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A STUDY OF SUGARCANE CULTIVATION AND SUGAR PRODUCTION IN TAIKKYI TOWNSHIP

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A STUDY OF SUGARCANE CULTIVATION AND SUGAR PRODUCTION IN TAIKKYI TOWNSHIP

A thesis submitted as a partial fulfillment towards the requirement of the Degree of Mater of Public Administration (MPA)

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This is to certify that this thesis entitled **"A STUDY OF SUGARCANE CULTIVATION AND SUGAR PRODUCTION IN TAIKKYI TOWNSHIP",** 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

This study aims to investigate the factors affecting sugarcane cultivation and analyze the sugar production in Taikkyi Township, Myanmar. The study uses descriptive method by utilizes both primary and secondary data, with primary data collected through a structured questionnaire administered to 100 sugarcane farmers in Taikkyi Township. The findings reveal significant obstacles, including labor availability and costs, a heavy reliance on herbicides, challenges in securing rented land, and high input costs for fertilizers. These issues link to a decline in sugarcane cultivation and production in Taikkyi Township, which poses a risk to the output of the Okkan Sugar Mill, heavily dependent on local sugarcane availability.

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ABBREVIATIONS

AIT	Annual International Trade Statistics
CSO	Central Statistical Organization
CSR	Corporate Social Responsibility
FAO	Food and Agriculture Organization
ICU	International Control Unit
IPM	Integrated Pest Management
MMK	Myanmar Kyat
MOALI	Ministry of Agriculture, Livestock and Irrigation

CHAPTER I
INTRODUCTION

1.1 Rationale of the Study

Sugarcane is one of the most important agricultural crops in Myanmar, contributing significantly to the country's economy and rural livelihoods. As a key raw material for sugar production, sugarcane plays a vital role in food processing industries and provides employment for thousands of farmers. Beyond its economic value, sugarcane farming supports rural development by creating jobs in both the cultivation and processing stages, thereby reducing poverty in farming communities. Given its importance, the stability and growth of the sugarcane sector are essential for maintaining economic progress, especially in regions like Taikkyi Township, where farming is a primary livelihood.

Despite the overall national trend of increasing sugarcane planting areas and yields in Myanmar, Taikkyi Township faces a contrasting situation. The region has experienced a steady decline in sugarcane cultivation and production output over recent years. This difference highlights the importance of examining the local conditions that are inhibiting growth in sugarcane farming within this specific township. Factors such as rising labor costs, difficulties in securing access to land, and the high cost of essential agricultural inputs like fertilizers and herbicides are making it increasingly challenging for farmers in Taikkyi to maintain sustainable sugarcane production. Addressing these local challenges is crucial to reversing the trend and aligning Taikkyi's sugarcane cultivation with the national growth pattern.

One of the critical problems facing sugar production in Taikkyi Township is the direct link between the availability of sugarcane and the operational capacity of Okkan Sugar Mill. Oakkan sugar mill is the only sugar mill located in the Taikkyi Township. As the primary sugar mill in the region, Okkan Sugar Mill relies entirely on the supply of sugarcane from local farmers to meet its production goals. However, with the ongoing decline in sugarcane output, the mill is struggling to maintain consistent production levels. This decline in raw material availability not only affects the mill's sugar yield but also hampers its ability to process other by-products like molasses. The instability in sugarcane supply threatens the overall efficiency and profitability of the

mill, making it necessary to find solutions that can boost sugarcane production in the region.

The current challenges faced by both sugarcane farmers and the Okkan Sugar Mill illustrate the interconnectedness of sugarcane cultivation and sugar production in Taikkyi Township. As sugar production depends entirely on the availability of sugarcane, any disruptions in farming practices or productivity directly impact the mill's capacity to produce sugar. The continued decline in sugarcane cultivation poses a significant threat not only to the mill's operations but also to the livelihoods of local farmers, as sugarcane is their primary source of income. Therefore, it is needed to study the underlying factors contributing to the decreasing sugarcane cultivation in Taikkyi Township and how these factors can be mitigated to improve both farming practices and sugar production outcomes.

1.2 Objectives of the study

The objective of this study was to investigate the factors affecting on sugarcane cultivation, and to analyze sugar production in Taikkyi Township, Yangon region.

1.3 Method of study

This study utilized descriptive method by using both primary and secondary data. The primary data was collected from sugarcane farmers by using structurally prepared a set of questionnaires. The secondary data were obtained from Okkan Sugar Mill in Taikkyi Township.

1.4 Scope and limitations of the study

This study focused on sugarcane cultivation practices processes within Taikkyi Township, specifically analyzing data collected from 100 sugarcane farmers in Okkan Sugar Mill, in Taikkyi Township.

1.5 Organizations of the study

This study was organized into five chapters. Chapter I provided an introduction, including the rationale of the study, objectives, methodology, scope and limitations, and organization of the study. Chapter II reviewed relevant literature on sugarcane cultivation and sugar production, with a focus on the role of the Okkan Sugar Mill in Taikkyi Township. Chapter III presented an overview of sugarcane cultivation and

sugar production at the Okkan Sugar Mill in Taikkyi Township. Chapter IV outlined the survey findings. And Chapter V concluded the study with recommendations for improving sugarcane cultivation and sugar production at the Okkan Sugar Mill in Taikkyi Township.

CHAPTER II
LITERATURE REVIEW

Sugarcane is an essential crop predominantly cultivated in tropical and subtropical regions. It serves as the main raw material for sugar production and is also a vital resource for various other sugar products. This literature review explores various views of sugarcane cultivation, sugar manufacturing, consumption, and production. Additionally, it examines the significance of sugarcane, its different varieties, the uses and nutritional value of sugar, as well as the crop's origins.

2.1 Importance of Sugarcane

Sugarcane holds immense importance globally, not only as a key source of sugar but also for its wide-ranging applications in various industries. As one of the most versatile crops, sugarcane is integral to the economies of many developing countries, supporting millions of livelihoods in both rural and urban areas. The crop is a primary raw material for producing sugar, which is essential for human consumption, food processing, and other sectors such as pharmaceuticals and beverages. Sugarcane's global significance extends beyond food production, influencing energy markets, environmental sustainability, and socio-economic development.

Firstly, sugarcane's importance is reflected in its contribution to global sugar production. Around 80% of the world's sugar is derived from sugarcane, with the remainder coming from sugar beet. The crop's high yield and efficiency make it the preferred source of sugar in tropical and subtropical regions, particularly in Brazil, India, Thailand, and China. The ability of sugarcane to produce large amounts of sugar per hectare and its relatively low input requirements have made it a crucial agricultural commodity, especially in regions where favorable growing conditions enable continuous cultivation and harvest throughout the year (FAO, 2021).

Economically, sugarcane is vital to the agricultural sectors of numerous countries, particularly in the developing world. It supports local economies by providing employment to millions of farmers, laborers, and workers involved in the cultivation, harvesting, processing, and transportation of sugarcane. In countries like Brazil, India, and Thailand, sugarcane is a major source of income for smallholder

farmers who rely on it as their primary cash crop. The revenue generated from sugarcane exports and domestic sales contributes significantly to national GDP, making it a critical sector for economic development (Singh & Mishra, 2020).

Beyond its role in sugar production, sugarcane is increasingly recognized for its potential as a renewable energy source. Sugarcane by-products, particularly bagasse and molasses, are used to produce ethanol, a biofuel that is gaining global traction as a cleaner alternative to fossil fuels. In countries like Brazil, sugarcane-based ethanol plays a crucial role in the transportation sector, powering millions of vehicles. The ability to produce ethanol alongside sugar allows sugarcane producers to diversify their revenue streams, making the crop an essential component of the renewable energy industry. This dual role of sugarcane in food and energy production underscores its importance in transitioning towards more sustainable energy solutions (Goldemberg et al., 2020).

In addition to its economic and energy benefits, sugarcane is also important from an environmental perspective. The crop is known for its high biomass production, which contributes to carbon sequestration, helping to mitigate the effects of climate change. Moreover, sugarcane is used in the production of bio-based products such as bioplastics and biodegradable packaging, offering alternatives to petroleum-based materials. These innovations are driving the development of a bio-economy, where sugarcane is increasingly valued for its environmental benefits and potential to reduce dependency on non-renewable resources (Carvalho et al., 2021).

The socio-economic importance of sugarcane is also evident in the role it plays in poverty alleviation and rural development. In many sugar-producing regions, the crop provides a stable income for farming communities, contributing to improved living standards and access to education, healthcare, and infrastructure. The sugarcane industry often stimulates local economies by generating employment opportunities, creating value-added industries like sugar refining, ethanol production, and by-product processing. The presence of sugar mills and processing plants in rural areas leads to the development of infrastructure such as roads, electricity, and water systems, further benefiting local communities (Chum & Garcia-Perez, 2021).

Furthermore, sugarcane has cultural significance in many parts of the world. It is not only a source of economic livelihood but also a crop deeply intertwined with local traditions and practices. In countries like India and Thailand, sugarcane is celebrated in festivals and religious rituals, symbolizing prosperity and abundance. Its cultivation

and harvesting are often associated with the annual agricultural cycle, making it a crop that is not only economically important but also culturally meaningful.

2.2 Background History of Sugarcane

Sugarcane (Saccharum officinarum) is one of the oldest cultivated crops, with a history that spans over 8,000 years. It is believed that the domestication of sugarcane first occurred in New Guinea, where indigenous people cultivated it for chewing and juice extraction. From there, the crop spread to nearby regions in Southeast Asia, particularly in Indonesia, Malaysia, and the Philippines (Galloway, 1989). The crop was eventually introduced to India, where its potential for sugar production was fully realized, becoming a staple in the Indian agricultural economy. India is often credited as the birthplace of crystallized sugar production, as early inhabitants learned to process the sugarcane juice into granular sugar, which became a highly sought-after commodity (Wailes, 1851).

By 327 BCE, during the reign of Alexander the Great, sugarcane was introduced to the Mediterranean and Middle Eastern regions, with Greek and Roman historians referring to sugar as “Indian salt” or “honey without bees” (Mintz, 1986). With the expansion of the Islamic Empire, sugarcane cultivation spread across the Middle East, North Africa, and Southern Europe. The Arabs played a critical role in developing sugar refining techniques and expanding its cultivation into Egypt, Spain, and Sicily. These developments helped establish sugarcane as an important economic crop in the Mediterranean region (Galloway, 1989).

The global significance of sugarcane dramatically increased during the European colonial period, particularly in the 15th and 16th centuries when Portuguese and Spanish explorers transported the crop to the Caribbean, Brazil, and other parts of the Americas. These regions provided the ideal climate for large-scale sugarcane production. As sugar consumption grew rapidly in Europe, the demand for sugarcane skyrocketed, leading to the establishment of plantations that utilized forced labor, particularly African slaves, to meet the labor-intensive demands of sugar production (Curtin, 1998). This shift not only fueled the transatlantic slave trade but also positioned sugar as a driving force in global trade networks during the colonial period (Solow, 1991).

The rise of sugarcane plantations in the Caribbean and Latin America also led to significant advancements in sugar refining and processing technology. Innovations

such as improved mills and boiling techniques allowed for higher yields of sugar, which in turn increased profitability for European colonizers (Mintz, 1986). Sugarcane cultivation transformed the agricultural economies of these regions, and by the 18th and 19th centuries, sugar had become a dominant export crop, essential to the economies of colonies like Jamaica, Cuba, and Brazil (Curtin, 1998).

2.3 Sugarcane Cultivation

Sugarcane cultivation plays a significant role in the agricultural economies of many countries, serving as a vital source of income for farmers and a key input in the production of sugar and other sugar products. Its long history, spanning centuries, has seen the crop evolve from a basic agricultural commodity to a critical industrial raw material, driving both economic and technological advancements. The literature surrounding sugarcane cultivation highlights the various agronomic practices, challenges in production, environmental impacts, and innovations aimed at improving yield and sustainability. This review explores the key studies that provide insights into the global and regional perspectives on sugarcane cultivation, with a focus on its socio-economic impact, production techniques, and evolving trends.

Sugarcane cultivation involves a combination of traditional and modern agricultural practices, depending on the region and technological advancements. The crop is typically planted using either the traditional sett method or mechanized planting techniques. In the sett method, cane stalks, known as "setts," are planted horizontally in furrows, which are then covered with soil. According to Singh et al. (2021), the use of high-quality setts, often from disease-resistant varieties, is essential to ensure a good yield. In regions with more advanced farming practices, mechanized planting methods are employed, which improve planting precision and reduce labor costs.

The growth cycle of sugarcane typically lasts between 10 and 18 months, depending on the climate, variety, and agricultural management. Sugarcane is known as a ratoon crop, meaning it can regrow after harvest from the remaining stalks left in the field. This ratooning ability allows farmers to harvest multiple crops from the same planting over successive seasons, which reduces the need for frequent replanting and minimizes input costs (Rao & Sharma, 2019). However, the quality of ratoon crops tends to decrease over time, and replanting is required after two or three cycles to maintain high yields.

Sugarcane's high-water demand makes irrigation a critical factor in its successful cultivation. Efficient water management systems, such as drip irrigation, are increasingly adopted in sugarcane-growing regions to optimize water usage and reduce wastage. Patel et al. (2020) notes that water stress during critical growth stages, such as tillering and elongation, can severely impact the yield and sugar content of the crop. In countries like India and Brazil, research into drought-resistant varieties is ongoing, aimed at improving crop resilience in regions with limited water availability or where climate variability poses challenges.

Fertilization is another important aspect of sugarcane cultivation. Nitrogen, phosphorus, and potassium are the primary nutrients required for optimal growth, along with micronutrients such as zinc and boron. The balanced application of fertilizers improves not only the yield but also the quality of the sugar produced. In recent years, there has been a shift towards sustainable farming practices, with integrated nutrient management systems combining organic and inorganic fertilizers to enhance soil health and reduce chemical input dependency (Singh et al., 2021). The use of biofertilizers and green manures is also becoming common in sugarcane cultivation, promoting soil fertility and reducing the environmental impact of synthetic fertilizers.

Weed and pest management are significant concerns in sugarcane cultivation due to the crop’s long growth cycle. Weeds compete for resources such as water, nutrients, and sunlight, reducing the overall productivity of the crop. Herbicides, mechanical weeding, and crop rotation are among the methods employed to control weed infestations. In terms of pest management, sugarcane is susceptible to various pests, including borers, aphids, and termites, which can affect both the yield and quality of the cane. Integrated Pest Management (IPM) strategies are now commonly used, combining biological control, chemical treatments, and cultural practices to manage pests more sustainably (Reddy et al., 2021).

Climate change poses a growing challenge to sugarcane cultivation. Rising temperatures, erratic rainfall patterns, and the increasing frequency of extreme weather events such as droughts and floods are already affecting the productivity of sugarcane crops in several regions. Climate-smart agriculture, including the use of climate-resilient varieties, improved water management techniques, and precision farming, is being promoted to mitigate the impact of these changes. According to a study by the FAO (2020), regions like South Asia and Latin America, which are major producers of

sugarcane, are increasingly focusing on adaptive strategies to ensure the sustainability of sugarcane farming in the face of climate variability.

Sugarcane cultivation is a complex process that requires careful management of various inputs, from water and soil nutrients to pest control and climate adaptation. The adoption of modern technologies, sustainable farming practices, and climate-resilient varieties will be crucial to maintaining the productivity and profitability of sugarcane farming in the coming years.

2.4 Sugar Production and Consumption

Sugar production is a vital part of the global agricultural industry, with sugarcane being one of the primary sources of sugar alongside sugar beet. The process of sugar production begins with the harvest of sugarcane, which is then transported to mills for processing. At the mill, the sugarcane is crushed to extract juice, which is clarified to remove impurities, and then boiled to concentrate the juice. The final stage involves crystallization, where the concentrated juice is cooled and crystallized into raw sugar. This raw sugar is further refined in factories to produce white, refined sugar for consumption (Gupta & Patil, 2020).

Global sugar production is dominated by countries like Brazil, India, China, and Thailand, with Brazil being the largest producer and exporter. According to the International Sugar Organization (2022), Brazil accounted for nearly 38% of global sugar exports, followed by India and Thailand. In these countries, sugar production is closely linked to the domestic ethanol industry, particularly in Brazil, where sugarcane is also used to produce ethanol for fuel. The integration of sugar and ethanol production has become a key strategy for optimizing the use of sugarcane and increasing profitability (Oliveira & Vasconcelos, 2021).

Sugar consumption varies widely across regions and countries, driven by economic, cultural, and dietary factors. In high-income countries, sugar consumption has stabilized or even declined in recent years due to growing health concerns about its link to obesity, diabetes, and other health issues. On the other hand, in low- and middle-income countries, sugar consumption has been increasing, driven by rising incomes, urbanization, and changes in dietary habits. The FAO (2020) estimates that global sugar consumption has grown by about 2% annually over the past decade, with the highest growth rates in Asia, Africa, and Latin America.

In terms of global sugar consumption, India and China are the two largest consumers, with India consuming more sugar than any other country, driven by its large population and the cultural importance of sweets in its cuisine. The United States, the European Union, and Brazil are also major consumers of sugar, though consumption in these regions has been more stable in recent years due to increasing health awareness and government regulations aimed at reducing sugar intake (International Sugar Organization, 2022). Despite this, sugar remains an integral part of many diets worldwide, contributing to the production of a wide range of products, including confectionery, beverages, and processed foods.

The global demand for sugar has been met with increasing concerns over the environmental and social impacts of sugarcane production. Intensive sugarcane farming has been linked to deforestation, water depletion, and soil degradation, especially in regions where water resources are scarce. For instance, the expansion of sugarcane plantations in Brazil and Southeast Asia has raised concerns over the sustainability of sugar production, prompting governments and industry stakeholders to adopt more sustainable farming practices. Initiatives such as the Bonsucro certification aim to promote sustainability in the sugarcane industry by encouraging environmentally friendly and socially responsible production methods (Ranjan & Singh, 2021).

In addition to environmental concerns, sugar production has significant economic implications for many developing countries. In countries like India, Thailand, and Brazil, the sugar industry provides employment to millions of farmers and workers in both the agricultural and industrial sectors. According to the International Sugar Organization (2022), sugarcane cultivation and processing are a major source of income for rural communities in these countries, contributing significantly to rural development and poverty reduction. However, fluctuations in global sugar prices, climate change, and trade policies pose challenges to the long-term viability of sugar production as an economic activity.

In terms of nutrition, sugar is a source of simple carbohydrates that provide energy but lacks essential vitamins and minerals. While sugar plays a role in energy metabolism, its excessive consumption has been associated with health risks, including obesity, type 2 diabetes, and dental problems. This has led to growing efforts by public health organizations to reduce sugar consumption, particularly in developed countries. Initiatives such as sugar taxes, labeling regulations, and public health campaigns aim

to encourage consumers to reduce their intake of added sugars in processed foods and beverages (WHO, 2020).

Sugar production and consumption are closely interlinked with global economic trends, dietary habits, and public health concerns. While sugar remains a staple in diets worldwide, its production faces challenges related to sustainability, market volatility, and health implications. Balancing the economic importance of sugar production with environmental and public health considerations will be crucial for the future of the industry.

2.5 Sugar Exports

Sugar exports are a vital component of the global agricultural trade, influencing economies, trade balances, and food security. The international sugar market is characterized by a complex network of producing and consuming countries, with significant variations in production, consumption, and export volumes. Understanding the dynamics of sugar exports provides insights into global trade patterns, economic dependencies, and market trends.

Brazil, India, and Thailand are among the largest sugar exporters globally. Brazil has long been the world's top exporter, leveraging its vast sugarcane plantations and efficient production processes to supply a significant portion of global sugar needs. The country's favorable climate and advanced agricultural technologies contribute to its dominant position in the sugar export market. India, with its large-scale sugarcane cultivation and substantial production capacity, ranks second in global sugar exports. Thailand follows closely, known for its well-established sugar industry and strategic export policies. These countries play a critical role in meeting global sugar demand and stabilizing international sugar prices (FAO, 2022).

Conversely, many countries with limited domestic sugar production rely heavily on imports to meet their consumption needs. The European Union, the United States, and several countries in Africa and the Middle East are significant importers of sugar. These regions often have stringent regulations and tariffs that influence sugar trade dynamics. The European Union, for instance, has a complex sugar market with a common agricultural policy that affects import quotas and pricing. Similarly, the United States maintains high tariffs on imported sugar, impacting trade flows and prices in the global market (USDA, 2021).

Sugar trade is subject to various policies and agreements that affect global market dynamics. International trade agreements, such as the World Trade Organization (WTO) agreements, and regional trade agreements influence sugar trade by setting tariffs, quotas, and subsidies. For example, the WTO's Agreement on Agriculture impacts sugar trade by regulating export subsidies and market access. Regional agreements, such as the Economic Partnership Agreements (EPAs) between the European Union and African, Caribbean, and Pacific (ACP) countries, also affect sugar trade by providing preferential access to markets and reducing tariffs for certain producers (WTO, 2023).

Trade policies and market dynamics are further influenced by fluctuations in global sugar prices, which are affected by supply and demand imbalances, weather conditions, and currency fluctuations. For instance, adverse weather events, such as droughts or floods, can disrupt sugarcane production and lead to price volatility in the global market. Currency fluctuations can also impact the competitiveness of sugar exports, as changes in exchange rates affect the pricing of sugar in international markets (OECD-FAO, 2022).

Sugar-producing countries often adopt various strategies to enhance their export potential and add value to their products. These strategies include improving production efficiency, investing in modern processing technologies, and exploring niche markets for specialty sugars. For instance, countries like Brazil and Thailand have invested in advanced sugar refining technologies to produce high-value products such as ethanol and specialty sugars. Ethanol derived from sugarcane is used as a renewable fuel, providing an additional revenue stream for producers and contributing to the global transition towards sustainable energy sources (Goldemberg et al., 2020).

Value addition through the production of specialty sugars, such as organic or fair-trade sugar, also plays a significant role in enhancing export potential. Specialty sugars often command higher prices in international markets and cater to the growing consumer demand for sustainable and ethically produced products. Producers in countries like India and the Philippines have capitalized on these trends by developing and marketing organic and fair-trade certified sugars, which offer premium pricing and access to niche markets (Sodhi & Singh, 2021).

Sugar exports have a substantial impact on developing economies, where sugarcane cultivation and processing often serve as key sources of income and employment. For many developing countries, sugar production is a critical component

of their agricultural sectors and contributes significantly to export earnings. The revenue generated from sugar exports supports local economies, infrastructure development, and social programs. However, reliance on sugar exports can also expose these economies to market fluctuations and trade policy changes, necessitating a focus on diversification and sustainability in agricultural practices (FAO, 2022).

2.6 Types of Sugar

Sugar, derived primarily from sugarcane and sugar beet, is available in various types that serve different purposes in the culinary, industrial, and pharmaceutical sectors. These types of sugar differ based on their refinement process, chemical composition, and intended use, ranging from raw sugars to highly processed varieties. Understanding these different types is crucial not only for consumers but also for industries relying on sugar for specific production needs.

The most common and widely used type of sugar is granulated white sugar, also known simply as table sugar or refined sugar. This is a highly processed form of sucrose obtained from either sugarcane or sugar beet, with all molasses content removed to create fine, white crystals. It is the most versatile form of sugar, used in a wide range of applications including baking, cooking, and sweetening beverages. Its purity and neutral flavor make it ideal for commercial food production, and it is a staple ingredient in households around the world (Harvey, 2020).

Another widely recognized type is brown sugar, which retains some of the molasses content that is removed during the production of white sugar. Brown sugar can be categorized into light and dark varieties, with the dark variety containing a higher percentage of molasses. The presence of molasses gives brown sugar a moist texture and a distinct, richer flavor compared to white sugar, making it a popular choice for baking, particularly in recipes that require a deeper caramel or toffee flavor. Brown sugar is commonly used in the production of baked goods like cookies and cakes, as well as in sauces and marinades (Galloway, 2020).

Raw sugar is another variety, less processed than refined white sugar. It includes sugars like turbinado and demerara, which have larger, coarser crystals and a light brown color due to the retention of some natural molasses. Turbinado sugar, often marketed as "raw" sugar, is partially refined and has a mild caramel flavor. Demerara sugar, named after the region in Guyana where it was first produced, has large golden crystals and is often used as a sweetener for beverages or as a topping for baked goods.

Both types of raw sugar are considered more natural, appealing to consumers seeking less processed alternatives (Prinz, 2019).

Powdered sugar, also known as confectioners' sugar or icing sugar, is made by grinding granulated sugar into a fine powder and often mixed with a small amount of cornstarch to prevent clumping. This ultra-fine sugar dissolves quickly, making it ideal for making icing, frosting, or dusting desserts. It is widely used in confectionery, baking, and decorative applications due to its smooth texture and ability to blend seamlessly into liquids and batters (Smith, 2021).

Liquid sugars like invert sugar and corn syrup are commonly used in industrial food production. Invert sugar is created by breaking down sucrose into glucose and fructose, which results in a syrup that is sweeter than regular table sugar and helps retain moisture in products like candies, baked goods, and beverages. Corn syrup, derived from corn starch, is another liquid sweetener used to add sweetness and improve texture, particularly in processed foods like soft drinks, cereals, and confections. High-fructose corn syrup (HFCS) is a widely used variant in the food industry due to its low cost and high sweetness (Marshall, 2020).

Specialty sugars, such as muscovado and jaggery, offer distinctive flavors and are less refined than standard white sugar. Muscovado is an unrefined sugar with a strong molasses content and sticky texture, often used in rich desserts, sauces, and marinades due to its robust flavor. Jaggery, a traditional non-centrifugal sugar produced in many parts of Asia and Africa, is made by boiling sugarcane juice and evaporating the water content. It is sold in solid chunks or paste form and is valued for its natural, earthy taste. Jaggery is often used in traditional sweets and beverages, and it is believed to have some health benefits due to the presence of minerals like iron and potassium (Joshi & Singh, 2018).

Another type is cane syrup, produced by boiling sugarcane juice into a thick, dark syrup. Cane syrup is a staple in some regional cuisines, particularly in the Southern United States, where it is drizzled over pancakes or biscuits. Similarly, molasses, a by-product of the sugar refining process, is a thick, dark syrup used in baking and as a sweetener in some beverages. Blackstrap molasses, the most concentrated form, is rich in minerals like iron and calcium and is often used in health supplements or as a natural sweetener with a bold, slightly bitter taste (Park, 2019).

2.7 Usage of Sugar

Sugar is a ubiquitous ingredient that plays a critical role in numerous aspects of daily life, ranging from culinary applications to industrial uses. Its versatility and functional properties make it indispensable in a variety of contexts, including food and beverage production, preservation, and even non-food applications. Understanding the diverse uses of sugar can provide insights into its importance across different sectors and its impact on global economies and lifestyles.

In the culinary world, sugar is primarily used as a sweetener to enhance the flavor of foods and beverages. Its ability to add sweetness makes it a key ingredient in baking, where it contributes to the texture, color, and taste of products such as cakes, cookies, pastries, and bread. Sugar acts as a leavening agent in baked goods, helping to create a desirable crumb structure by interacting with other ingredients like yeast and baking powder. Its hygroscopic nature, meaning it attracts and holds moisture, helps to keep baked goods moist and extends their shelf life (Miller, 2021).

Beyond its role in flavor enhancement, sugar is also used in food preservation. The high sugar content in preserves, jams, and jellies acts as a natural preservative by reducing the water activity in the food, which inhibits the growth of microorganisms. This preservation method has been used for centuries to extend the shelf life of seasonal fruits and vegetables, allowing them to be enjoyed year-round. Additionally, sugar is employed in the production of condiments like ketchup and sauces, where it helps to balance acidity and enhance taste while acting as a preservative (Edelstein, 2019).

In the beverage industry, sugar is a fundamental ingredient in soft drinks, fruit juices, and flavored waters. Its ability to mask bitterness and enhance flavor makes it a preferred choice for sweetening beverages. Soft drinks, for instance, are typically sweetened with high-fructose corn syrup or sucrose, contributing to their palatability and consumer appeal. Sugar also plays a role in the fermentation process of alcoholic beverages, where it provides the necessary substrate for yeast to produce alcohol. In brewing and winemaking, sugar levels influence the final taste, alcohol content, and carbonation of the product (Sweeney, 2020).

Sugar's usage extends beyond food and beverages into industrial applications. In the pharmaceutical industry, sugar is used as a base in syrups and oral medications to improve taste and facilitate patient compliance. It also serves as a binding agent in tablet formulations and a carrier for active ingredients in medicinal products. The confectionery industry relies heavily on sugar to produce a wide range of candies,

chocolates, and gum, where its functional properties contribute to texture, flavor, and shelf stability (Johnson & Mody, 2021).

In addition to its culinary and industrial uses, sugar has applications in the production of biofuels and biodegradable materials. Sugarcane-derived ethanol is used as a renewable energy source, providing an alternative to fossil fuels and contributing to the reduction of greenhouse gas emissions. This application is particularly relevant in countries like Brazil, where sugarcane-based ethanol is a major component of the transportation fuel mix. Similarly, sugarcane by-products like bagasse are used in the production of bio-based plastics and packaging materials, offering environmentally friendly alternatives to petroleum-based products (Goldemberg et al., 2020).

The impact of sugar on health is another critical area of discussion. While sugar is a source of energy and contributes to the enjoyment of food and beverages, excessive consumption has been linked to various health issues, including obesity, diabetes, and dental problems. Public health initiatives aim to raise awareness about the risks associated with high sugar intake and promote healthier dietary choices. Efforts include labeling regulations, public education campaigns, and the development of low-sugar or sugar-free alternatives to address the growing concern over sugar-related health impacts (Mozaffarian et al., 2018).

Sugar's diverse range of uses highlights its significance in modern life. From enhancing the flavor and texture of foods and beverages to serving as a crucial component in industrial applications and biofuel production, sugar's role is multifaceted and far-reaching. Understanding its various applications helps to appreciate the complexity of sugar's impact on both individual health and global industries, underscoring its importance in contemporary society.

2.8 Nutrition and Calories of Sugar

Sugar, primarily composed of sucrose, is a carbohydrate that provides a quick source of energy but is often debated in terms of its nutritional value and health implications. Understanding the nutritional profile and caloric content of sugar is essential for evaluating its role in the diet and its impact on overall health.

Sugar is a high-calorie food, with each gram of sucrose providing approximately 4 calories. This calorie density contributes to its role as a major energy source in the diet. For example, one teaspoon of granulated sugar, which weighs about 4 grams, contains approximately 16 calories. While this energy can be beneficial for immediate

fuel, excessive consumption of sugar can lead to an imbalance in caloric intake, potentially contributing to weight gain and related health issues (USDA, 2021).

From a nutritional standpoint, sugar is considered a source of "empty calories." It provides energy but lacks essential nutrients such as vitamins, minerals, and fiber. Unlike fruits, vegetables, and whole grains, which offer a wide range of nutrients along with carbohydrates, sugar does not contribute any significant amount of nutrients to the diet. This lack of nutritional value makes it important to moderate sugar intake, as excessive consumption can displace more nutrient-dense foods and potentially lead to deficiencies (Micha et al., 2017).

The health implications of sugar consumption are significant and have been the subject of extensive research. Excessive intake of sugar, particularly from sugary beverages and processed foods, has been linked to various health conditions, including obesity, type 2 diabetes, and cardiovascular disease. High sugar consumption can lead to increased calorie intake, which, if not balanced with physical activity, can result in weight gain. Additionally, sugar can affect blood glucose levels, leading to insulin resistance and an increased risk of developing type 2 diabetes (Schulze et al., 2004).

The relationship between sugar and dental health is also a concern. Frequent consumption of sugary foods and drinks can contribute to dental caries (cavities) by providing a substrate for harmful bacteria in the mouth. These bacteria produce acids that erode tooth enamel, leading to decay. Public health recommendations often emphasize reducing sugar intake to prevent dental problems and maintain oral health (Moynihan & Kelly, 2014).

Health organizations such as the World Health Organization (WHO) and the American Heart Association (AHA) provide guidelines on sugar intake to promote better health outcomes. The WHO recommends that added sugars should constitute less than 10% of total daily energy intake, with a further reduction to below 5% being beneficial for additional health benefits. For an average adult, this translates to about 25 grams (6 teaspoons) of added sugar per day. Similarly, the AHA recommends that women limit their intake of added sugars to no more than 100 calories per day (about 25 grams) and men to no more than 150 calories per day (about 37.5 grams) (WHO, 2015; AHA, 2018).

It is important to differentiate between natural sugars and added sugars. Natural sugars, found in fruits, vegetables, and dairy products, come with a package of beneficial nutrients such as vitamins, minerals, and fiber. In contrast, added sugars,

which are incorporated into foods during processing or preparation, contribute additional calories without providing nutritional benefits. Emphasizing whole foods that contain natural sugars while reducing the intake of added sugars is a key aspect of a balanced diet (Slavin, 2013).

2.9 Review on Previous Studies

Kumar et al. (2019) emphasized the importance of optimizing planting densities and row configurations to enhance yield and quality. Their study indicates that adopting precision agriculture techniques can significantly improve the efficiency of input use and crop management, leading to higher productivity levels.

Patel et al. (2020) analyzed the impact of agronomic practices on sugarcane yield and found that advancements in crop management, such as the adoption of precision agriculture techniques and improved irrigation practices, have the potential to significantly enhance productivity. The study highlighted that although traditional cultivation methods are still prevalent, integrating modern practices could address productivity stagnation and yield improvements.

Silva et al. (2022) investigated the technological advancements in sugar mills, emphasizing the adoption of modern milling equipment and automation to improve processing efficiency. Their study finds that upgrading technology can lead to higher sugar extraction rates and reduced production costs, thus enhancing the overall competitiveness of sugar mills.

Choudhury and Sahu (2022) examined the economic viability of sugar mills and identified several challenges related to production costs and market fluctuations. They found that rising input costs and volatile sugar prices significantly impact the profitability of sugar production. The study suggests that improving process efficiency and adopting cost-control measures can help mitigate these challenges and enhance the economic stability of sugar mills.

Upreti and Singh (2017) studied an economic analysis of sugarcane cultivation and its productivity in major sugar producing states of Uttar Pradesh and Maharashtra. The research found that while the expansion of cultivated area has significantly increased sugarcane production, productivity levels have stagnated. Notably, the cost of cultivation has been rising, with Maharashtra experiencing higher costs due to greater input use compared to Uttar Pradesh. Despite these increased costs, the growth in the value of output has surpassed the rise in cultivation costs, leading to a positive trend in

profitability. Furthermore, the study identified that factors such as human labor, machinery, fertilizers, insecticides, and plot size positively and significantly contribute to sugarcane productivity. Efficient management of these inputs is crucial for enhancing productivity levels. This research underscores the importance of optimizing input use and managing costs to improve sugarcane cultivation efficiency and profitability.

Tun Win Aung and Zaw Min Naing (2019) documented the historical evolution of sugarcane cultivation in Myanmar, emphasizing the transition from manual to mechanized processes. This transition, though gradual, has been pivotal in increasing production efficiency and output.

Sai Kyaw (2021) have analyzed the impact of these challenges on sugarcane productivity, noting that the sector has struggled with issues related to outdated farming practices and inadequate infrastructure. This historical context provides a foundation for understanding the current dynamics of sugarcane cultivation and sugar production in Myanmar.

Naing Htay Win et al. (2022) examined the current practices employed by sugarcane farmers, including planting methods, irrigation techniques, and fertilizer use. The findings indicated a heavy reliance on traditional methods, with many farmers using basic tools and manual labor. While these methods have supported local production for decades, they often result in lower productivity compared to more modern practices.

Htay Htay Soe and Win Nwe (2023) assessed the impact of introducing advanced irrigation systems and high-yielding sugarcane varieties on productivity. The research found that the adoption of these innovations led to significant improvements in yield and efficiency. However, challenges related to cost and training remain barriers to widespread adoption.

CHAPTER III
OVERVIEW OF SUGARCANE CULTIVATION AND SUGAR PRODUCTION IN MYANMAR

This study examines the current state of sugarcane cultivation and sugar production in Myanmar, exploring historical developments, modern practices, economic contributions, and the challenges and opportunities that shape the industry's future.

3.1 Sugarcane Cultivation in Myanmar

Sugarcane cultivation in Myanmar has deep historical roots, dating back to ancient times when it was valued both for its dietary and medicinal uses. The modern era of sugarcane farming began with the Sugarcane Development Project in 1932, which marked a key advancement in the sector. After Myanmar gained independence in 1950, the government launched the Pyidawtha Project to expand sugarcane cultivation and build new sugar mills. The transfer of sugar mills management from the Ministry of Industry No. 1 to the Ministry of Agriculture and Irrigation in 1994 led to the establishment of nine additional sugar mills. Since 2004-2005, the industry has seen involvement from not only state-owned enterprises but also Myanmar Economic Corporation, Myanmar Economic Holdings Limited, and private companies. This diversification has supported the expansion of sugarcane farming to meet the raw material needs of domestic mills, with more than 400,000 acres of sugarcane now cultivated annually across all 13 states and regions of Myanmar.

The evolution of sugarcane cultivation in Myanmar over recent decades reflects significant changes in agricultural practices, economic conditions, and government policies. The country's fertile alluvial soils and favorable climate, particularly in regions like the Irrawaddy Delta and central Myanmar, are ideal for sugarcane cultivation. Farmers in these areas often view sugarcane as a lucrative cash crop due to its high yield and relatively short growth cycle compared to other crops. Modernization efforts, including the adoption of hybrid cane varieties and improved irrigation techniques, have been introduced to boost productivity and resilience.

Nevertheless, the sector faces several challenges. One major issue is the inconsistent quality of sugarcane, attributed to limited access to advanced farming technologies and inputs. Traditional farming methods still dominate in many areas, resulting in lower yields and inefficiencies. Additionally, insufficient knowledge of pest and disease management has negatively affected crop health and overall productivity. The sector also contends with inadequate infrastructure, such as limited transportation facilities and outdated processing equipment at many mills.

The efforts have been made to revitalize and modernize the sugarcane sector. The government has promoted private investment and formed partnerships with international companies to introduce advanced technologies and best practices. Initiatives include the development of new sugar mills, mechanized harvesting techniques, and investment in research to improve cane varieties and farming methods. Agro-industrial zones and special economic zones have also been established to enhance production efficiency and value-added processing.

There is increasing recognition of the need for sustainable practices in sugarcane cultivation. Efforts to address environmental concerns, such as soil degradation and water use, include promoting conservation practices and integrated pest management. The adoption of organic farming techniques and exploration of bioenergy options, like ethanol production from sugarcane, are also gaining momentum as part of a broader strategy to ensure the long-term viability of the industry.

Therefore, sugarcane cultivation in Myanmar holds significant potential for growth and development. With ongoing efforts to tackle current challenges and seize new opportunities, the sector can make substantial contributions to the country's agricultural economy and rural livelihoods. Continued investment in technology, infrastructure, and sustainable practices will be crucial for realizing this potential and securing the future success of Myanmar's sugarcane industry.

3.2 Sown Area of Sugarcane in Myanmar

Sugarcane has been a critical crop in Myanmar's agricultural landscape for many decades, playing a significant role in both the economy and the rural livelihoods of farmers. Since its introduction, the cultivation of sugarcane has evolved considerably, driven by changes in agricultural practices, market demands, and government policies. The sown area of sugarcane reflects the broader trends and shifts

in the agricultural sector, indicating how the crop's prominence has grown or fluctuated over time.

The sown area of sugarcane in Myanmar has fluctuated over the years, influenced by various factors such as changes in agricultural technology, market demands, and government policies. From the early 2010s to the early 2020s, the amount of land dedicated to sugarcane cultivation has expanded, highlighting the crop's increasing importance as both a cash crop and a key component of the industrial crop sector. This expansion has been driven by efforts to boost production, improve yields, and meet the growing demand for sugar and related products.

Sugarcane cultivation in Myanmar has experienced variations in sown area over the years. The sown area for sugarcane is a critical indicator of its significance in the agricultural sector, particularly in relation to the total cultivated area and the share of industrial crops. The following table provides data on the sown area of sugarcane from 2010 to 2023, showing the percentage of total cultivated area and the percentage of industrial crops.

Table (3.1) Sown Area of Sugarcane (2010-2023)

Year	Total Area (Thousand Acres)	Industrial Crops Area (Acres)	Sugarcane Sown Area (Acres)	% of Total Area (Industrial Crops)	% of Total Area (Sugarcane)
2010-2011	167,186	9,278	369,482	5.55%	2.21%
2011-2012	167,186	9,269	396,138	5.54%	2.37%
2012-2013	167,186	9,293	380,751	5.56%	2.28%
2013-2014	167,186	9,314	418,636	5.57%	2.50%
2014-2015	167,186	9,329	446,907	5.58%	2.67%
2015-2016	167,186	9,327	400,087	5.58%	2.39%
2016-2017	167,186	9,316	405,461	5.57%	2.43%
2017-2018	167,186	9,045	403,670	5.41%	2.41%
2018-2019	167,186	9,953	444,944	5.95%	2.66%
2019-2020	167,186	9,167	450,815	5.48%	2.70%
2020-2021	167,186	9,166	438,447	5.48%	2.62%
2021-2022	167,186	9,160	427,915	5.48%	2.56%
2022-2023	167,186	9,138	408,402	5.47%	2.44%

Source: Central Statistical Organization.

The data in Table 3.1 illustrates the trends in sugarcane cultivation in Myanmar from 2010 to 2023, highlighting both the total area of land, the area dedicated to

industrial crops, and specifically the sown area of sugarcane. Additionally, the percentage of total land dedicated to industrial crops and sugarcane are provided, offering insights into the significance of sugarcane cultivation within Myanmar's agricultural landscape.

Throughout the period from 2010 to 2023, the total agricultural area in Myanmar remained constant at 167,186 thousand acres. However, the proportion of this land dedicated to sugarcane cultivation experienced fluctuations, reflecting changes in agricultural priorities and production conditions. In 2010-2011, sugarcane accounted for 2.21% of the total area. This percentage gradually increased over the years, reaching a peak of 2.70% in 2019-2020, reflecting the growing significance of sugarcane as a key crop in Myanmar's agricultural sector. However, after this peak, the percentage slightly decreased, falling to 2.44% by 2022-2023, indicating a modest reduction in sugarcane cultivation in recent years.

The area devoted to industrial crops, which includes sugarcane, also fluctuated during the 2010-2023 period. In 2010-2011, industrial crops occupied 9,278 acres, representing 5.55% of the total area. This percentage remained relatively stable, with slight increases and decreases over the years. The largest proportion of land devoted to industrial crops occurred in 2018-2019, with 9,953 acres, or 5.95% of the total agricultural land, showing a period of agricultural intensification.

Sugarcane’s share of industrial crop land also fluctuated, with a notable increase in sown area between 2010 and 2014, where it rose from 369,482 acres to 446,907 acres. This growth in sugarcane cultivation suggests an increased focus on sugar production during these years. The peak of sugarcane cultivation occurred in 2019-2020, with 450,815 acres sown, which also coincided with the highest percentage of total area (2.70%) dedicated to sugarcane.

The data indicates a general upward trend in sugarcane cultivation until 2019-2020, driven by a growing emphasis on industrial crops and increased demand for sugar production. However, a slight decline in both the percentage of total area and the absolute sown area of sugarcane can be observed after 2020, possibly due to factors such as changing market conditions, environmental challenges, or shifts in agricultural policies.

While sugarcane remains a significant crop within Myanmar's agricultural framework, occupying a considerable portion of the industrial crop area, the trends

suggest that sugarcane cultivation has stabilized in recent years, with a slight decrease in the proportion of land devoted to this crop.

3.3 Distribution of Sugarcane Cultivation in States and Regions of Myanmar

Sugarcane cultivation in Myanmar is distributed unevenly across its states and regions, reflecting a range of climatic, soil, and infrastructural factors that influence agricultural practices. This distribution plays a crucial role in the country's sugar production and highlights regional disparities in cultivation and output. The following table show the distribution of sugarcane cultivation across various states and regions in 2023.

Table (3.2) Distribution of Sugarcane in 2023 by State/Region

No.	State/Region	Sown Acre (acres)	Harvested Acre (acres)	Production (Tonnes)
1	Kachin State	6,805	6,805	193,268
2	Kayah State	-	-	-
3	Kayin State	5,952	5,952	146,918
4	Chin State	238	238	2,207
5	Sagaing Region	141,577	141,577	3,660,342
6	Taninthayi Region	-	-	-
7	Bago Region	49,524	49,524	1,332,806
8	Magway Region	11,270	11,270	291,162
9	Mandalay Region	21,325	21,325	544,819
10	Yangon Region	3,400	3,400	68,478
11	Ayeyawady Region	120	120	2,742
12	Mon State	125	125	1,710
13	Rakhine State	280	280	5,254
14	Shan State	157,583	157,583	4,353,630
15	Nay Pyi Taw	10,203	10,203	277,266

Source: Central Statistical Organization.

3.3.1 Major Sugarcane Cultivating Regions

Shan State is the most prominent area for sugarcane cultivation in Myanmar. With a total of 157,583 acres sown and harvested, Shan State leads in both cultivation area and production, yielding 4,353,630 tonnes of sugarcane. The state’s favorable

climatic conditions, including sufficient rainfall and warm temperatures, coupled with its fertile soil, create an ideal environment for large-scale sugarcane farming. This significant production contributes heavily to Myanmar's sugar industry.

Sagaing Region is another major contributor to Myanmar's sugarcane production. Spanning 141,577 acres of cultivated land, Sagaing produces 3,660,342 tonnes of sugarcane. The region's extensive agricultural infrastructure and favorable growing conditions support its large-scale production. The combination of rich soil and adequate water supply facilitates high yield and quality of sugarcane.

Bago Region plays a crucial role in Myanmar's sugarcane sector, with 49,524 acres dedicated to cultivation and a production of 1,332,806 tonnes. The region benefits from its tropical climate and fertile alluvial soils, which are well-suited for sugarcane growth. The Bago Region's production is significant, adding to the overall sugar supply and supporting local economies.

In Mandalay Region, sugarcane is cultivated over 21,325 acres, producing 544,819 tonnes. Although not as extensive as the leading regions, Mandalay's contribution is notable. The region's semi-arid climate presents challenges, but effective water management and irrigation practices help maintain productive sugarcane farming.

Magway Region, with 11,270 acres of sown and harvested land, produces 291,162 tonnes of sugarcane. While its production is smaller compared to leading regions, Magway's cultivation contributes to the regional sugarcane supply. The area benefits from a relatively favorable climate and soil conditions for sugarcane growth.

3.3.2 Minor Cultivating Areas

Kachin State and Kayin State have smaller scales of sugarcane cultivation. Kachin State, with 6,805 acres, produces 193,268 tonnes, while Kayin State, covering 5,952 acres, yields 146,918 tonnes. Both states contribute to Myanmar's overall sugarcane production, although their outputs are modest compared to the major regions. Chin State and Rakhine State have limited sugarcane cultivation. Chin State, with 238 acres, produces 2,207 tonnes, while Rakhine State has 280 acres and a production of 5,254 tonnes. These regions have smaller agricultural footprints for sugarcane, reflecting their less favorable conditions or limited infrastructure.

The distribution of sugarcane cultivation in Myanmar highlights significant regional variations. Major regions like Shan State, Sagaing Region, and Bago Region lead in both the area under cultivation and production levels, thanks to their favorable

environmental conditions and established agricultural practices. In contrast, other states and regions have more limited cultivation and production, reflecting variations in climate, soil quality, and agricultural infrastructure. Understanding these distribution patterns is essential for optimizing production, addressing regional challenges, and planning for future agricultural development.

3.4 Types of Sugarcane in Myanmar

Sugarcane varieties grown in Myanmar are selected based on factors such as climate adaptability, yield potential, and resistance to pests and diseases. The sugarcane industry in Myanmar primarily focuses on cultivating varieties that are suitable for the local agro-climatic conditions, ensuring optimal sugar production. The following are the main types of sugarcane grown in Myanmar:

3.4.1 Commercial Hybrid Varieties

Commercial hybrid sugarcane varieties are developed for their high sugar content, yield potential, and resistance to environmental stressors. These hybrids are often imported or cross-bred within Myanmar to enhance their performance under the country's growing conditions. Common traits of these hybrids include improved resistance to drought, pests, and diseases, as well as a higher yield of both sugarcane and sugar.

i. **Co 997**: Known for its high yield and early maturity, Co 997 is a popular variety that adapts well to Myanmar’s climatic conditions. It is resistant to waterlogging, which makes it suitable for cultivation in areas with heavy rainfall.
ii. **Co 6806:** Another widely grown hybrid in Myanmar, this variety has high sugar content and is drought-tolerant, making it suitable for regions with lower rainfall or less irrigation.

3.4.2 Local Varieties

Local sugarcane varieties have been cultivated in Myanmar for generations. These varieties are often favored in specific regions due to their adaptation to local soil and climatic conditions. While local varieties might not always have the highest sugar content compared to hybrid types, they are more resilient to pests and diseases native to Myanmar.

i. **Yezin-2**: Developed in Myanmar through local breeding programs, Yezin-2 is an example of a variety adapted to Myanmar's environmental conditions. It has moderate sugar content and is resistant to certain diseases.

ii. **Yezin-3**: This variety is bred for its drought resistance and ability to grow in areas with less irrigation, such as central Myanmar.

iii. **KK-3**: This variety is known for its high sucrose content and adaptability to various soil conditions. It is often chosen for its productivity and efficiency in sugar extraction.

iv. **DAR-4**: This variety is typically selected for its disease resistance and high yield. It is suitable for regions with specific pest and disease challenges.

v. **PMA-0636**: Known for its robustness and good quality of juice, this variety is favored in areas with varying climatic conditions and soil types.

vi. **Naypyitaw-1**: A local variety that may be adapted to the specific conditions of the Naypyitaw region, offering traits suited to the local environment and agricultural practices.

3.4.3 Early Maturing Varieties

Early maturing varieties are grown to provide a quick return on investment for farmers. These varieties tend to reach maturity faster than regular sugarcane varieties, allowing for earlier harvests. This is particularly advantageous in areas with short growing seasons or where multiple crops are rotated throughout the year.

i. **Co 419:** An early maturing variety, Co 419 is favored in areas with shorter growing seasons. It provides a quick harvest and has high sugar recovery rates.

ii. **Co 527:** This variety is known for its early ripening and is commonly grown in regions where the sugarcane harvesting season needs to be completed before the onset of monsoons.

3.4.4 Late Maturing Varieties

Late maturing sugarcane varieties are planted to extend the harvesting season and spread-out production. These varieties are generally harvested later in the year and are valued for their high sugar content and yield.

i. **Co 1148**: A late-maturing variety known for its robust growth and high sugar yield, Co 1148 is often used to extend the harvesting season and improve overall sugar production.

ii. **BO 91**: This late-maturing variety is prized for its ability to continue growing during cooler months, allowing farmers to harvest sugarcane over a longer period.

3.4.5 Drought-Tolerant Varieties

Certain areas of Myanmar experience dry spells or lack sufficient irrigation, making drought-tolerant sugarcane varieties essential for sustaining production. These varieties can survive with minimal water and are more resilient to drought conditions.

i. **Co 86032**: Widely grown in areas prone to drought, this variety has excellent drought tolerance and still produces a good yield under low-water conditions.

ii. **Co 85004**: Another drought-tolerant variety, Co 85004 is particularly suited for areas in central Myanmar where rainfall is limited.

The diversity of sugarcane varieties in Myanmar reflects the need for different types to adapt to varying environmental conditions. Hybrid varieties dominate commercial production due to their high yield and sugar content, while local and early- or late-maturing varieties serve specialized roles in different regions.

3.5 Production of Sugarcane in Myanmar

The production of sugarcane in Myanmar plays a vital role in the country's agricultural sector and economy. As one of the key crops cultivated across various states and regions, sugarcane is essential not only for its economic contribution but also for its impact on rural livelihoods and agricultural practices. Myanmar's diverse climatic conditions and soil types provide a broad range of growing environments for sugarcane, which is cultivated primarily for sugar production but also for its by-products such as molasses and ethanol.

Myanmar's sugarcane cultivation has undergone significant developments over the years, with advancements in farming techniques, crop management, and processing technologies. The country's favorable growing conditions, including ample sunlight and sufficient rainfall in many areas, contribute to the successful cultivation of sugarcane. However, the industry also faces challenges such as varying regional climates, pest infestations, and the need for improved infrastructure and technology.

The sugarcane production landscape in Myanmar is marked by a variety of cultivation practices and regional adaptations. Different states and regions specialize in specific types of sugarcane varieties, selected for their suitability to local environmental

conditions and their potential for high yield and quality. As Myanmar continues to develop its sugarcane sector, efforts are being made to enhance productivity, sustainability, and profitability through research, technological innovations, and policy support.

Understanding the production dynamics of sugarcane in Myanmar is crucial for evaluating its contribution to the national economy and addressing the challenges faced by the industry. Table (3.3) provides the production of sugarcane in Myanmar from 2010 to 2023.

Table (3.3) Sugarcane Production in Myanmar (2010-2023)

Year	Sown (Acre)	Harvested (Acre)	Production (Ton)	Growth Rate (Percentage)
2010-2011	369482	359851	9250392	
2011-2012	396138	383942	9537246	3.10
2012-2013	380751	379576	9413120	-1.30
2013-2014	418636	418561	10307355	9.50
2014-2015	446907	440631	11128417	7.97
2015-2016	400087	399917	10142383	-8.86
2016-2017	405461	404387	10437058	2.91
2017-2018	403670	403400	10370042	-0.64
2018-2019	444944	444681	11397183	9.90
2019-2020	450815	450123	11846176	3.94
2020-2021	438447	438137	11551111	-2.49
2021-2022	427915	427721	11333345	-1.89
2022-2023	408402	408402	10880602	-3.99

Source: Central Statistical Organization.

According to Table (3.3), the growth rate of sugarcane production in Myanmar from 2010 to 2023 shows significant fluctuations, reflecting both periods of expansion and contraction. The early years exhibited moderate growth, with an initial upward trend followed by slight declines, indicating a period of instability in production. Particularly noticeable is the strong growth seen in some years, such as 2013-2014 and 2018-2019, when production surged substantially. These positive growth rates highlight successful efforts to increase productivity during those periods.

However, the data also reveals periods of negative growth, most notably in 2015-2016, when production experienced a sharp decline. This suggests that certain

factors, such as environmental conditions or economic challenges, may have negatively impacted sugarcane yields. Subsequent years also saw minor contractions in growth, particularly from 2020 to 2023, reflecting a period of stagnation or challenges in sustaining high levels of productivity.

While there have been commendable efforts to enhance sugarcane production in some years, consistent negative growth in recent years indicates the need for more robust strategies to stabilize and boost production. Addressing factors such as cultivation practices, resource management, and infrastructural support will be key to achieving more sustainable growth in the sugarcane industry moving forward.

Sugarcane prices in Myanmar have experienced notable fluctuations over the years, influenced by various economic, agricultural, and market-related factors. From 2010 to 2024, sugarcane prices have steadily increased, with occasional periods of stability and sharp spikes in recent years. This price trajectory highlights the evolving economic landscape, driven by factors such as production costs, market demand, inflation, and policy shifts.

Between 2010 and 2024, the price of sugarcane in Myanmar showed a significant upward trend. In the early 2010s, the price was relatively stable at MMK 17,000 per ton in 2010-2011. From 2011 to 2016, the price remained consistent at MMK 30,000 per ton, showing no notable changes. However, beginning in 2016-2017, the price increased slightly to MMK 32,000 per ton, followed by a substantial rise to MMK 45,000 per ton in 2017-2018, where it stayed stable until 2018-2019.

From 2019 onwards, sugarcane prices fluctuated, dipping to MMK 42,000 per ton in 2019-2020 and further to MMK 40,000 per ton in 2020-2021. However, the price surged significantly in 2021-2022 to MMK 50,000 per ton, and by 2022-2023, it rose sharply to MMK 75,000 per ton. The most dramatic increase occurred in 2023-2024, when the price reached MMK 110,000 per ton. These price changes reflect both domestic market dynamics and external factors, such as inflation, cost of production, and possibly shifts in supply and demand in the sugarcane industry. The rapid increase in recent years, particularly between 2021 and 2024, indicates significant changes in the agricultural market, economic factors, or government policies affecting the sugar industry. The following table shows sugarcane price in Myanmar from 2010 to 2023.

Table (3.4) Sugarcane Price in Myanmar (2010-2023)

Year	Unit	Price (MMK)
2010-2011	1 ton	17,000
2011-2012	1 ton	30,000
2012-2013	1 ton	30,000
2013-2014	1 ton	30,000
2014-2015	1 ton	30,000
2015-2016	1 ton	30,000
2016-2017	1 ton	32,000
2017-2018	1 ton	45,000
2018-2019	1 ton	45,000
2019-2020	1 ton	42,000
2020-2021	1 ton	40,000
2021-2022	1 ton	50,000
2022-2023	1 ton	75,000
2023-2024	1 ton	110,000

Source: Central Statistical Organization.

3.6 Sugar Mills in Myanmar

Sugar mills in Myanmar are integral to the country's sugar production ecosystem, playing a crucial role in converting harvested sugarcane into processed sugar. These mills, which vary widely in size and capacity, are distributed across different regions of Myanmar, each contributing to the overall production output. The performance and efficiency of these sugar mills are critical for meeting the domestic demand for sugar and supporting the livelihoods of thousands of farmers who supply the cane.

The sugar mill industry in Myanmar is characterized by a mix of large-scale industrial operations and smaller, locally managed facilities. Major mills, such as those operated by Yuzana Co., Rakhaing Multi Trading, and Delicious Food Co., represent the backbone of the sector, processing large volumes of cane and implementing advanced technologies to enhance production efficiency. These mills are equipped with modern machinery and follow established processes to maximize sugar recovery and minimize waste.

Despite the advancements, the industry faces several challenges, including outdated technology in some mills, fluctuations in cane quality, and operational inefficiencies. Mills like Okkan and Taung Zin Aye, for example, highlight the variability in performance, with differences in sugar recovery rates and overall production efficiency. Addressing these challenges is vital for improving the competitiveness and sustainability of Myanmar's sugar industry.

In addition to their economic significance, sugar mills also impact local communities by providing employment opportunities and contributing to regional development. As the industry continues to evolve, the focus on modernizing mills, enhancing production techniques, and improving the quality of raw materials will be essential for ensuring the sector's growth and sustainability. The performance of sugar mills in Myanmar will play a key role in shaping the future of the country's sugar production landscape. The below table provides a comprehensive overview of sugar production across various mills in Myanmar for the 2023-2024 crushing year.

Table (3.5) Sugar Mills Production and Capacities (2023-2024 Crushing Year)

No	Factory Name	Crushed Cane (Ton)	Purchase Cane (Ton)	Sugar Production (Ton)	Molasses Production (Ton)	Remarks
	Yuzana Co.,					
1	Pyinmana (2)	36,018.47	36,018.47	2,706.00	1,640.00	Close
2	Pyinmana (3)	36,018.47	36,018.47	2,706.00	1,640.00	
	Delicious Food Co.,					
3	Yedashe	63,631.00	63,631.00	5,307.30	4,713.00	Close
	Rakhaing Multi Trading					
4	Kyught taw	Not crushed				
	Sutech Engineering Co., Ltd					
5	Nawadae	198,546.63	198,546.63	18,328.65	10,109.46	Close
	International Gateways Group Co.,					
6	Taung Zin Aye	76,095.48	76,095.48	7,609.38	3,680.86	
7	Dahutkone	33,367.57	33,367.57	3,680.86	1,423.00	
8	Myohla	93,487.61	93,487.61	10,352.87	3,395.00	

	Ministry of Industry					
9	Zayyawadi	47,500.00	47,500.00	3,895.00	2,232.00	Close
10	Bilin	Not crushed				
	Myanma Economic Corporation					
11	Kanhla	33,918.89	33,918.89	3,134.15	3,991.00	Close
12	Du Yin Gabo	54,629.56	54,629.56	5,072.80	2,261.00	
13	Kantbalu	Not crushed				
	Myanmar Economic Holding Ltd					
14	Oktwin	64,953.50	64,953.50	6,063.00	4,000.00	Close
15	In Nga Gwa	94,723.77	94,723.77	10,163.00	3,888.00	
16	Okkan	23,341.05	23,341.05	1,307.00	1,000.00	
	Mya Ba Yin Co.,					
17	Shwe Naung	57,211.88	56,252.88	6,621.90	1,500.00	
	Great Wall Wilmar Co.,					
18	Matayya	20,545.00	20,545.00	1,660.00	1,200.00	
19	Maung Kone	63,000.00	63,000.00	6,300.00	2,500.00	
	Grand Precious Co.,					
20	Nantoun	52,765.00	52,765.00	5,765.00	2,000.00	
	Ngwe Yi Pale					
21	Naung Cho (1)	103,917.65	103,710.00	10,391.00	3,900.00	
22	Naung Cho (2)	467,135.42	465,873.00	47,053.00	19,800.00	
	Than Daung Co.,					
23	Mine Yae	304,733.41	301,569.00	30,160.00	12,700.00	

Source: Ministry of Industry (1) and Myanmar Economic Corporation.

The data in Table 3.4 provides a comprehensive overview of sugar mill production and capacities for the 2023-2024 crushing year in Myanmar. In the 2023-2024 crushing year, Myanmar operated 23 sugar mills, showcasing diverse production capacities and outputs. The total crushed cane across all mills amounted to approximately 2,735,959.96 tons, resulting in total sugar production of around 238,175.91 tons and 92,572.32 tons of molasses, a significant by-product used in various industries.

Among the operational mills, the Naung Cho (2) mill stands out with the highest production figures, crushing 467,135.42 tons of cane and yielding 47,053 tons of sugar, complemented by a molasses production of 19,800 tons. This indicates a well-functioning operation with significant processing capacity and efficiency in sugar extraction.

Conversely, the Okkan Sugar Mill produced only 1,307 tons of sugar from 23,341.05 tons of crushed cane, highlighting its status as one of the lower-performing mills in terms of output. Its molasses production was recorded at 1,000 tons, suggesting a basic level of efficiency but reflecting room for improvement in maximizing both sugar and by-product outputs. This performance raises questions regarding the operational methods, resource management, or potential challenges faced by the mill.

Several mills have been identified as closed, including the Yedashe and Zayyawadi mills. The closure of these facilities indicates possible economic constraints, market challenges, or infrastructural issues that have hindered their operations. This trend of mill closures may significantly impact local sugar supply and employment opportunities, indicating the need for strategic interventions to revitalize these facilities or support alternative economic activities in affected areas.

Additionally, the Kyught taw, Kanhla and Bilin mills reported no cane crushed during this period, further underscoring the operational difficulties faced by certain factories. Such inactivity not only limits sugar production but also reflects the broader challenges within Myanmar's sugar industry, including issues related to supply chain, financing, or infrastructure development.

The data provides a mixed landscape of production capabilities among sugar mills in Myanmar, highlighting both successful operations and significant challenges. It suggests that while certain mills demonstrate robust performance, others require urgent attention to improve efficiency and productivity, as well as to address the closure and inactivity issues impacting the sector.

CHAPTER IV
SURVEY ANALYSIS

4.1 Survey Profile

Taikkyi Township, situated in the northern part of the Yangon Region, is a prominent area for agricultural activities, particularly sugarcane cultivation. The township benefits from fertile soil and a favorable climate, making it well-suited for growing sugarcane. At the heart of the local sugar industry is the Okkan Sugar Mill, which processes the sugarcane produced in the region and significantly influences the township's economy. The mill not only provides a crucial market for local farmers but also creates job opportunities and contributes to community development. The survey was designed to gather both quantitative and qualitative insights into sugarcane cultivation practices in Taikkyi Township and the sugar production process at Okkan Sugar Mill. Data were collected from 100 sugarcane farmers using a structured questionnaire, with a simple random sampling method ensuring a representative sample of the farming community. Additionally, secondary data covering production levels, costs, and productivity from Okkan Sugar Mill were incorporated into the study. This approach allowed for a comprehensive analysis of the sugarcane cultivation process and the associated economic impacts within the township.

4.2 Survey Design

The main objective of this study is to analyze the current situation of sugarcane cultivation and sugar production at Okkan Sugar Mill in Taikkyi Township. The survey for this study was designed to gather both quantitative and qualitative data on sugarcane cultivation practices in Taikkyi Township and the sugar production process at Okkan Sugar Mill in Taikkyi Township. The primary data were collected from a total of 350 sugarcane farmers in Taikkyi Township, with a sample size of 100 (28.57%). Additionally, secondary data on production levels, costs, and productivity were obtained from Okkan Sugar Mill to complement the primary data collected from the farmers. This study used secondary data from Okkan Sugar Mill, covering the period from 2010 to 2022. This dual approach allowed for a comprehensive analysis of the sugarcane cultivation process and sugar production in Okkan Sugar Mill.

4.3 Basic Information of the Respondents

This section provides an overview of the basic demographic and operational characteristics of the respondents involved in the study. It covers essential aspects such as age, gender, educational background, and experience in sugarcane cultivation. Additionally, it includes details on the size of the sugarcane plantations, the types of planting instruments or machines used, the duration of cultivation, and the nature of the cultivation land. The section also explores the varieties of sugarcane cultivated, the irrigation methods employed, and the frequency of fertilizer and pesticide applications. Finally, it examines the methods used for transporting harvested sugarcane. The following table show the basic characteristics of the respondents in Taikkyi Township.

Table (4.1) Demographic Characteristics of the Respondents

Sr. No	Characteristics	Items	Frequency	Percent
1	Age	21-30	18	18.0
		31-40	12	12.0
		41-50	64	64.0
		Above 50	6	6.0
		Total	100	100.0
2	Gender	Male	94	94.0
		Female	6	6.0
		Total	100	100.0
3	Education Level	No formal education	10	10.0
		Primary education	34	34.0
		Secondary education	22	22.0
		Higher education	34	34.0
		Total	100	100.0

Source: Survey Data, 2024.

The demographic characteristics of the respondents in Table 4.1 show that the majority of sugarcane farmers in Taikkyi Township are aged between 41 and 50 years, accounting for 64% of the sample, indicating that sugarcane cultivation is largely managed by middle-aged individuals with significant experience. Only 18% are in the younger age group of 21-30, and 6% are above 50 years old. Regarding gender, the

farming community is predominantly male, with 94% of respondents being men, which highlights a gender imbalance in sugarcane cultivation in the area.

In terms of education level, a considerable proportion of farmers have attained some level of formal education, with 34% having completed primary education and another 34% having reached higher education. However, 10% of the respondents have no formal education, which may indicate potential barriers to accessing modern agricultural techniques or training. The data provide that most sugarcane farmers in Taikkyi Township are middle-aged men with varying levels of education, which could influence their farming practices and openness to new technologies or methods.

Table (4.2) Sugarcane Cultivation Characteristics

Sr. No	Characteristics	Items	Frequency	Percent
1	Training Experience	No	72	72.0
		Yes	28	28.0
		Total	100	100.0
2	Cultivation Area	Less than 1 acre	6	6.0
		1-5 acres	55	55.0
		6-10 acres	22	22.0
		More than 10 acres	17	17.0
		Total	100	100.0
3	Planting Instruments	Buffalo, Cows and animals	36	36.0
		Sugarcane Equipment	64	64.0
		Total	100	100.0
4	Experience	Less than 5 years	6	6.0
		5-10 years	23	23.0
		11-20 years	17	17.0
		More than 20 years	54	54.0
		Total	100	100.0
5	Types of cultivation land	Rent	66	66.0
		Own	34	34.0
		Total	100	100.0
6	Types of Sugarcane	KK-3	53	53.0
		DAR-4	22	22.0
		PMA-0636	18	18.0
		Naypyitaw-1	7	7.0
		Total	100	100.0

7	Irrigation Methods	Rain-fed	70	70.0
		Canal irrigation	22	22.0
		Tube well irrigation	8	8.0
		Total	100	100.0
8	Fertilizer Application	Seasonally	100	100.0
9	Transportation Method	Using animals	22	22.0
		By truck	78	78.0
		Total	100	100.0

Source: Survey Data, 2024.

The data in Table 4.2 provide insights into the sugarcane cultivation practices of farmers in Taikkyi Township. A significant portion of the respondents (72%) reported having no formal training in sugarcane farming, which may indicate a potential need for improved training programs to enhance farming techniques. In terms of land size, the majority (55%) cultivate plots between 1 to 5 acres, while a smaller portion (17%) farm more than 10 acres, indicating that small-scale farming dominates the region.

Regarding planting methods, 64% of the farmers use modern sugarcane equipment, while 36% still rely on traditional methods such as using buffalo, cows, and animals for cultivation. This suggests that while some farmers have adopted modern tools, traditional practices are still prevalent. Most farmers (54%) have been cultivating sugarcane for more than 20 years, reflecting substantial experience in the field, while a smaller percentage (6%) are relatively new to the practice, with less than 5 years of experience.

A majority of the respondents (66%) rent their cultivation land, which could impact their long-term investment in land improvements and sustainability. In terms of the types of sugarcane grown, KK-3 is the most popular variety, cultivated by 53% of the farmers, followed by DAR-4 at 22%. This indicates a preference for specific varieties that may offer better yields or suit local conditions.

Most farmers (70%) rely on rain-fed irrigation, which suggests a vulnerability to weather patterns and climate change. Only 30% use more reliable irrigation methods, such as canal or tube well irrigation. All respondents apply fertilizers and pesticides seasonally, ensuring consistent crop management practices. Finally, the majority (78%) transport their harvested sugarcane by truck, while a smaller group (22%) still use animals, indicating a reliance on modern transportation methods for efficiency.

4.4 Factors Affecting Sugarcane Cultivations

This section explores the various factors that impact sugarcane cultivation in Taikkyi Township, focusing on key elements that influence productivity and overall efficiency. By examining labor availability, herbicide usage, land availability, credit accessibility, and fertilizer availability, this section aims to identify and understand the challenges and opportunities faced by sugarcane farmers. Through a detailed analysis of these factors, the study seeks to uncover how each aspect contributes to or detracts from the success of sugarcane farming. This comprehensive overview will provide insights into the operational constraints and resources affecting sugarcane cultivation, offering a clearer picture of the dynamics at play within this vital agricultural sector.

4.4.1 Labor Availability

Labor availability is a critical factor influencing sugarcane cultivation, as it directly affects the efficiency and productivity of farming operations. This section delves into the types of labor employed by sugarcane farmers, including family labor, hired labor, or a combination of both. It also examines the specific labor requirements for various cultivation activities, such as land preparation, planting, transportation, weeding, fertilizer application, and harvesting. The following table presents labor used in sugarcane cultivation.

Table (4.3) Labor Used in Sugarcane Cultivation

Sr. No	Characteristics	Items	Frequency	Percent
1	Types of labor	Family labor	6	6.0
		Hired labor	33	33.0
		Both family and hired labor	61	61.0
		Total	100	100.0
2	Challenges acquiring labor	No problem	11	11.0
		Difficult	28	28.0
		High cost	61	61.0
		Total	100	100.0

Source: Survey Data, 2024.

The data presented in Table 4.3 illustrate the labor dynamics involved in sugarcane cultivation in Taikkyi Township. A majority of respondents (61%) utilize both family and hired labor for their sugarcane farming activities, indicating a reliance

on a combination of personal and external resources. In contrast, only 6% of farmers use family labor exclusively, while 33% depend solely on hired labor.

When it comes to challenges in acquiring labor, the most significant issue reported is high cost, affecting 61% of respondents. This indicates that the financial burden of hiring labor is a substantial concern for many farmers. Additionally, 28% of farmers find it difficult to acquire labor, which may be due to factors such as labor availability or competition. Conversely, only 11% of farmers report no issues with labor acquisition, indicating that while some manage to secure labor without difficulty, it remains a significant challenge for the majority.

The reliance on both family and hired labor, coupled with the high cost and difficulty in acquiring labor, highlights the need for strategies to address labor shortages and manage labor costs effectively in the sugarcane cultivation sector in Taikkyi Township.

4.4.2 Herbicide Availability

Herbicide availability plays a significant role in managing weed control and enhancing sugarcane productivity. This section investigates the use of herbicides in sugarcane production, including the types and quantities applied, their cost, and their impact on yield. It also addresses challenges faced by farmers in acquiring herbicides, such as accessibility issues and high costs. Table (4.4) indicates herbicide usage in sugarcane cultivation within Taikkyi Township.

Table (4.4) Herbicide Usage in Sugarcane Cultivation

Sr. No	Characteristics	Items	Frequency	Percent
1	Use of Herbicides	Yes	75	75.0
		No	25	25.0
		Total	100	100.0
2	Challenges Acquiring Herbicides	Difficult	28	28.0
		High cost	72	72.0
		Total	100	100.0
3	Herbicides improving productivity	Yes	100	100.0
		Total	100	100.0

Source: Survey Data, 2024.

Table (4.4) presents data on herbicide usage in sugarcane cultivation based on survey responses from 100 farmers. A significant majority of farmers (87%) use herbicides, indicating that they recognize the importance of these chemicals in managing weed growth and enhancing crop yield. In contrast, only 13% of farmers do not use herbicides, which may be due to personal preference, cost constraints, or alternative weed management practices. The findings reveal that a substantial majority, 75%, of respondents utilize herbicides, while 25% do not. This indicates that herbicide application is a common practice among sugarcane growers, highlighting its importance in their farming strategies.

When examining the challenges associated with acquiring herbicides, the data show that a significant 72% of respondents cite high costs as a primary obstacle. This financial burden can hinder effective weed management, placing a strain on farmers' resources. Additionally, 28% of respondents reported difficulties in obtaining herbicides, likely due to accessibility issues or supply chain constraints. These challenges underscore the barriers that farmers face in securing essential agricultural inputs for their operations.

Despite these difficulties, all respondents (100%) acknowledged that herbicides improve productivity in sugarcane cultivation. This overwhelming consensus underscores the perceived value of herbicides in enhancing yields. The findings illustrate that while herbicides are widely embraced and recognized for their positive impact on sugarcane productivity, challenges related to cost and availability remain critical issues. Addressing these barriers could enhance the efficiency of herbicide use and further increase productivity in sugarcane cultivation in Taikkyi Township.

4.4.3 Land Availability

Land availability is also a fundamental factor affecting the scope and scale of sugarcane cultivation. This section explores the amount of land used for sugarcane farming, including details on ownership, acquisition methods, and the total land area owned by farmers. It also identifies challenges related to land acquisition, such as high costs or difficulties in accessing land. The below table provides land usage in sugarcane cultivation of Taikkyi Township.

Table (4.5) Land Usage in Sugarcane Cultivation

Sr. No	Characteristics	Items	Frequency	Percent
1	Land used	Bought	12	12.0
		Hired	56	56.0
		Inherited	19	19.0
		Accessed free land	13	13.0
		Total	100	100.0
2	Challenges Acquiring Land	No problem	71	71.0
		Difficult	17	17.0
		High cost	12	12.0
		Total	100	100.0

Source: Survey Data, 2024.

Table 4.5 provides an overview of land usage in sugarcane cultivation in Taikkyi Township. The data reveal that a significant portion of land used for sugarcane farming is rented, with 56% of respondents utilizing hired land. This indicates a reliance on rental agreements, possibly due to constraints in purchasing land or the preference for flexible land use arrangements. In contrast, 12% of the land is bought, 19% is inherited, and 13% is accessed for free.

Regarding challenges in acquiring land, a substantial majority (71%) of farmers report no issues, suggesting that land acquisition is relatively smooth for most. However, 17% find it difficult to acquire land, which may be due to factors such as competition or limited availability. Only 12% cite high costs as a significant barrier, indicating that while cost is a concern, it is less prevalent compared to other challenges.

The data indicate that while land acquisition is generally manageable for most farmers, the reliance on rented land and the varying sources of land access highlight the diverse approaches to land use in sugarcane cultivation. Addressing the challenges faced by those who find land acquisition difficult could further support the growth and sustainability of sugarcane farming in the region.

4.4.4 Credit Availability

Access to credit is crucial for financing sugarcane production and sustaining farming operations. This section assesses the availability and sources of credit used by sugarcane farmers, including the amount borrowed and its impact on production. It also explores the challenges associated with obtaining credit, such as high interest rates or

limited access to financial institutions. The following Table (4.6) presents access to credit in sugarcane cultivation within Taikkyi Township.

Table (4.6) Access to Credit in Sugarcane Cultivation

Sr. No	Characteristics	Items	Frequency	Percent
1	Taking Credit	Yes	93	93.0
		No	7	7.0
		Total	100	100.0
2	Credit improving productivity	Yes	100	100.0
		Total	100	100.0

Source: Survey Data, 2024.

Table (4.6) provides insights into the access to credit among sugarcane farmers in Taikkyi Township. The findings indicate that a substantial majority of farmers (93%) rely on credit to support their sugarcane cultivation activities, underscoring the essential role that financial resources play in facilitating farming operations. Conversely, only 7% of farmers do not access credit, which may be attributed to factors such as self-financing, alternative funding sources, or challenges in obtaining loans.

The data also reveal a strong positive correlation between credit access and productivity, with 100% of farmers affirming that credit improves their productivity. This unanimous response highlights how financial support enables farmers to invest in crucial inputs, adopt advanced technologies, and manage their operational costs more effectively, ultimately leading to improved production outcomes. The absence of farmers reporting a lack of productivity benefits from credit suggests that financial assistance is perceived as universally beneficial in enhancing farming efficiency.

These findings emphasize the critical role of credit in bolstering sugarcane cultivation and its significant impact on productivity. To maximize the effectiveness of financial support for farmers, addressing any barriers to credit access such as high interest rates or limited availability could further enhance the growth and sustainability of sugarcane farming in Taikkyi Township.

4.4.5 Fertilizer Availability

Finally, fertilizer availability is also essential for enhancing soil fertility and maximizing sugarcane yield. This section investigates the use of fertilizers in sugarcane

farming, including the types and quantities applied, their cost, and their effect on productivity. It also addresses challenges related to acquiring fertilizers, such as high costs or supply shortages. Table (4.7) indicates fertilizer usage in sugarcane cultivation.

Table (4.7) Fertilizer Usage in Sugarcane Cultivation

Sr. No	Characteristics	Items	Frequency	Percent
1	Using fertilizer	Yes	100	100.0
		Total	100	100.0
2	Challenges Acquiring Fertilizer	No problem	17	17.0
		Difficult	11	11.0
		High cost	72	72.0
		Total	100	100.0
3	Fertilizer improving productivity	Yes	100	100.0
		Total	100	100.0

Source: Survey Data, 2024.

Table (4.7) presents a comprehensive overview of fertilizer usage in sugarcane cultivation among farmers. The data reveal that 100% of respondents utilize fertilizers in their farming operations, indicating a strong consensus on the importance of fertilization for enhancing soil fertility and boosting crop yields.

Among those using fertilizers, an overwhelming 100% believe that these inputs improve productivity, emphasizing the essential role of effective nutrient management in increasing sugarcane yields. This widespread acknowledgment of the benefits of fertilization highlights its significance in achieving optimal growth and producing high-quality crops.

Despite the high usage rates, challenges in acquiring fertilizers are evident. While 17% of farmers report no problems in obtaining fertilizers, 11% experience difficulties, and a notable 72% identify high costs as a significant barrier to access. The high expense associated with fertilizers can limit farmers' ability to apply them adequately, potentially hindering crop yields and overall production efficiency.

These findings underscore that while fertilizers are universally utilized and are recognized for their positive impact on productivity, cost remains a critical challenge. Addressing the issues related to fertilizer affordability and access could enhance their effective use, thereby supporting the sustainability and growth of sugarcane farming in the region.

4.5 Situation of Sugarcane Cultivation and Production in Taikkyi Township

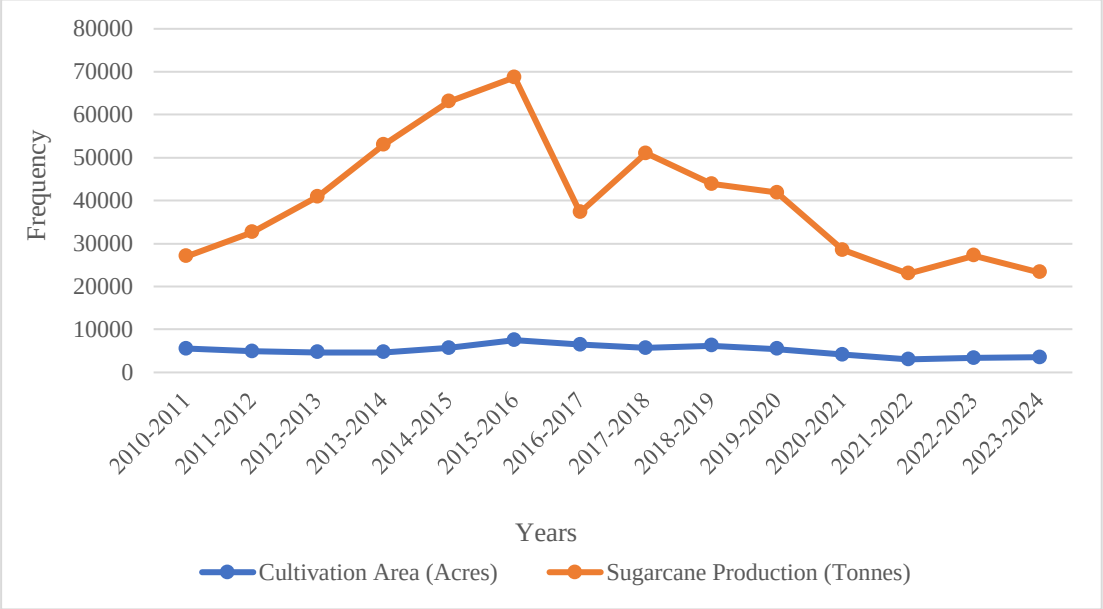
Sugarcane cultivation plays a significant role in the agricultural landscape of Taikkyi Township, contributing to the local economy and the livelihoods of many farming communities. The region's favorable climate, fertile soil, and access to essential water resources have made it an ideal location for growing sugarcane. Over the years, this cultivation has evolved, reflecting broader agricultural trends and responding to both local and global demands for sugar and related products. The following table and figure show trends in the cultivation area and production of sugarcane at Taikkyi Township from 2010 to 2022.

Table (4.8) The Cultivation Area and Production of Sugarcane in Taikkyi Township

Year	Cultivation Area (Acres)	Cultivation Growth Rate (Percentage)	Sugarcane Production (Tonnes)	Production Growth Rate (Percentage)
2010-2011	5558	-	27034	-
2011-2012	4896	-11.90%	32629	20.70%
2012-2013	4641	-5.20%	40892	25.30%
2013-2014	4685	1%	52935	29.40%
2014-2015	5710	21.90%	63082	19.20%
2015-2016	7518	31.70%	68710	8.90%
2016-2017	6491	-13.70%	37262	-45.80%
2017-2018	5696	-12.20%	51046	37%
2018-2019	6242	9.60%	43904	-14%
2019-2020	5484	-12.10%	41848	-4.70%
2020-2021	4106	-25.10%	28469	-32%
2021-2022	3037	-26%	22985	-19.30%
2022-2023	3381.5	11.30%	27221	18.40%
2023-2024	3540	4.70%	23341	-14.30%

Source: Compiled from Okkan Sugar Mill.

Figure (4.1) Trends in Cultivation Area and Production of Sugarcane in Taikkyi Township



Source: Compiled from Okkan Sugar Mill.

The cultivation growth rates and production growth rates presented in Table (4.8) provides significant fluctuations in the sugarcane sector within Taikkyi Township over the years. The cultivation growth rates exhibited a mixed trend. Negative growth rates of -11.90% in 2011-2012 and -5.20% in 2012-2013 indicated a decline in the area under cultivation, which may have negatively impacted overall production. However, a notable recovery occurred in 2014-2015, with a cultivation growth rate of 21.90%, indicating an increase in planting efforts during that period. This upward trend continued, peaking at 31.70% in 2015-2016, reflecting a substantial expansion of sugarcane cultivation.

Following this peak, the sector faced challenges, as evidenced by the significant drop in cultivation area in 2020-2021, which saw a decline of -25.10%, and an even steeper reduction of -26% in 2021-2022. These declines indicate difficulties in maintaining or expanding cultivation areas. However, there was a slight recovery in 2022-2023, with an increase of 11.30%, followed by a modest rise of 4.70% in 2023-2024, providing a potential stabilization in cultivation efforts.

In terms of production growth rates, the data illustrates a more volatile pattern. A significant production increase of 20.70% occurred in 2011-2012, highlighting improved yields or farming practices. The production growth rate peaked at 29.40% in 2013-2014, indicating enhanced production efficiency or favorable environmental

conditions. However, the sector faced severe challenges in 2016-2017, with a drastic drop of -45.80%, likely due to adverse environmental factors or management issues.

Despite a recovery in 2017-2018, which saw a remarkable growth rate of 37%, the following year experienced a negative growth rate of -14% in 2018-2019, reflecting instability in production levels. The downturn continued, with further negative growth rates of -4.70% in 2019-2020 and -32% in 2020-2021, emphasizing ongoing crises within the sector. Production fell again by -19.30% in 2021-2022, indicating persistent difficulties. Although positive growth of 18.40% was recorded in 2022-2023, the subsequent year (2023-2024) saw another decline of -14.30%, underscoring the continued uncertainty and volatility in production.

Sugarcane cultivation in Myanmar is a labor-intensive and resource-driven agricultural practice, with average yields ranging from 15 to 22 tons per acre. The total cost of cultivating one acre of sugarcane includes various essential activities such as harrowing, planting, weeding, fertilizer application, irrigation, and transportation. These costs vary depending on the region and farming practices but typically range from MMK 1,120,000 to MMK 1,900,000 per acre. Given the current sugarcane price of MMK 110,000 per ton, farmers can expect a significant return, especially with higher yields. For instance, with an average yield of 20 tons per acre, the revenue could reach MMK 2,200,000, which highlights the potential profitability of sugarcane farming, despite the substantial initial investment in cultivation. However, factors such as fluctuating sugarcane prices and varying input costs can impact overall profitability.

The cultivation and production growth rates in Taikkyi Township reflect a highly variable landscape for sugarcane farming, marked by periods of significant growth alongside substantial decline. This volatility highlights the need for strategic interventions to stabilize and enhance productivity in the sugarcane sector moving forward.

4.6 The Situation of Sugar Production at Okkan Sugar Mill

Oakkan sugar mill is the only sugar mill located in the Taikkyi Township. The Okkan Sugar Mill, a key industrial facility in Taikkyi Township, plays a crucial role in the region's sugar production, serving as a vital link between local sugarcane farmers and the broader market. Established to capitalize on the abundant sugarcane supply in the area, the mill has evolved into a central hub for processing and refining sugarcane into various sugar products. Over the years, the mill has faced both opportunities and

challenges, ranging from fluctuations in sugarcane supply to advancements in processing technologies. This section explores the current situation of sugar production at Okkan Sugar Mill, highlighting its operational dynamics, production capacity, and the impact it has on the local economy and the livelihoods of those involved in the sugarcane supply chain. Table (4.3) indicates the production of sugarcane at Okkan Sugar Mill from 2010 to 2022.

Table (4.9) Sugar Production at Okkan Sugar Mill

Year	Sugarcane (Tonnes)	Production of Sugar (Tonnes)	Growth Rate (Percentage)	Production of Molasses (Tonnes)	Growth Rate (Percentage)
2010-2011	27034	2435	-	1095	-
2011-2012	32629	2790	14.6 %	1475	34.7 %
2012-2013	40892	3724	33.5 %	1884	27.7 %
2013-2014	52935	4939	32.6 %	2865	52.1 %
2014-2015	63082	5095	3.2 %	3765	31.4 %
2015-2016	68710	6264	22.9 %	4395	16.7 %
2016-2017	37262	2987	-52.3 %	2145	-51.2 %
2017-2018	51046	4697	57.2 %	2197	2.4 %
2018-2019	43904	3622	-22.9 %	2396	9.1 %
2019-2020	41848	3931	8.5 %	2241	-6.5 %
2020-2021	28469	2517	-36 %	1238	-44.7 %
2021-2022	22985	2082	-17.3 %	955	-22.9 %
2022-2023	27221	2531	21.6 %	1003	5 %
2023-2024	23341	1885	-25.5 %	1307	30.3 %

Source: Oakkan Sugar Mill.

The growth rates for sugar production at Okkan Sugar Mill, as presented in Table (4.9), demonstrate a fluctuating performance over the years. In 2011-2012, the sugar yield increased by 14.6%, and molasses production saw a significant rise of 34.7%. This positive trend continued into 2012-2013, with a substantial increase in sugar yield of 33.5% and a 27.7% growth in molasses production, indicating strong operational performance. The upward trajectory persisted in 2013-2014, where sugar yield rose by 32.6%, complemented by a notable 52.1% increase in molasses production. These figures suggest a robust year for both sugar and molasses outputs.

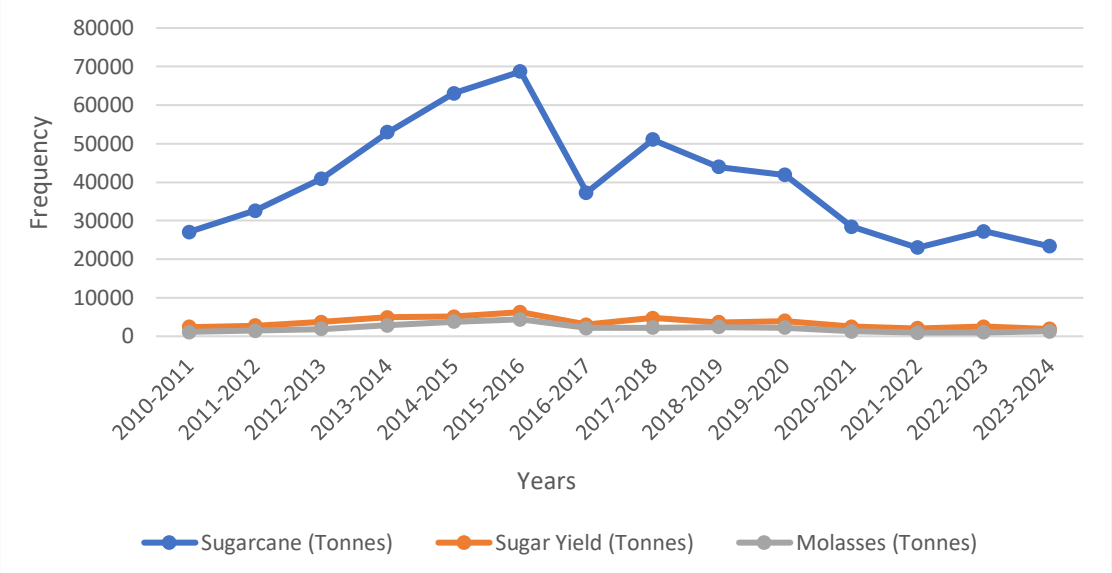
However, 2014-2015 marked a slowdown in growth, with sugar yield increasing only by 3.2%, although molasses production still experienced significant growth at 31.4%. The following year, 2015-2016, saw a rebound in sugar yield, which increased by 22.9%, while molasses production also grew by 16.7%. This period indicated an improvement in production efficiency.

The year 2016-2017 introduced a troubling decline, with sugar yield plummeting by -52.3%, alongside a significant decrease of -51.2% in molasses production. This downturn raised concerns about the operational challenges faced by the mill. The subsequent year, 2017-2018, showcased a recovery, with sugar yield bouncing back by 57.2%, while molasses production saw a slight increase of 2.4%.

Despite this recovery, the year 2018-2019 witnessed another decline in sugar yield of -22.9%, although molasses production grew by 9.1%. A modest increase of 8.5% in sugar yield was recorded in 2019-2020, yet molasses production faced a slight downturn of -6.5%. The challenges escalated in 2020-2021, with a sharp decline in sugar yield by -36% and a significant drop in molasses production of -44.7%. This trend of decline persisted into 2021-2022, with sugar yield decreasing by -17.3% and molasses production falling by -22.9%.

Signs of recovery emerged in 2022-2023, as sugar yield increased by 21.6% and molasses production rose by 5%. However, this recovery was short-lived, as the year 2023-2024 experienced another decline in sugar yield of -25.5%, despite a significant rebound in molasses production, which grew by 30.3%.

Figure (4.2) Trends in Sugar Production at Okkan Sugar Mill



Source: Compiled from Okkan Sugar Mill.

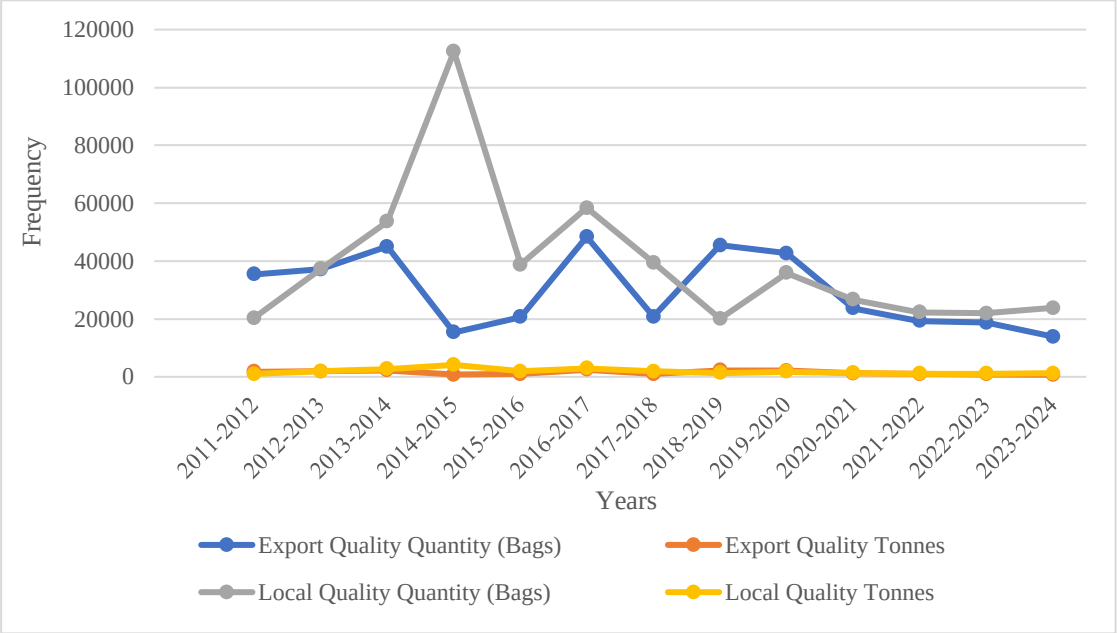
The Okkan Sugar Mill has experienced varying situations in its sugar export operations over the years. Initially, the mill faced challenges related to production capacity and market access, which impacted its ability to effectively compete in the global market. However, recent improvements in production technology and increased efficiency have enabled the mill to boost its export performance. Despite these advancements, the mill's export volumes are still subject to fluctuations based on global market conditions, local agricultural policies, and competition from other sugar-producing countries. Additionally, the mill has been working to enhance its product quality and expand its market reach, aiming to increase its share in international sugar markets. The below table presents sugar volumes for export and local consumption from Okkan Sugar Mill between 2011 and 2024.

Table (4.10) Sugar Production for Export and Local Quality

Year	Export Quality		Local Quality	
	Quantity (Bags)	Tonnes	Quantity (Bags)	Tonnes
2011-2012	35481	1774.05	20309	1015.45
2012-2013	37187	1859.35	37290	1864.50
2013-2014	45041	2257.05	53642	2681.45
2014-2015	15405	762.81	112430	4132.68
2015-2016	20724	1015.48	38828	1902.57
2016-2017	48392	2419.46	58342	2964.63
2017-2018	20843	1021.32	39461	1932.19
2018-2019	45435	2271.75	20075	1350.25
2019-2020	42721	2136.05	35914	1795.70
2020-2021	23681	1184.05	26669	1333.45
2021-2022	19288	964.40	22344	1117.20
2022-2023	18746	910.61	21895	1106.94
2023-2024	13913	695.95	23771	1188.55

Source: Okkan Sugar Mill.

Figure (4.3) Trends in Sugar Production for Export and Local Quality



Source: Compiled from Okkan Sugar Mill.

The data presented in Table (4.10) illustrates the annual sugar production for export and local quality at the Okkan Sugar Mill from 2011-2012 to 2023-2024. The production data are expressed in two forms: the number of bags and their equivalent weight in tonnes. The figures cover both export-quality and local-quality sugar, with a distinction that the Okkan Sugar Mill exclusively produces local consumption sugar and does not engage in export production directly. However, the export-quality column reflects the production of sugar that meets international standards, though it is consumed locally.

It is evident that the volumes for export quality have experienced significant fluctuations over the years. The highest export volume occurred in the 2013-2014 period, with over 45,000 bags produced, which demonstrates a peak in demand or production capabilities during that year. Conversely, the lowest export volume was noted in the 2014-2015 period, where the export volume dramatically dropped to around 15,000 bags.

In contrast, local quality sugar production shows a different trend. While the production volumes for local consumption have generally been higher than those for export, the data indicates that local quality production peaked in 2014-2015, with over 112,000 bags produced. This suggests that local demand may have significantly influenced production strategies during this period.

The export quality figures have been consistently lower than local quality production in recent years, particularly in the 2023-2024 period, where export quality dropped to around 13,913 bags while local quality production reached 23,771 bags. This indicates a possible shift in focus towards satisfying local demand rather than pursuing export opportunities.

It is found that the Okkan Sugar Mill relies on local sugar production, because if sugarcane cultivation increases, sugar production will increase and if sugarcane cultivation decreases, sugar production will be decrease. Furthermore, the classification of both export and local quality as ICU quality implies a standard that meets specific industry criteria, ensuring that even local production adheres to quality norms.

The trends in sugar volumes for export and local quality production reflect dynamic market conditions and production capabilities at the Okkan Sugar Mill. The mill's focus on local consumption is evident, and the data underscores the importance of local demand in shaping production strategies within the sugar industry.

CHAPTER V
CONCLUSION

This chapter consists of two sections: findings, and suggestions. The findings include The Overview of Sugarcane Cultivation in Taikkyi Township, the production activities at Okkan Sugar Mill and the relationship between sugar production and various inputs at Okkan Sugar Mill. The suggestions present recommendations to enhance sugarcane cultivation and sugar production efficiency at Okkan Sugar Mill in in Taikkyi Township.

5.1 Findings

The objective of this study was to investigate the factors affecting sugarcane cultivation and to analyze sugarcane cultivation and sugar production in Taikkyi Township. To achieve this, a mixed-method approach was employed, utilizing both primary and secondary data. The primary data were gathered through a structured questionnaire distributed to 100 sugarcane farmers, employing a simple random sampling method to ensure a representative selection of respondents. This descriptive method allowed for an in-depth exploration of the current practices, challenges, and outcomes faced by farmers in their cultivation efforts. Additionally, secondary data were obtained from Okkan Sugar Mill, providing context on the area under cultivation, production levels, and productivity rates.

The findings indicate that the labor availability and costs pose significant challenges for sugarcane farmers. The high reliance on family and hired labor indicates a need for external support, resulting in elevated labor expenses that strain finances. Issues such as competition for labor, migration, and seasonal availability further complicate farming operations. To mitigate these challenges, strategies like mechanization, improved labor management practices, and community-based labor-sharing schemes could be implemented. Government or cooperative initiatives offering subsidized labor or mechanization support may also alleviate the financial burden on farmers.

The extensive use of herbicides for weed management among sugarcane farmers highlights a reliance on chemical solutions to enhance productivity, but the

associated costs create financial strain and limit application frequency. Access issues related to herbicides indicate potential weaknesses in supply chains or distribution systems. Addressing these challenges through subsidies or improved availability could support farmers. Additionally, promoting integrated weed management practices, which combine herbicides with more sustainable methods, could alleviate financial pressures while maintaining crop yields.

Additionally, the heavy reliance on rented land reflects farmers' need for flexibility, but 17% of farmers face challenges in securing land, indicating possible underlying issues with land availability and competition that could hinder sector growth. To promote long-term investment and sustainability, land access policies or reforms are necessary. Providing support for land ownership through affordable financing options or land tenure security programs could reduce dependency on rental arrangements.

Access to credit is crucial for enhancing agricultural productivity in Taikkyi Township. It enables farmers to invest in essential tools, fertilizers, and labor, leading to improved crop yields. All surveyed farmers reported productivity gains linked to credit access, highlighting its importance. However, addressing barriers such as high interest rates and complex application processes is vital for further sector growth.

Fertilizers play a key role in sugarcane productivity, yet their high cost poses significant challenges for many farmers. The reliance on fertilizers underscores their importance in cultivation, but financial barriers may limit long-term sustainability. Addressing fertilizer costs and accessibility through subsidies, improved supply chains, or credit options could enhance the efficiency and profitability of sugarcane farming, ultimately strengthening the agricultural economy and allowing farmers to maintain high yields over time.

The sugar production data from Okkan Sugar Mill reveals significant fluctuations in both sugar yield and molasses production over the years. From 2011 to 2014, the mill experienced robust growth, with notable increases in sugar yield and molasses production. However, the years 2016-2017 marked a drastic downturn, with sugar yield dropping by -52.3% and molasses production by -51.2%. Following some recovery in subsequent years, production again faced declines in 2023-2024, despite a rebound in molasses production. These trends indicate persistent volatility in production performance, influenced by operational challenges and market conditions. Furthermore, while recent improvements in production technology have enhanced

export performance, fluctuations in global market dynamics and competition continue to impact the mill's ability to maintain consistent output and profitability.

In Myanmar, the overall trend shows a significant yearly increase in both the sugarcane planting area and yield; however, Taikkyi Township has experienced a concerning decline in sugarcane cultivation and production. This decrease can be attributed to several factors highlighted in the findings, such as labor shortages, high costs of inputs like fertilizers and herbicides, and the challenges related to land acquisition. The heavy reliance on rented land and the difficulties in accessing essential resources create instability in sugarcane production, directly impacting sugar yield. As sugar production at Okkan Sugar Mill is entirely dependent on the availability of sugarcane sourced from Taikkyi Township, the decline in local cultivation threatens the mill's output and, consequently, the broader sugar production landscape. Thus, addressing the underlying issues in Taikkyi Township is critical for sustaining both local and national sugar production efforts.

5.2 Suggestions

To address the challenges faced by sugarcane farmers in Taikkyi Township, it is crucial to implement strategies that enhance labor availability and reduce costs. One approach is to promote mechanization in sugarcane cultivation, which can alleviate the dependence on manual labor and improve productivity. Additionally, the establishment of community-based labor-sharing schemes can facilitate more efficient labor management, helping farmers to better utilize available workforce resources.

Another critical area for intervention is the accessibility and affordability of agricultural inputs such as fertilizers and herbicides. Implementing subsidy programs for these essential resources can help farmers manage their production costs more effectively. Additionally, enhancing the supply chain for agricultural inputs is vital to ensure consistent availability at reasonable prices. Promoting integrated weed management practices that combine chemical and sustainable methods can also alleviate financial pressures while maintaining crop yields. Training programs that educate farmers about sustainable agricultural practices can empower them to adopt more efficient methods, ultimately contributing to the long-term sustainability of sugarcane production in the region.

Finally, addressing land access issues is imperative for fostering investment and

stability in sugarcane farming. Policies that promote land tenure security and provide affordable financing options for land ownership can help reduce farmers' dependence on rented land. Furthermore, the government should consider land reforms that facilitate better access to land for smallholder farmers, enabling them to make long-term investments in their agricultural practices. Strengthening local cooperatives can also enhance farmers' negotiating power in securing land and resources, thus contributing to a more resilient sugarcane sector in Taikkyi Township. By focusing on these areas, stakeholders can work towards revitalizing sugarcane cultivation and ensuring sustainable production in the region.

REFERENCES

Ahmed, M., & Rahman, M. (2014). The economic impact of the sugar industry in India. Journal of Agricultural Economics, 6(3), 45-57.

Aung, S. K., & Khaing, K. M. (2022). Technological Advancements and Operational Efficiency in Sugar Production: A Case Study of Okkan Sugar Mill. Journal of Agricultural Engineering, 45(2), 123-134.

Aung, T. M. (2018). The impact of sugar mills on local farming communities: A case study of Taikkyi Township. Myanmar Rural Development Journal.

Choudhury, R., & Sahu, R. K. (2022). Economic Viability of Sugar Mills: Challenges and Strategies. Journal of Economic Agriculture, 59(2), 147-162.

Cobb, C. W., & Douglas, P. H. (1928). A Theory of Production. *The American Economic Review*, 18(1), 139-165.

FAO. (2018). Sugarcane farming practices in Southeast Asia. Food and Agriculture Organization Report. Retrieved from FAO website

FAO. (2019). World sugar production and trade. Food and Agriculture Organization Statistical Yearbook. Retrieved from FAO website

Garcia, L. R., & Martinez, J. F. (2023). Environmental Impacts and Sustainability in Sugar Production: A Comprehensive Review. Journal of Cleaner Production.

Goldemberg, J. (2008). The Brazilian sugarcane industry: The key to reducing carbon emissions. Energy Policy, 36(2), 2086-2097.

Hlaing, N. T. (2020). Environmental concerns in sugar mill operations in Myanmar. Journal of Environmental Management, 9(2), 98-112.

Htay, M. S., & Maung, M. (2022). Water Management Practices in Myanmar's Sugarcane Cultivation: Challenges and Solutions. Myanmar Journal of Agricultural Sciences, 48(1), 67-82.

Htwe, N. W. (2016). Challenges in sugarcane farming in Myanmar. Myanmar Agricultural Journal, 10(1), 20-30.

Jha, A., Singh, R., & Kumar, P. (2021). Climate Change Adaptation Strategies for Sugarcane Cultivation: A Review. Agricultural Systems, 191, 103-115.

Khin, S. M. (2019). Economic contributions of sugar mills in rural Myanmar. Myanmar Economic Review, 20(4), 34-47.

Knox, J. W., Rodríguez Díaz, J. A., Nixon, D. J., & Mkhwanazi, M. (2010). A preliminary assessment of climate change impacts on sugarcane in Swaziland. Agricultural Systems, 103(2), 63-72.

Kumar, A., Sharma, P., & Verma, A. (2023). Policy Impacts on Sugar Production: A Review of Regulatory Frameworks and Economic Effects. Agricultural Policy Review, 41(1), 33-45.

Kumar, V., Sharma, A., & Singh, R. (2019). Optimizing Agronomic Practices for Enhanced Sugarcane Yield: A Review. Field Crops Research, 233, 92-105.

Kyaw, M. L., & Thant, K. T. (2023). Economic Impacts of Policy Changes on Myanmar's Sugar Industry: A Case Study of Okkan Sugar Mill. Asian Economic Journal, 37(2), 134-149.

Kyaw, T. T. (2018). Government policies and sugarcane production in Myanmar. Journal of Rural Development, 8(2), 56-72.

Lee, S. H., & Choi, J. S. (2021). The Impact of Market Volatility on Sugar Production: Economic Implications and Management Strategies. Agricultural Economics Review, 56(1), 45-60.

Lin, M. T. (2022). Technological advancements and operational efficiency in the Myanmar sugar industry. Asian Journal of Agricultural Development.

Min, T. K. (2020). Challenges in the sugarcane supply chain in Myanmar. Journal of Agricultural Economics, 18(1), 112-126.

Mitr Phol. (2017). The Thai sugar industry: An overview. Mitr Phol Annual Report.

Mya, S. M. (2019). Environmental impacts of sugarcane cultivation in Myanmar. Environmental Science Journal, 7(4), 119-132.

Oo, S. M. (2017). The state of technological adoption in sugarcane farming in Myanmar. Journal of Agricultural Science and Technology, 9(3), 233-245.

Patel, R., Bhatia, S., & Mehta, P. (2020). Agronomic Practices and Their Impact on Sugarcane Yield: A Review. Journal of Crop Improvement, 45(4), 567-580.

Patil, R. S., & Yadav, S. K. (2020). Soil Fertility Management in Sugarcane Cultivation: Best Practices and Challenges. Soil Science Society of America Journal.

Sawhney, A. (2016). Regulatory challenges in the Indian sugar industry. Economic and Political Weekly, 51(6), 45-50.

Sharma, S., & Singh, R. (2021). Climate Change Adaptation Strategies for Sugarcane Cultivation: Insights and Recommendations. Climate Resilience Journal.

Silva, F. J., Costa, L. M., & Oliveira, J. A. (2022). Technological Innovations in Sugar Milling: Enhancing Efficiency and Reducing Costs. Journal of Sugar Technology, 35(4), 265-278.

Singh, R., & Rathi, N. (2020). Integrated Pest Management in Sugarcane: Strategies and Challenges. International Journal of Pest Management, 66(3), 205-220.

Singh, V., Gupta, R., & Sharma, N. (2023). Environmental Sustainability in Sugar Production: Addressing Water Use and Waste Management. Environmental Management Journal, 68(1), 99-112.

Soe, P. L. (2019). Sustainable waste management practices in the sugar industry. Environmental Science and Technology Review, 13(2), 87-95.

Solomon, S. (2016). Sugarcane production and productivity in India: Challenges and prospects. Sugar Tech, 18(1), 1-8.

Than, Z. M. (2017). The role of sugar mills in the economic development of rural areas. Journal of Southeast Asian Agricultural Studies, 11(4), 56-70.

Thant, K. (2021). The relationship between sugar mills and farmers in Myanmar. Journal of Rural Economics, 12(2), 67-82.

Thein, A., & Nyein, M. (2021). Improving Planting Materials for Sugarcane Cultivation in Myanmar: Challenges and Opportunities. Journal of Crop Science, 58(3), 201-215.

UNICA. (2018). Brazilian Sugarcane Industry Association Annual Report. Retrieved from UNICA website

Verma, A. (2015). Economic issues facing the sugarcane industry in India. Indian Journal of Agricultural Economics, 70(3), 248-260.

Wai, T. T. (2020). The role of sugar mills in rural economic development in Myanmar. Development Studies Review, 22(3), 110-124.

Win, H. H. (2019). The sugar industry in Bago Region: Opportunities and challenges. Myanmar Economic Journal, 14(2), 34-47.

Win, S. K., & Aung, T. M. (2023). Operational Efficiency and Technological Upgrades in Myanmar's Sugar Industry: Insights from the Okkan Sugar Mill. Industrial Engineering Journal, 61(4), 98-110.

Zhang, Y., Liu, J., & Wang, X. (2023). Economic Challenges in the Global Sugar Market: Implications for Sugarcane Producers. Agricultural Economics.

APPENDIX

Questionnaire

Section A

Basic Information

1. Age

- ☐ Below 20
- ☐ 21-30
- ☐ 31-40
- ☐ 41-50
- ☐ Above 50

2. Gender

- ☐ Male
- ☐ Female

3. Education Level

- ☐ No formal education
- ☐ Primary education
- ☐ Secondary education
- ☐ Higher education
- ☐ Graduate
- ☐ Other

4. Sugarcane Cultivation Training Experience

- ☐ No
- ☐ Yes

5. Size of Sugarcane Plantation

- ☐ Less than 1 acre
- ☐ 1-5 acres
- ☐ 6-10 acres
- ☐ More than 10 acres

6. Planting Instruments/ Machine Used

- ☐ Buffalo, Cows and animals
- ☐ Sugarcane Equipment

7. How long does sugarcane cultivation take?

- ☐ Less than 5 years
- ☐ 5-10 years
- ☐ 11-20 years
- ☐ More than 20 years

8. Types of cultivation land.

- ☐ Rent
- ☐ Own

9. Which sugarcane variety do you primarily cultivate on your farm? (Select all that apply)

- ☐ KK-3
- ☐ DAR-4
- ☐ PMA-0636
- ☐ Naypyitaw-1

10. Irrigation Methods Used

- ☐ Rain-fed
- ☐ Canal irrigation
- ☐ Tube well irrigation
- ☐ Other (please specify): _____

11. Frequency of Fertilizer and Pesticide Application

- ☐ Monthly
- ☐ Every two months
- ☐ Seasonally
- ☐ Not at all

12. Transportation Method for Harvested Sugarcane

☐ By hand

☐ Using animals

☐ By truck

☐ Other (please specify): _____

Section B

Costs for Sugarcane Cultivation

Sr. No.	Costs	Total (MMK)
1	Harrowing	
2	Planting	
3	Weeding	
4	Fertilizer Application	
5	Irrigation	
6	Transportation	

Section C

Factors Affecting Sugarcane Productivity

I. Labor Availability

1. Which types of labor did you use in the sugarcane production season? (Please select one)

- 1 = Family labor
- 2 = Hired labor
- 3 = Both family and hired labor

2. Please indicate the area cultivated, output obtained, and the number of labor hours (man hours/days) used in sugarcane production for the following activities:

Activity	Area (acres)	Family Labor (man hours/days)	Hired Labor (man hours/days)
Land preparation			
Manual planting			
Transportation			
Weeding			
Fertilizer application			
Harvesting			

3. What challenges do you face when acquiring labor? (Please select one)

- 1 = No problem
- 2 = Difficult
- 3 = High cost
- 4 = Other (please specify): _____

II. Herbicide Availability

4. Do you use herbicides in sugarcane production?

- 1 = Yes
- 2 = No

5. If yes, please indicate the following information for this season:

Area Cultivated (acre)	Herbicides Used (liters/acre)	Cost (MMK/liter)	Output Obtained (tons/acre)	Total Production (tons)

6. If no, please state why:

_____

7. What challenges do you face when acquiring herbicides? (Please select one)

- 1 = No problem
- 2 = Difficult
- 3 = High cost
- 4 = Other (please specify): _____

8. Do you believe herbicides are helpful in improving productivity?

- 1 = Yes
- 2 = No

9. If no, please explain why:

_____

III. Land Availability

10. Please provide information on the land cultivated and total output obtained from sugarcane in this season:

Land Cultivated (acre)	Output (tons/ha)	Total Production (tons)

11. What is the total land owned by your family?

_____

12. How did you acquire the land used for sugarcane production? (Please select one)

- 1 = Bought
- 2 = Hired
- 3 = Inherited
- 4 = Given by the village government
- 5 = Accessed free land
- 6 = Other (please specify): _____

13. What challenges do you face when acquiring land? (Please select one)

- 1 = No problem
- 2 = Difficult
- 3 = High cost
- 4 = Other (please specify): _____

IV. Credit Availability

14. Did you take any credit for sugarcane production in this season?

- 1 = Yes
- 2 = No

15. If yes, please indicate the amount of credit taken and the source:

S/N	Amount of Credit (Cash)	Source (Bank, Saccos)

16. Do you think credit is helpful in sugarcane production?

- 1 = Yes
- 2 = No

17. If no, please explain why:

_____

V. Fertilizer Availability

18. Do you use fertilizer in sugarcane production?
- 1 = Yes
- 2 = No

19. If yes, please indicate the following information for this season:

Area Cultivated (acre)	Fertilizer Used (kg/acre)	Cost (MMK/50kg)	Output (tons/acre)	Total Production (tons)

20. If no, please state why:

_____

21. What challenges do you face when acquiring fertilizer? (Please select one)
- 1 = No problem
- 2 = Difficult
- 3 = High cost
- 4 = Other (please specify): _____

22. Do you believe fertilizer is helpful in improving productivity?
- 1 = Yes
- 2 = No

23. If no, please explain why:

_____