw, Mmbando, & Mekuria, 2013). Crop rotation, adequate soil preparation, exact spacing, and the use of certified seeds are a few important agricultural practices that this study could look at. Weeding, hilling, using insecticides, and fertilizing are further procedures. When combined, these techniques may increase soil productivity, decrease the buildup of pests and diseases, increase the yield of potatoes, and encourage the addition and recycling of nitrogen (Abdeldaym, Traversa, Cocozza & Brunetti, 2018).

It is possible to grow potatoes in rotation with grains before moving on to leguminous crops, but not with plants in the Solanaceae family, which are susceptible to the same weeds, pests, and diseases. According to Uwamahoro, Berlin, Bucagu, Bylund, and Yuen's (2018) study, planting in rotation with brassica, perennial rye grass, and mustard may reduce the incidence of soil-borne illnesses such powdery scab by 31–55 percent. Minimal disturbance of the soil should occur during land preparation. Deep, well-drained, well-aerated soils with a high organic matter content are ideal for this use. It's important to consider several aspects while determining the appropriate spacing, including the kind of potato, tuber size, and cultural customs like gentle ridging. The usage of subpar seed potatoes has had a significant impact on crop production (Kinyua, Smith, Lung'aho, Olanya, & Priou, 2005). The quality and quantity of crops have significantly decreased due to the lack of clean seeds, while pests and illnesses continue to spread (Riungu, 2011).

Crop output may rise by as much as 70% by using certified seeds obtained from breeders, multipliers, seed merchants, or positive selection (Muthoni, Shimelis, & Melis, 2013). Furthermore, farmers may grow potato seeds free of bacterial wilt by using the seed plot technique (Kinyua, Smith, Lung'aho, Olanya, & Priou, 2005). To inhibit weed development and encourage healthy crop growth, weeding should be done either one month after planting or when the crop reaches a height of 20 cm. Korres (2018) asserts that weeding improves the crop's general health in addition to lessening its susceptibility to pests and illnesses. Hilling is another way to keep weeds at bay. It protects tubers from greening and keeps the solons from growing into aerial crops.

To avoid damage from pests such as potato beetles, potato moths, and leaf miner flies, as well as diseases like bacterial wilt, it is best to apply pesticides by chemical spraying only when absolutely necessary (Champoseau, Jones, & Allen, 2009). This strategy may reduce yield and quality losses to a minimum. One cannot stress the significance of integrated pest control techniques, which include insect scouting, crop rotation, the use of clean seed, planting resistant cultivars, and the encouragement of natural enemies (Waaswa, Oywaya Mwangi & Ngeno, 2021).

In order to minimize fertilizer residue in the ware potato, fertilizer application is crucial during land preparation, planting, and topdressing (Belanger, Walsh, Richards, Milburn& Ziadi, 2000). Evaluating the soil and crop nutrient needs is crucial to achieving this aim. For example, acidic soils often lack potassium, phosphorus, and magnesium, which are necessary for the growth of potatoes (Muriithi, Menale, Diiro, & Muricho, 2018). Furthermore, it is possible to minimize soil erosion, improve soil quality, and maintain appropriate nitrogen levels by using organic fertilizer. According to further research by Johnston and Poulton (2018), it may be used at the start of a new crop rotation plan to promote crop growth and raise production.

2.3.1 Good Agricultural Practice Certification Process

By obtaining the certification, farmers may demonstrate their commitment to upholding the norms of good farm practices and their understanding of the fundamentals of good agricultural practice. Ayupp and Tudin (2013) delineate three tiers of certification procedures. The first certification phase entails suppliers creating and adhering to their own standards for food safety programs and engaging an impartial certification team to examine their operations and quality. In the second certification phase, providers have to follow the food safety plans that purchasers have created. The

buyers develop these criteria, and either the buyers themselves, independent certifying agencies, or auditors evaluate compliance and supplier operations. When it comes to third certification, purchasers put in place separate food safety programs for their suppliers and themselves.

As a result, suppliers or buyers may ask an impartial certifying organization to evaluate the suppliers. As of right now, all good agricultural practice certificates are optional. Regulations do not need to follow good agricultural practice standards. Certification just serves as evidence of compliance with good agricultural practices criteria.

The benefits for farmers from good agricultural practice certification are;

- Enhanced food safety through the improvement of collaboration with suppliers
- Reduction of risks and liabilities in production leads to a reduction in product recalls and withdrawals during the distribution process
- Improved cost management and good practices for integrated pest control
- Improved productivity through the introduction of effective operations management
- Competitive advantages associated with expenses, the marketplace, credibility, and price
- Market access and acknowledgement by buyers
- Improvements in agricultural ecology by effectively managing input resources

2.3.2 Development of Private Sector Good Agricultural Practice Standards

Actions taken by the private sector inside the giant food manufacturing firm to address customer concerns about food safety and environmental sustainability. One of the most well-known consumer products companies in the world is Unilever. According to Voora (2020), it is the world's biggest consumer of agricultural raw materials and purchases a substantial amount of agricultural goods for distribution and processing around the globe. As a result, the program has produced excellent farming rules that are now part of Unilever's contracts with farmers. These recommendations include how to prepare the soil, when to fertilize, how to harvest, and other chores related to a particular crop. Farmers are actively forming good agricultural practices thanks to this initiative. Furthermore, grocery store chains compete fiercely with one another to get their items from suppliers of premium agricultural commodities at competitive costs.

Technological developments and improvements in seed types are to blame for the increase in worldwide competitiveness.

2.4 Reviews on Previous Studies

In Kalaw Township, potatoes are the second most significant food crop and income crop after rice, according to research by Soe Soe Lwin (2012). Although growing potatoes may be an expensive agricultural activity, if the produce's market price stays reasonable, it can provide substantial profits. Potatoes grow best in the summer and are best cultivated in lowlands with irrigation. This is also the most lucrative cropping strategy. However, since most potato farming in Kalaw occurs in hilly, rain-fed regions, growers typically encounter difficulties as a consequence of seasonal output and poor product pricing.A 2019 study by Nwe Nwe Tun examined the value chain of mangoes in Myanmar. According to the survey, most producers are facing tremendous challenges when it comes to finding workers, applying sound agricultural practices, expanding into new markets, adopting current growing methods, and getting information from global markets. On the other side, producers gain by having access to financial resources, agricultural equipment, high-quality seeds, land, and knowledge of nearby markets. Regarding customers, they exhibit a predilection for premium mangoes seen in contemporary metropolitan retail establishments. In addition, buyers are more likely to examine mangoes carefully for flaws and damage, and some are starting to ask whether the fruit has been treated with chemical pesticides and fertilizers. Pyae Pa Pa Aung (2021) investigated the knowledge, attitudes, and present farming methods of farmers in Kalaw Township about pest management in potato production. According to the report, most farmers raise a variety of other highland crops in addition to potatoes for both profit and food security. Nonetheless, potato farming remains the main source of revenue for their home. Few farmers combine "Chemical Pesticides and Alternative Methods" in their agricultural methods; the majority depend only on "Chemical Pesticides" for pest control and yield increase. Since chemical pesticides are more effective and simple to apply, none of the farmers exclusively adopt alternative approaches for managing pests. Chemical pesticides may have negative effects on the ecosystem, degrade land, accumulate agricultural residue, and reduce biodiversity even when they are effective.Aung Naing Oo (2022) conducted research on how Sagaing Region farmers felt about the adoption of appropriate agricultural methods for rice production. The study's findings show that criteria of good

agricultural practices are being followed in the safe and sustainable production of agricultural goods. The farmers are reluctant to admit how important it is to adhere to these standards, however. When a product or service's social costs are higher than the providers' private costs, good farming practices may help offset external costs. Good agricultural practices adopters in Myanmar face many risks and challenges, such as restricted access to fertilizers, tight budgets, pervasive poverty, low levels of education, trouble accessing agricultural markets, vulnerability to natural disasters and heavy rains, and higher production costs than with traditional farming methods.

CHAPTER III
AN OVERVIEW OF POTATO CULTIVATION AND PRODUCTION IN MYANMAR

3.1 Potato Cultivation and Production in Myanmar

In Myanmar's rural areas, agriculture is the primary source of income, with small-scale farmers making up the bulk of the agricultural community. In agriculture, value chains are organized networks that make it easier to sell and transform raw resources into finished goods, increasing their value throughout the manufacturing and distribution process. Smallholder farmers take part in these value chains by producing commodities for local buyers at the first stage of production. As the primary distribution channels for smallholder farmers in Myanmar, local markets are vital, and their importance in crop farming is only going to grow.The availability and accessibility of food are two important aspects that contribute to a community's health and to the economic success of a country. As a commercial crop, potatoes are an essential part of farmers' incomes in Myanmar. Potatoes are a major non-cereal crop that contribute to food security since they are a calorie-dense and nutritious vegetable. Since its introduction in the middle of the 19th century, Myanmar has grown to be one of Southeast Asia's leading producers of potatoes. In rural Myanmar, especially in townships like Kalaw, Pinlaung, and Pindaya in Southern Shan State (hill and mountain regions), potatoes are now a vital income crop for many farmers. Furthermore, Sinphyukyune is notable for being the main township in the Magway area (central arid zone) of Myanmar that produces potatoes.

In Myanmar, different regions cultivate potatoes at different times of the year. Southern Shan State grows potatoes as an irrigated spring crop from January to April on peaty and clay soils, with a comparatively high yield. The crop, which depends on rain-fed irrigation, is cultivated as an early monsoon crop in Shan State's mountainous area from April to August. As the late monsoon season approaches, Southern Shan State becomes the primary location for potato farming from August to November. Lastly, farmers in Central Myanmar grow potatoes as a winter crop in irrigated fields and

alluvial plains from November to February.In the next years, there will likely be a noticeable rise in the use of potatoes in processed foods and curries due to the anticipated expansion and growing income levels. There are work and income prospects due to the changing needs of the market. rising dietary patterns such as snacking are contributing to the rising desire for processed foods, which is driving the potato processing industry's growth and opening up new business opportunities. The increasing urbanization and changing dietary patterns of city dwellers are associated with the rise in farmer involvement in potato farming and market demands. Smallholder farmers benefit from this development, but there are drawbacks as well since bigger potato suppliers across the globe are posing competition (Njuki et al., 2005). However, smallholder farmers sometimes utilize seed potatoes that were undersized from prior harvests, which leads to crops that are sick and produce little.

Table (3.1) Sown & Harvested Acreage and Production of Potato in Myanmar

Year	Sown (Acre)	Harvested (Acre)	Production (Ton)
2015-2016	90684	90671	560360
2016-2017	90279	90278	554327
2017-2018	80831	80812	499949
2018-2019	78904	78904	488535
2019-2020	77496	77479	485823
2020-2021	74590	74590	468098
2021-2022	71517	71517	441807
2022-2023	70609	70609	439120

Source: Department of Agricultural Land Management and Statistics (2024)

3.2 Potato Cultivation and Production in Shan State

The potato holds significant importance as a staple food and cash crop for both farmers and consumers, particularly in Shan State where it dominates in terms of cultivated land area compared to other regions. Globally, the potato ranks as the third most crucial single food crop and is considered a vital edible tuber crop in Myanmar. Furthermore, it plays a pivotal role in ensuring food security and generating income. Currently, the potato is widely favored as a key ingredient in traditional dishes and nutritious diets in Myanmar households, being consumed either as a main course or a snack due to its high nutritional value.

In addition, potatoes are cultivated and value-added such as fries and crisps, and then marketed and distributed nationwide, with a focus on Southern Shan State. According to the Department of Planning (2020), the potato cultivation area in 2019-2020 was 31,000 hectares. The majority of farmers rely on chemical pesticides to achieve optimal yields in potato production. Price variations in potatoes are mainly determined by the different potato varieties available.

Southern Shan State has the fertile lands and there have been a favorable climate for potato cultivation as well as improved potato storage facilities. Nowadays, potato production serves as a profitable cash crop for ethnic farmers and holds promise for further income growth in the future, particularly within Southern Shan State. Additionally, there are numerous small and medium enterprises run by local residents in Shan State that specialize in creating value-added, processed food products from potatoes, including crisps, fries, curry, street food, and other processed goods, which are expected to experience significant growth in the coming years.

The price of Chinese potatoes is higher than in Shan State and Chinese potatoes being primarily used in curry dishes while Shan potatoes are often found in the potato chip industry. In Southern Shan State, potatoes are considered a lucrative cash crop for ethnic farmers and traders when compared to other crops, whether used as raw materials or in processed potato products (Soe Soe Lwin, 2012). Despite a slight increase in average potato yields in Myanmar in the past, recent times have seen a decrease. Additionally, the production costs of potatoes continue to rise annually.

Table (3.2) Sown & Harvested Acreage and Production of Potato in Shan State

Year	Sown (Acre)	Harvested (Acre)	Production (Ton)
2015-2016	54685	54685	359741
2016-2017	54522	54522	356254
2017-2018	55077	55077	362974
2018-2019	53927	53927	353890
2019-2020	52586	52586	352977
2020-2021	51296	51296	342810
2021-2022	50374	50374	333080
2022-2023	50808	50808	339981

Source: Department of Agricultural Land Management and Statistics (2024)

3.2.1 Ethnic Farmers' Potato Production in Shan State

Shan State is home to a diverse range of ethnic groups, with the majority being farmers who grow a variety of crops including cash crops like rice, maize, wheat, groundnut, soybean, potato, cabbages, and cauliflower. The ethnic communities in Shan State boast a rich history in Myanmar, having coexisted for more than a millennium. Among the ethnic groups in Shan State are the Pao, Wa, Danu, Taungyo, Kayan, Innthar, Lahu, Palaung, and Li Sue, who heavily rely on agricultural farming for their livelihood, cultivating crops like rice, tropical fruits, and vegetables even in urban settings.

In Shan State, Taunggyi and Pintaya are the main potato production due to the favorable weather conditions in the upland areas and the presence of fertile soil that can boost yields. The key areas where potatoes are cultivated in Myanmar include Kalaw, Heho, Aungban, Pintaya, Pinlaung, Nyaung Shwe, and Naung Cho Townships in Shan State (Soe Soe Lwin, 2012). Currently, potatoes play a significant role as one of the main staple crops for ethnic communities in Southern Shan State, serving as the primary income source for many ethnic groups engaged in agricultural activities. The predominant potato varieties grown in Southern Shan State are Marki, Carolus, and China varieties.

Ethnic farmers cultivate potatoes not only for local consumption but also for international trade. In the local market, potatoes are considered a profitable crop by both consumers and traders. In Myanmar, approximately 70% of the potato cultivation takes place in the mountainous regions, with the majority of growers belonging to ethnic communities (Soe Soe Lwin, 2012). The potato cultivation area in Shan State covers 31,000 hectares, allowing for multiple plantings of potato varieties within a year. While most ethnic farmers rely solely on chemical pesticides to manage pests and diseases in their potato fields, there are some who are unfamiliar with organic farming practices. These farmers tend to immediately resort to spraying chemical pesticides upon detecting pests and diseases, with some even applying them on a weekly basis. In some cases, ethnic farmers use chemical pesticides more than 10 times in a single season to safeguard their crops against pests and diseases, predominantly utilizing insecticides and fungicides based on their own observations and knowledge.

3.3 Potato Export in Myanmar

Prices on the potato market are steady right now in Myanmar. In the global market, the main commerce of fresh potatoes is across borders with neighboring countries. Prices for potatoes at wholesale are seldom variable, and people buy them to make curries and make sure their food is safe. The primary region for the production and sale of potatoes is Shan State, and market movements have little impact on organic farming. There is no difference in the cost of potatoes treated with chemical pesticides and those treated with alternate means of pest management. In addition, there is a household-level commercial market for potato chips, munchies, and fries (Soe Soe Lwin, 2012).

Customers buy potatoes in bulk at the neighborhood market, where they are used in a variety of culinary preparations. Furthermore, potatoes play a significant role in certain popular Shan State recipes as well as traditional dinners. Because they have limited access to transportation and storage options, smallholder farmers often sell potatoes at a low farm gate price. Because of this, they have to sell their goods rapidly in order to pay for other demands and bills. Size-based classifications for potatoes include A1, OK, S1, S2, and S3. S2 and S3 are used to make fried potatoes, although A1, OK, and S1 potatoes are marketed for domestic use. For later sowing, farmers save S1 and OK potato seeds.

Despite their best efforts, Myanmar's potato producers are forced to accept prices set by supply and demand realities. Their production is seasonal, which makes them susceptible to scams by middlemen and brokers. We use the potatoes to make French fries and crisps. There are five well-known potato chip enterprises in the nation that sell their goods all over the place. These businesses give preference to high-yielding cultivars that possess certain qualities including an oblong or long form, medium to big size, yellow flesh color, shallow eyes, year-round availability, extended shelf life, and little oxidation or discoloration after peeling. Shops and people alike purchase the potato chips. internet selling of potato chips via numerous internet channels has increased nationwide after the COVID-19 outbreak.

The four corresponding HS codes apply to Myanmar's potato exports. These include potatoes that are frozen, fresh or chilled, cooked or uncooked by steaming or boiling in water, and potatoes prepared or preserved in methods other than those using vinegar or acetic acid. Among these four categories, frozen potatoes cooked or

preserved in any other manner than using vinegar or acetic acid are regrettably not exportable from Myanmar.

Table (3.3) Export of Potato in Myanmar

Year	Ton	US$ Million
2017-2018	512.06	0.231
2018-2019	1771.00	0.900
2019-2020	896.00	0.471
2020-2021	0.00	0.000
2021-2022	1.75	0.002

Source: Department of Trade (2023)

3.4 Critical Issues of Potato Production

Myanmar faces numerous obstacles within its agricultural sector, particularly in relation to farm management, storage, marketing, and packaging. The cultivation of potatoes is steadily increasing in various regions of Myanmar, particularly in Southern Shan State. However, the rise in potato production also brings about challenges such as pests and diseases. The harvesting of potatoes is a crucial stage in the process, as these tuber crops are highly susceptible to damage. Consequently, farmers utilize a combination of traditional techniques and modern technology to ensure successful potato cultivation.

Mostly, late blight can be seen in potatoes grown after the monsoon season rather than during the monsoon. Additionally, potato production can be negatively affected by various harmful organisms such as pests, diseases, bacteria, and viruses. As a result, effective pest management is crucial in minimizing crop losses while also minimizing negative impacts on the environment.

In the Southern Shan State, various diseases affect potato production, including bacterial wilt, late blight, early blight, and root-knot. Ethnic potato farmers have observed that water scarcity and excessive rainfall can lead to decreased potato yields. Additionally, seed and soil-borne diseases significantly impact the potato production cycle.

In general, farmers utilize fungicides to manage it (Asano & Tamiya, 2016). Summer potato growers tend to use more pesticides compared to monsoon potato

growers (Soe Soe Lwin, 2012). The majority of farmers begin applying fungicides upon observing late blight symptoms in their crops. The application of pesticides varies depending on the type of crops and prevailing weather conditions. The employment of chemical pesticides in potato farming offers both benefits and drawbacks, as they help farmers prevent crop losses and achieve high yields, yet the residues can pose risks to farmers and animals, particularly in developing nations.

In Myanmar, some of the potato farmers still face late blight of potato especially in the Southern Shan State. These farmers are in need of high-quality seed varieties that can produce high yields and are resistant to late blight. In Southeast Asia, the northern agricultural regions of Thailand are likely the most suitable areas for seed potato production, as they experience lower levels of rainwater and disease occurrence compared to other regions (Kittipadakul et al., 2016).

3.5 Myanmar Good Agriculture Practice Protocol

Myanmar Good Agriculture Practice (GAP) aims to guarantee food safety and enhance the quality of products. It involves implementing agricultural practices that minimize environmental impact and prioritize the health and well-being of workers. This system is utilized throughout the cultivation and production of crops to minimize the risk of product damage during harvesting and post-harvest handling operations.

The methods of GAP in Myanmar guarantee the safety, quality, and cost-effectiveness of products cultivated by individuals or organizations adhering to this practice. Products from the GAP system should undergo retrospective inspection to verify their safety and transparency.

Myanmar's implementation of GAP is founded on the principles of ASEAN GAP and GLOBAL GAP. This approach ensures the safe production of crops, not only within Myanmar but also for export to ASEAN regions and beyond. Furthermore, it is imperative that good agriculture practices are adopted and implemented throughout Myanmar.

Table (3.4) Myanmar Good Agriculture Practice Protocol

No.	Particular	Points to be followed
1	Selection of land to be planted	The agricultural land and surrounding land must not become a chemical or biological hazard. Plantation map and records must be kept.
2	Water	The quality of water to be used for cultivation must be analyzed. Do not use municipal waste water, breeding zone water, hospital water and factories water that may cause harm to the environment. (If the wastewater is recycled and used, it should be used according to the WHO Guideline).
3	Seeds	Good quality varieties that are suitable for the water and soil area and are free from pests and diseases must be planted. The seeds to be planted Where seedlings and reproductive parts are obtained. The number received and the date received must be recorded.
4	Fertilizers and soil amendments	Fertilizers or soil additives used for each crop must not contain harmful chemical and biological contaminants. Natural fertilizers must be properly decomposed and used. Mixing and storage of fertilizers or soil amendments, decomposing organic materials should not be done in areas that affect the cleanliness of soil and water resources. When buying and using fertilizers (or soil supplements), they must be registered materials and must be recorded in the records.

Table (3.4) Myanmar Good Agriculture Practice Protocol (Continued)

No.	Particular	Points to be followed
5	Agricultural chemicals and other chemicals	Multi-pest control methods should be used to minimize the use of chemicals. In accordance with the regulations of pesticide act fertilizer law, special care must be taken to prevent environmental pollution and harm to human health. If it is necessary to use chemicals, only officially recognized and registered chemicals should be used. According to the group of drugs that will be used after spraying, the waiting period before harvesting must be strictly followed. Must know and understand the proper handling and use of pesticides. Buy chemicals storage usage and disposal must be carried out properly and recorded in records. Fuel handling and using lubricants and other non-agricultural chemicals to minimize the risk of crop contamination, Storage and disposal must be done.
6	Plant Care	Care must be taken according to the correct method according to the crop.
7	Agricultural equipment and other related equipment	The equipment used for crop production, storage facilities and other facilities must be free from crop contamination. Waste chemicals and other hazardous materials used must be identified. Do not add or store cereal products with these materials.

Table (3.4) Myanmar Good Agriculture Practice Protocol

No.	Particular	Points to be followed
8	Harvesting and product processing	Crops must be picked and harvested at the correct ripeness using appropriate techniques. Harvested produce must be placed on a clean surface/material so that it does not come into direct contact with the soil (or the floor of the handling and packing area) (or the floor of the storage area). The water used for crops and parts that need to be cleaned must be clean and pure. According to the standards set for each crop, they must be graded and packed properly.
9	Storage and Transportation	The products are chemical, separate storage from products that may cause biological and physical contamination risks; Must carry. Do not store products mixed with other materials, including agricultural tools, fuel pesticides and fertilizers. Cleanliness before using transport vehicles; chemical spills; Check for contamination with other materials.
10	Construction of buildings	In order to minimize the risk of disaster during handling, packaging of products processing and storage, separate buildings must be constructed or designated areas and must be repaired and maintained.
11	Animal and pest control	The package must not be in storage areas of harvesting domestic and farm animals.

Table (3.4) Myanmar Good Agriculture Practice Protocol

No.	Particular	Points to be followed
12	Evidence and records	Producers must keep records related to good agricultural practices for a minimum of two (2) years. Records must be recorded in the record format specified for the current work.
13	Back check and storage	In order to be able to trace back to the place of production of the crop, a clear mark and registration mark must be placed on the packaging materials. Keep a record of the place of shipment and the date of delivery for each crop product.
14	Training	Producers and workers must attend good agricultural practice courses to obtain skills and techniques according to their field of business.
15	Review of practices	All operations must be reviewed at least once a year to ensure that the methods used by producers are being followed correctly. If there are any complaints, you will have to resolve them yourself. Records must be maintained for these activities.
16	Personal hygiene and well-being of workers	Instructions related to personal hygiene must be written and displayed in prominent places in the workplace or distributed to the workers. Sewage and waste water must be disposed of carefully so as not to be hazardous. Workers' health and social welfare must be taken care of.

Source: Department of Agriculture (2024)

The proper agricultural practice applications are sent to the GAP website through the assistance of the Township Admin, following verification and approval by the township manager. The completion of the application accounts for 20%. Field inspections are carried out by the district field inspection team, which also aids in water and soil testing.

The GAP Guideline records are endorsed by the district supervisor and then forwarded to the regional/state supervisor. The inspection records need to be uploaded to the GAP website with the district supervisor's approval. The application is deemed completed 50%. The Department of Horticulture, Vegetables, and Plant Biotechnology oversees and supports the inspection records in line with the GAP Guideline, which are submitted with the district supervisor's approval and then sent to the director.

The inspection records must be uploaded to the GAP website with the regional/state supervisor's endorsement. The application is considered completed 70%. The records are submitted with the regional/state supervisor's approval. The Horticulture, Vegetable, and Plant Biotechnology Division; manages the verified GAP certificates from the GAP department.

These certificates must be sent to the Director General (Agriculture Department) with the Director's approval. The township district GAP certificate can be issued after verifying all inspection records with endorsements from the regions/provinces on the GAP website. The application is considered fully completed 100%.

CHAPTER IV
SURVEY ANALYSIS

4.1 Survey Profile

Kalaw Township is between North Latitude 20 degrees 20 minutes and East Longitude 96 degrees 26 minutes in Kalaw District, Shan State, Myanmar. This township is 382.13 square miles in size, with 257 villages contained within 27 village tracts. It borders the following areas: Thasi Township and Pywebwe Township in the west; Pin Laung Township in the south; Naung Shwe Township and Taunggyi Township in the east; Pindaya Township and Yatsauk Township in the north.

The climate in Kalaw Township is subtropical. There are three distinct seasons in this region: the rainy season, which spans from April to mid-November, the winter season, which lasts from November to February, and the summer season, which lasts from March to April. 85.17 mm of total rainfall and 91 days of wet weather are averages. With 202.95 mm, May has the most rainfall, while January has the least amount with 4.06 mm. The average mean temperature is 4.25˚C in January and reaches a high of 30.65˚C in May.

The township of Kalaw Township, which is part of Shan State, has the economic hub of Aung Ban. The township's residents work mostly in agriculture. Potatoes, garlic, ginger, tomatoes, cabbage, cauliflower, and oranges are the township's principal exports to areas of Myanmar.

Kalaw Township has 4928 hectares of potato producing land, of which 4085 hectares are used for monsoon crops and 843 hectares for summer crops. As a result, Kalaw Township accounts for close to 25% of Shan State's entire cultivated land. Rainfed, hilltop potato farms produce the majority of their crop. In the summer, a small irrigated field in the foothills valley (lowland) is farmed. Potatoes are mostly farmed as a monocrop on steep slopes. Table (4.1) displays the Kalaw Township's potato production and cultivated area.

Table (4.1) Potato Cultivated Area and Production in Kalaw Township

Year	Cultivated Area (Acre)	% Change	Production (Ton)	% Change
2017-2018	10320	1	95307	1
2018-2019	12130	+ 17.5	97119	+ 1.9
2019-2020	12135	+ 0.1	98391	+ 1.3
2020-2021	12225	+ 0.7	99326	+ 1.0
2021-2022	12103	- 0.9	98198	- 1.1
2022-2023	12251	+ 1.2	99586	+ 1.4

Source: Kalaw Township Department of Agriculture, 2024

According to Table (4.1), the increase in potato production in Kalaw Township is a result of the expansion of potato cultivation areas from 2017 to 2023. The study results showed that to the increase in potato production is the adoption of modern agricultural techniques and technologies by farmers in Kalaw Township. These practices, including precision farming, use of high-quality seeds, and efficient irrigation methods, have enhanced crop yields and overall productivity. The rise in market demand for potatoes, both domestically and internationally, has incentivized farmers in Kalaw Township to expand their production. Favorable prices and export opportunities have encouraged increased cultivation of potatoes, leading to a surge in overall output.

The fluctuations in potato production in Kalaw Township, Shan State, are influenced by a myriad of factors ranging from technological advancements and market dynamics to environmental challenges and policy interventions. Understanding these complexities is essential for developing targeted strategies to enhance the resilience and sustainability of potato farming in the region. By fostering collaboration among stakeholders, investing in research and innovation, and promoting sustainable agricultural practices, Kalaw Township can navigate the ebbs and flows of potato production with confidence and foresight.

Heho' village is near the railway and highway that connects Taunggyi to Yangon. The village has both lowland and upland farming areas. The soil in the lowland areas is mostly red laterite, while the soil in the upland areas is peaty and clay loam. Moving on to Myanchar village, it is in a mountainous area about 7 miles from the

Taunggyi-Yangon highway. Myanchar is known for its upland farming areas, especially on slope lands in the hilly area. The soil in the potato area is red laterite.

Table (4.2) Sample of the Study

Name of Village	Number of Respondents
Heho	50
Myanchar	50

Source: Survey data, 2024

4.2 Survey Design

Relied on the voluntary participation of individuals and interview inquiries. It employed the descriptive analysis approach using both primary and secondary data. Primary data was gathered through a structured questionnaire, while secondary data was sourced from pertinent departments in Kalaw Township. The study involved 100 respondents from two villages in Kalaw Township, selected through a simple random sampling method. The survey questionnaire was divided into three sections: (a) characteristics of the respondents, (b) potato farming and (c) good agricultural practices in potato production. The survey questionnaire utilized multiple choice questions and a five-point Likert scale.

4.3 Survey Result

The survey result is showed on characteristics of the respondents, potato farming, and good agricultural practices in potato production. The following Table (4.3) presents the characteristics of the respondents such as gender, age, educational qualification, marital status and ethnic.

Table (4.3) Characteristics of the Respondents

Particular	No. of Respondents	%
Gender		
Male	96	96.0
Female	4	4.0
Total	**100**	**100**
Age Group		
20 years to 30 years	17	17.0
31 years to 40 years	37	47.0
41 years to 50 years	23	23.0
51 years to 60 years	15	15.0
More than 60 years	8	8.0
Total	**100**	**100**
Educational Qualification		
Middle school	36	36.0
High school	60	60.0
Graduate	4	4.0
Total	**100**	**100**
Marital Status		
Single	12	12.0
Married	88	88.0
Total	**100**	**100**
Ethnic		
Danu	52	52.0
Intha	4	4.0
Burma	7	7.0
PaO	12	12.0
Taungyoe	25	25.0
Total	**100**	**100**

Source: Survey data, 2024

According to Table (4.3), the study made an assessment through sample respondents of 100 potato farmers from two villages. The majority of respondents are

male and married. Most respondents are those who are still in the working age level as the majority's age ranges from 31 years to 50 years and this is somehow a factor that they may have the capacity to hold on to the livelihood activities they are engaged in. This states why the villagers or respondents are relying largely on agriculture for their livelihood. The majority of the total respondents' main income earning activity is agriculture. The majority of the respondents have high school level. This is also linked to the factor of education status of the respondents have to rely on agriculture. Majority of the respondents are Danu followed by Taungyoe, PaO, Burma and Intha.

Table (4.4) Years of Residence

Particular	No. of Respondents	%
10 years to 20 years	4	4.0
More than 20 years	96	96.0
Total	**100**	**100**

Source: Survey data, 2024

According to Table (4.4), all of the respondents are living in the study area and most of the respondents have been living more than 20 years.

Most of the potato farmers cultivate potatoes in lowland areas and work on their own land. All the respondents said that post-monsoon potato is the main source of income.

Table (4.5) Areas of Potato Farmland

Particular	No. of Respondents	%
1 acre to 3 acres	50	50.0
4 acres to 6 acres	23	23.0
7 acres to 9 acres	20	20.0
10 acres to 12 acres	3	3.0
Above 16 acres	4	4.0
Total	**100**	**100**

Source: Survey data, 2024

According to Table (4.5), 50 respondents cultivate potatoes in 1 care to 3 acres, 23 respondents cultivate in 4 acres to 6 acres, 20 respondents cultivate in 7 acres to 9

acres, 3 respondents cultivate in 10 acres to 12 acres and 4 respondents have above 16 acres respectively.

The land is left empty during the dry season until it is time to plant again. The next year, mountain rice is grown from May to June until October to November. After that, the land is not used for farming for another year. On the steep hills, potatoes are grown as a post-monsoon crop from August to November. After the first year, the land is left empty. Planting paddy starts in June and ends in November. There is a one-month break between harvests. Planting potatoes in January and harvesting them in April comes after paddy. Some people in that area also put corn after the potatoes.

Table (4.6) Subsidiary Cropping in the Potato Farming

Particular	No. of Respondents	%
Paddy	96	96.0
Corn	4	4.0
Total	**100**	**100**

According to Table (4.6), most of the respondents said that they have cultivated paddy in the potato farming.

Table (4.7) Hire Labors

Particular	No. of Respondents	%
3 Persons	2	2.0
4 Persons	5	5.0
5 Persons	14	14.0
7 Persons	10	10.0
8 Persons	36	36.0
10 Persons	22	22.0
12 Persons	11	11.0
Total	**100**	**100**

Source: Survey data, 2024

According to Table (4.7), the potato farmers hired labors while they require to work in their operation for potato growing season. There are at least three number of hired laborers and a maximum of twelve number.

Table (4.8) Labors Cost for Potato Cultivation Season

Particular	No. of Respondents	%
Kyat 300,000	35	35.0
Kyat 400,000	31	31.0
Kyat 450,000	3	3.0
Kyat 500,000	23	23.0
Kyat 525,000	8	8.0
Total	**100**	**100**

Source: Survey data, 2024

According to Table (4.8), the potato farmers said that the cost of hired labor is 300,000 kyats to 550,000 kyats during the potato cultivation season.

Table (4.9) Post-monsoon Potato Cultivated Acre

Particular	No. of Respondents	%
3 acres	50	50.0
5 acres	4	4.0
6 acres	19	19.0
8 acres	13	13.0
9 acres	7	7.0
12 acres	3	3.0
20 acres	4	4.0
Total	**100**	**100**

Source: Survey data, 2024

According to Table (4.9), 50 respondents cultivated three acres of post-monsoon potato, 4 respondents cultivated five acres, 19 respondents cultivated six acres, 13 respondents cultivated eight acres, 7 respondents cultivated nine acres, 3 respondents cultivated twelve acres and 4 respondents cultivated twenty acres respectively.

Table (4.10) Post-monsoon Potato Production

Particular	No. of Respondents	%
9600 kg/acre	23	23.0
11200 kg/acre	66	66.0
11520 kg/acre	4	4.0
12800 kg/acre	7	7.0
Total	**100**	**100**

Source: Survey data, 2024

According to Table (4.10), most of the respondents said that they have produced 11200 kg per acre from post-monsoon potatoes

Table (4.11) Annual Income of Post-monsoon Potato Production

Particular	No. of Respondents	%
Kyat 2,000,000	27	27.0
Kyat 2,500,000	8	8.0
Kyat 3,000,000	65	65.0
Total	**100**	**100**

Source: Survey data, 2024

According to Table (4.11), as the annual income of post-monsoon production, most of the respondents said that they have received 3,000,000 kyats. The potato farmers answered that the income situation from potato cultivation has increased in the last three years as shown in Table (4.12).

Table (4.12) Condition of Income from Potato Farming within Three Years

Particular	No. of Respondents	%
Stable	4	4.0
Increase	96	96.0
Total	**100**	**100**

Source: Survey data, 2024

In the study area, most of the potato farmers have applied good agriculture practice from non-governmental organization and township department of agriculture.

Table (4.13) Applied Good Agriculture Practice

Particular	No. of Respondents	%
Do not apply	26	26.0
Prepare for application	48	48.0
Got certificate	26	26.0
Total	**100**	**100**

Source: Survey data, 2024

According to Table (4.13), 48 respondents are preparing for application of good agriculture practice and 26 respondents got certificate.

This section presents the knowledge on good agricultural practices of potato farmers in the study area. The following Table (4.14) shows the agricultural land management of potato farmers.

Table (4.14) Agricultural Land Management

Particular	Mean	S.D
Agricultural land and surrounding land must not be chemical or biologically hazardous land.	3.65	0.648
It must be a land with an advantage in crop rotation.	4.51	0.753
It must be land for mixed crops and crops.	3.96	0.716
In agricultural land, nitrogen, phosphorus and potassium should be added regularly.	3.65	0.693
Overall Mean Value	**3.94**	**0.703**

Source: Survey data, 2014

According to Table (4.14), the respondents approved that the agricultural land and surrounding land must not be chemical or biologically hazardous land. Moreover, the agricultural land with an advantage in crop rotation and this land for mixed crops. And also, they used nitrogen, phosphorus and potassium.

Table (4.15) Agricultural Usage Water

Agricultural Water	Mean	S.D
The quality of water to be used for cultivation must be known.	4.01	0.052
Do not use water that may cause harm to agriculture or the environment.	3.24	0.074
Do not use waste water for cultivation.	3.82	0.061
Good water must be used for the products.	4.75	0.520
Overall Mean Value	**3.96**	**0.177**

Source: Survey data, 2024

According to Table (4.15), the respondents agreed that the quality of water to be used for cultivation must be known. Although, the respondents are moderately knowledge on the use water that may cause harm to agriculture or the environment. But the respondents agreed that they did not use waste water for cultivation. Moreover, the respondents have used good water for the potato production.

Table (4.16) Seeds and Plant Care

Seeds and Plant Care	Mean	S.D
Good quality varieties must be selected and planted according to the region.	2.15	0.673
Records of seedlings and reproductive components shall be kept.	3.41	0.494
Plants must be planted properly.	3.86	0.501
Must be able to take care of plants properly.	3.84	0.731
Overall Mean Value	**3.32**	**0.601**

Source: Survey data, 2024

According to Table (4.16), the respondents have known good quality varieties must be selected and planted for suitable cultivation area but they have not got good quality seeds. The respondents indicates that they have kept records of seedling and reproductive components. The respondents have very care to plants properly.

Table (4.17) Fertilizers and Agricultural Chemicals

Particular	Mean	S.D
Fertilizers must be properly decomposed and used.	3.71	0.421
Manure used for each crop must be free of harmful chemical and biological substances.	3.53	0.508
Must be able to use chemical pesticides properly.	3.68	0.723
Chemical pesticides must not cause health and environmental harm.	3.47	0.652
Overall Mean Value	**3.60**	**0.576**

Source: Survey data, 2024

According to Table (4.17), the respondents have knowledge on fertilizers are properly and decomposes and used. The respondents approved that manure used for each crop must be free of harmful chemical and biological substances. The respondents agreed that they have chemical pesticides properly and they have knowledge on chemical pesticides must not cause health and environmental harm.

Table (4.18) Harvesting and Production

Particular	Mean	S.D
Crops must be picked and harvested properly at the right ripeness.	4.50	0.761
Harvest and produce must be kept in a clean place.	4.62	0.520
After harvesting, the products must be properly packed and sent.	4.25	0.605
There must be no animals near the area where the products are harvested and stored.	3.86	0.802
Overall Mean Value	**4.31**	**0.672**

Source: Survey data, 2024

According to Table (4.18), the respondents have picked and harvested properly at the right ripeness and they have kept their products in a clean place. The respondents indicates that they have packed and send their products to the markets. The respondent approved that they have no animals near the area where the products are harvested and stored.

Table (4.19) Potato Farmers Perspective Upon Good Agricultural Practices

Particular	Mean	S.D
Understanding good agricultural practices	3.48	0.836
Preference good agricultural practices	3.20	0.614
Healthy crop production	3.71	0.530
Clean farm	3.52	0.721
Increase crop income	4.31	0.820
Overall Mean Value	**3.64**	**0.704**

Source: Survey data, 2024

Table (4.19) shows that the respondents had a reasonable degree of knowledge of and desire for excellent agricultural practices. In response, the respondents firmly agreed that increased revenue and good agricultural production were priorities. They have also committed to cleaning the property.

Potato growers are eager to implement GAP, but since it is still in its infancy, additional assistance is required. Customers must also assist in GAP and agricultural production by helping with marketing, fair pricing, value-added goods, social support, guidance, and other aspects.

Most potato growers find it difficult to yield crops that fully realize their potential, and many are unable to do so. Despite being a relatively new strategy, some farmers are reluctant to switch from their previous practices to Good Agricultural Practices. Therefore, technical support is required to enable these farmers to use GAP on their fields.

Table (4.20) Types of Capacity Building Trainings for Good Agricultural Practices

Particular	Mean	S.D
Organic pesticide	4.38	0.520
Good agricultural practices operational techniques	4.20	0.635
Clean storage, package process	4.83	0.528
Marketing	4.35	0.734
Environmental conservation	4.26	0.253
Overall Mean Value	**4.04**	**0.534**

Source: Survey data, 2024

Table (4.20) shows that the respondents researched organic pesticides, operational procedures for appropriate agricultural practices, clean storage and packaging methods, marketing, and environmental preservation.

This research also discovered the types of GAP capacity development training. When it comes to trainings, the majority of potato farmers prefer to attend GAP operating procedures effectively. Actually, developing their marketing abilities is more important. While the GAP program is started, a work plan for capacity development training is required. The production of organic pesticides and their use, together with training, will help the GAP certification process and organic food.

The majority of responders are considering GAP for the production of potatoes. Due to decades-long use of inorganic pesticides that contaminated groundwater, they practiced on farms. Because GAP uses agricultural techniques that are responsible for farmers, consumers, and the environment, it may reduce soil and water pollution.

Increased output and quality in the production of potatoes the implementation of GAP techniques increases exports and market competitiveness. Potato growers may readily use GAP production guidelines that align with native knowledge and organic agro-ecosystems. Quality demands the efficient use of scarce resources. Selecting inputs that are safe for the environment is crucial.

GAP is an acronym for guidelines for the sustainable and safe production of animals and crops. It attempts to minimize production costs and environmental effect while assisting farm owners in maximizing yields and streamlining company operations. Producers find it simpler to provide goods with the quality that customers

and merchants expect when there is GAP. GAP is significant because it promotes ethical agricultural practices across the board, from selecting sites and preparing the soil to harvesting and handling.

CHAPTER V
CONCLUSION

5.1 Findings

In Kalaw Township, Shan State, farmers are using appropriate agricultural methods to produce potatoes, according to the report. Within the context of this research, good agricultural practices refer to rules that govern on-farm production and post-production procedures with the goal of optimizing agricultural productivity while taking sustainability into account on the levels of the economy, society, and environment.

Kalaw Township has 4928 hectares of potato producing land, of which 4085 hectares are used for monsoon crops and 843 hectares for summer crops. As a result, Kalaw Township accounts for close to 25% of Shan State's entire cultivated land.

Since most responders are between the ages of 31 and 50, it stands to reason that the majority of them are still in the working age range and might be able to continue with their current line of employment. This explains why the responders, or peasants, mostly depend on agriculture for their living. Agriculture is the primary source of income for the vast majority of respondents.

The majority of potato farmers labor on their own property and grow potatoes in lowland regions. Every responder said that the primary source of income is post-monsoon potatoes. In potato cultivation, the majority of respondents claimed to have grown paddy. In order to have workers during the potato growing season, the potato growers employed laborers. In the potato growing season, contracted labor costs range from 300,000 to 550,000 kyats.

The majority of those surveyed state that their earnings from the production of potatoes total 3,000,000 kyats. In response, the potato farmers said that throughout the previous three years, their revenue from growing potatoes had risen. The majority of potato growers have implemented appropriate agricultural practices that they learned from non-governmental organizations and the municipal agriculture department.

The study's findings demonstrated that farmers in Kalaw Township are adopting contemporary agricultural practices and technology, which has increased potato output. Precision farming, the use of premium seeds, and effective irrigation techniques are some of the strategies that have increased agricultural yields and overall production. Potato demand has increased both locally and globally, which has encouraged growers in Kalaw Township to increase their output. Potato farming has expanded due to favorable pricing and export prospects, resulting in an increase in total production.

Compared to conventional farming methods, they are hesitant to use GAP since it is a new technique. Therefore, in order to implement GAP on their farms, some farmers need specialized assistance. When it comes to trainings, the majority of potato farmers prefer to attend GAP operating procedures effectively. Actually, developing their marketing abilities is more important. While the GAP program is started, a work plan for capacity development training is required. Making and using organic pesticides and providing training on them assist the GAP certification process and organic food.

5.2 Suggestions

Based on the results, the research suggests that low prices during seasons of high output prevent potato producers from making annual crop expenses payments. As a result, setting production goals for potatoes that take into account the demand in this area is crucial. The Myanmar Agriculture Service need to carry out these goals.

In order to guarantee a satisfactory harvest, potato production requires a substantial financial and resource commitment. Regretfully, a lot of farmers lack the resources needed to grow potatoes effectively. It is necessary for the government to support potato growers financially, and it is also important to urge the private sector to give loans that are easily available and come with advantageous terms.

Through the provision of necessary infrastructure, the application of suitable market stimuli, the development of inclusive agribusiness structures, and the support of information and communication technology that promotes inclusive value chains, the government should establish a favorable environment for agri-food enterprises. Policies and regulatory frameworks must ensure that smallholder farmers have access to rural finance, education, technical assistance, and an agrochemical subsidy program in order to enable them participation in developing value chains.

The efficient provision of agricultural extension services by subject matter experts with the aim of educating farmers on optimal agricultural techniques and crop

patterns. Farmers will then be able to put into practice techniques like using fertilizer correctly, using better seeds, managing diseases, and making effective use of resources.

The research concludes that prioritizing awareness-raising initiatives before adopting GAP is crucial for improving Good Agricultural Practice among potato producers in the study region. Additionally, it is essential to provide chosen pilot farmers GAP trainings and continuing coaching. The promotion of farmers scaling up their operations to satisfy global market standards should also be a priority, with an emphasis on crop quality and demand.

Women farmers would have more access to GAP methods training than male farmers. GAP's female leaders confront obstacles arising from societal conventions, cultural standards, and women's skills. Governmental and non-governmental groups may overcome these barriers by putting policies and initiatives into action.

Complete nationwide implementation of the rules is required to meet the national GAP objective. The objective of these recommendations is to improve farmers' access to high-quality inputs and so increase agricultural production, market access, and competitiveness.

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SURVEY QUESTIONNAIRE

I am studying Master of Public Administration at Yangon University of Economics. I have designed the following survey questionnaire for **"A STUDY FARMERS' IMPLEMENTATION OF GOOD AGRICULTURAL PRACTICES ON POTATO PRODUCTION IN KALAW TOWNSHIP, SHAN STATE"**. I would appreciate if you filled out this short survey and answer as honestly as possible. **Your responses will be kept confidential**. The survey questionnaire will take approximately 15 to 20 minutes. I expect your kind cooperation in this respect. Please put a ☑ in the relevant square given. Thanks for your time.

Name of Village _____

Name of Village Track _____

Section (A) Characteristics of the Respondents

1. Gender

(a) Male ☐ (b) Female ☐

2. Age Level

(a) Less than 20 years ☐ (b) 20 to 30 years ☐ (c) 31 to 40 years ☐

(d) 41 to 50 years ☐ (e) 51 to 60 years ☐ (f) More than 60 years ☐

3. Educational Qualification

(a) Primary school ☐ (b) Middle school ☐ (c) High school ☐ (d) Undergraduate ☐

(e) Graduate ☐ (f) Postgraduate ☐ (g) Others ☐

4. Marital Status

(a) Single ☐ (b) Married ☐ (c) Divorced ☐ (d) Widowed ☐

5. Do you live in this village/village tract/township all your life?

(a) Yes ☐ (b) No ☐

6. How many years do you live in this village/village tract/township?

(a) Less than 10 years ☐ (b) 10 to 20 years ☐ (c) More than 20 years ☐

7. Ethnic _____

Section (B) Potato Farming

1. Acres of farmland

(a) 1 to 3 acres ☐ (b) 4 to 6 acres ☐ (c) 7 to 9 acres ☐ (d) 10 to 12 acres ☐

(e) 13 to 15 acres ☐ (f) Above 16 acres ☐

2. Type of farmland

(a) Lowland ☐ (b) Upland ☐ (d) Lowland and Upland ☐

3. Farmland ownership

(a) Owner operated ☐ (b) Lease operated ☐ (c) Unregistered farmland ☐

4. Main source of income from farming

(a) Pre-Monsoon Potato ☐ (b) Post-Monsoon Potato ☐ (c) Others (_____)

5. Name of others crop in the farming

(a) Paddy ☐ (b) Coffee ☐ (c) Ginger ☐ (d) Onion ☐ (e) Corn ☐ (f) Garlic ☐

(g) Others (Please specify _____)

6. Main source of potato farming labor

(a) Family labors ☐ (b) Hire local labors ☐ (c) Hire other township labors ☐

7. Number of full-time potato farming labors

(a) Family labors ( ) No. (b) Hire labors ( ) No.

8. Number of part-time potato farming labors

(a) Family labors ( ) No. (b) Hire labors ( ) No.

9. Average monthly cost for labors ( ) Kyat

10. Ownership of farming equipment (Please fill up)

Particular	**Number**

11. Cultivated, Yield and Production of Potato

Particular	**Cultivated (Acre)**	**Yield (Kg/Acre)**	**Production (Kg/Acre)**
Pre-Monsoon			
Post-Monsoon			

12. Total Production Cost of Potato Farming

Particular	**Pre-Monsoon (Kyat/Acre)**	**Post-Monsoon (Kyat/Acre)**
Land preparation cost		
Seed cost		
Planting (ploughing and harrowing) cost		
Fertilizer cost		
Labor cost of fertilizer application		
Pesticide cost		
Labor cost for pesticide application		
Weeding cost		
Harvesting cost		
Post harvesting cost		
Total cost		

13. Gross Profit of Potato Farming

Pre-Monsoon (Kyat/Acre)	**Post-Monsoon (Kyat/Acre)**

14. Annual Income of Potato Farming

Pre-Monsoon (Kyat/Acre)	**Post-Monsoon (Kyat/Acre)**

15. Condition of Income from Potato Farming within Three Years

(a) Stable ☐ (b) Increasing ☐ (c) Decreasing ☐

16. How to sell potato?

(a) Selling at own shop ☐ (b) Selling to wholesalers ☐ (c) Selling to retailers ☐

(d) Selling to exporters ☐ (e) Selling to value added producers ☐

17. Do you apply good agricultural practices?

(a) Do not apply☐ (b) Prepare for application ☐ (c) Got certificate ☐

18. Which organization provide good agricultural practices training?

(a) Department of Agriculture ☐ (b) Non-governmental Organization ☐

19. How many times did you attend good agricultural practice training?

(a) None ☐ (b) One time ☐ (c) Two times ☐ (d) Three times ☐

Section (C) Good Agricultural Practices in Potato Production

I. Knowledge on Good Agricultural Practices

(1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree)

Agricultural Land Management	**1**	**2**	**3**	**4**	**5**
Agricultural land and surrounding land must not be chemical or biologically hazardous land.					
It must be a land with an advantage in crop rotation.					
It must be land for mixed crops and crops.					
In agricultural land, nitrogen, phosphorus and potassium should be added regularly.					
Agricultural Water	**1**	**2**	**3**	**4**	**5**
The quality of water to be used for cultivation must be known.					
Do not use water that may cause harm to agriculture or the environment.					
Do not use waste water for cultivation.					
Good water must be used for the products.					
Seeds and Plant Care	**1**	**2**	**3**	**4**	**5**
Good quality varieties must be selected and planted according to the region.					
Records of seedlings and reproductive components shall be kept.					
Plants must be planted properly.					
Must be able to take care of plants properly.					

Fertilizers and Agricultural Chemicals	**1**	**2**	**3**	**4**	**5**
Fertilizers must be properly decomposed and used.					
Manure used for each crop must be free of harmful chemical and biological substances.					
Must be able to use chemical pesticides properly.					
Chemical pesticides must not cause health and environmental harm.					
Harvesting and Production	**1**	**2**	**3**	**4**	**5**
Crops must be picked and harvested properly at the right ripeness.					
Harvest and produce must be kept in a clean place.					
After harvesting, the products must be properly packed and sent.					
There must be no animals near the area where the products are harvested and stored.					

II. Potato Farmers Perspective Upon Good Agricultural Practices

(1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree)

Particular	**1**	**2**	**3**	**4**	**5**
Understanding good agricultural practices					
Preference good agricultural practices					
Healthy crop production					
Clean farm					
Increase crop income					

III. Types of Capacity Building Trainings for Good Agricultural Practices

(1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree)

Particular	**1**	**2**	**3**	**4**	**5**
Organic pesticide					
Good agricultural practices operational techniques					
Clean storage, package process					
Marketing					
Environmental conservation					

Thanks for your participation.