SUPPLY CHAIN MANAGEMENT OF SESAME UNDER INFORMAL CONTRACT SCHEME IN AUNGLAN TOWNSHIP, MAGWAY REGION

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SUPPLY CHAIN MANAGEMENT OF SESAME UNDER INFORMAL CONTRACT SCHEME IN AUNGLAN TOWNSHIP, MAGWAY REGION

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The thesis attached hereto, entitled **"Supply Chain Management of Sesame under Informal Contract Scheme in Aunglan Township, Magway Region"** was prepared under the direction of the chairperson of the candidate supervisory committee and has been approved by all members of that committee and board of examiners as a partial fulfillment of the requirements for the degree of **Master of Agricultural Science (Agricultural Economics).**

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DECLARATION OF ORIGINALITY

This thesis represents the original work of the author, except where otherwise stated. It has not been submitted previously for a degree at any other University.

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ABSTRACT

Sesame is an economically important oilseed crop in Myanmar. Magway Region occupied the largest sesame sown area for many years. Informal contract agreement among sesame farmers and buyers are practicing in Aunglan Township, Magway Region. This study aimed to understand the performance of sesame (Sahmon Nat) supply chain stakeholders under contract and non-contract system, and to determine the factors influencing the profits of sesame production in the study area. By using stratified random sampling procedure, total 102 farmers, 14 wholesalers and 2 food processors in Aunglan Township and 5 sesame exporters in Yangon Region were interviewed with structured questionnaires from November, 2017 to February, 2018. These findings indicated that contract farmers used high dose of farm yard manure, compound fertilizer and fungicide, thus, their sesame production cost per hectare was slightly higher as compared to non-contract farmers. However, it did not affect their benefit as a result of better sesame yield as compared to non-contract farmers. Sesame yield, hired labor and material input cost were the influencing factors for profit of monsoon sesame production by sampled farmers. Among the market participants, marketing margin of township wholesalers got the lowest margin and exporters got the highest profit. Climate change, labor scarcity and high input cost were major constraints for rain-fed dependent and labor-intensive sesame farmers while low quality of sesame due to chemical residue problem, unstable price, lack of capital and lack of advanced technology were common constraints for all stakeholders although they received reasonable profits at each nodes of supply chain. Apart from exporters, there was still lack of advanced technology in quality checking, grading and using international recognized weighting scale, thus, technology investment is crucially needed for good quality seed. Farmers should be supported for efficient use of input and improve technology including farm machinery and equipment to boost yield, high quality, safety products and to minimize labor cost and increase income. All stakeholders should pay attention not only quality improvement but also overcoming current constraints along supply chain in order to maintain global export share of Myanmar sesame.

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LIST OF ABBREBRASION

ADB	=	Asian Development Bank
Amd	=	Animal-day
BCR	=	Benefit-Cost Ratio
BV	=	Best Service and Value
˚C	=	Degree Celsius
CBCF	=	Cross Border Contract Farming
CP	=	Charoen Pokphand Group
DOA	=	Department of Agriculture
DOP	=	Department of Planning
FAO	=	Food and Agriculture Organization
FAOSTAT	=	Food and Agriculture Organization the United Nations Statistics
FYM	=	Farm Yard Manure
GAD	=	General Administration Department
GAP	=	Good Agricultural Practices
GDP	=	Gross Domestic Product
ha	=	Hectare
HH	=	Household
JICA-TCP	=	Japan International Cooperation Agency-Technical Cooperation Project
kg	=	Kilogram
MADB	=	Myanmar Agricultural Development Bank
Md	=	Man-day
mm	=	Millimeter
MMK	=	Myanmar Kyat
MOALI	=	Ministry of Agriculture, Livestock and Irrigation
MOC	=	Ministry of Commerce
MRF	=	Myanmar Rice Federation
MT	=	Metric Ton
NGO	=	Non-Governmental Organization
OLS	=	Ordinary Least Square
PLC	=	Private Limited Company
R^2	=	Coefficient of Determination
RSCs	=	Rice Specialization Companies
Sig.	=	Significant Level
SMFs	=	Small and Medium Farmers
SPS	=	Sanitary and Phytosanitary
UMFCCI	=	Union of Myanmar Federation of Chambers of Commerce and Industry
YAU	=	Yezin Agricultural University
US$	=	United States Dollar

LIST OF CONVERSION FACTORS

1 Basket of sesame	=	24.49 kilogram
1 Metric Ton	=	1,000 kilogram
1 Hectare	=	2.471 acres
1 Viss	=	1.63 kilogram

CHAPTER I
INTRODUCTION

1.1 Background

Myanmar is an agrarian country and agriculture sector remains important to the country's economy. In Myanmar, agriculture sector including livestock sector contributes 25.6% of GDP, 24.4% of total export earnings in 2017-2018 and is employed by 64.6% of the labor force (Ministry of Agriculture, Livestock and Irrigation [MOALI], 2018). The agriculture sector also contributes to be essential for food production with the growing population as well as for the country and will contribute to occupy a large part of export earnings. In 2017-2018, paddy took the largest area in the total crop sown areas which was about 35.49% and it was followed by pulses and oilseeds which were 21.71% and 16.21% in the total crop sown area respectively as shown in Figure (1.1) (MOALI, 2018).

Oilseed crops, third most important crop group in Myanmar agriculture covered nearly 8.2 million acres of total crop sown area. Expansion of area and technology of oilseed crops is needed for local consumption and generating more surpluses for export earnings. There are many kinds of oilseed crops such as groundnut, sesame, sunflower, mustard and niger. The most extensive and traditional oilseed crop is sesame among the principal of these oilseed crops. Sesame occupies the largest sown area (approximately 48.83% of total oilseed crop areas), followed by the groundnut 31.79% of total oilseed crop areas in 2017-18 as shown in Figure (1.2) (MOALI, 2018).

Sesame (*Sesamum indicum L.*), a member of the Pedaliaceae family, is an erect annual herb commonly known as sesamum, benniseed, or simsim which is an important and very ancient oil-yielding species cultivated extensively in Myanmar, India, China and drier parts of Africa for its excellent nutritional, medicinal, cosmetic and cooking qualities of its oil (Duhoon, Shrivastava & Jharia, 2000). Sesame is assumed commercial importance as a staple food of mankind. Sesame seeds have both nutritional and medicinal values because they are rich in fat, protein, carbohydrates, fiber, and essential mineral. Its seed can be consumed as raw, in roasted, crushed form: or incorporated with other eatables, while its extracted oil is utilizing as cooking oil, as well as salad dressing purposes. They are also used in sweets such as sesame bars and halva (dessert), and in bakery products or milled to get high-grade edible oil (Bedigian, 2004).

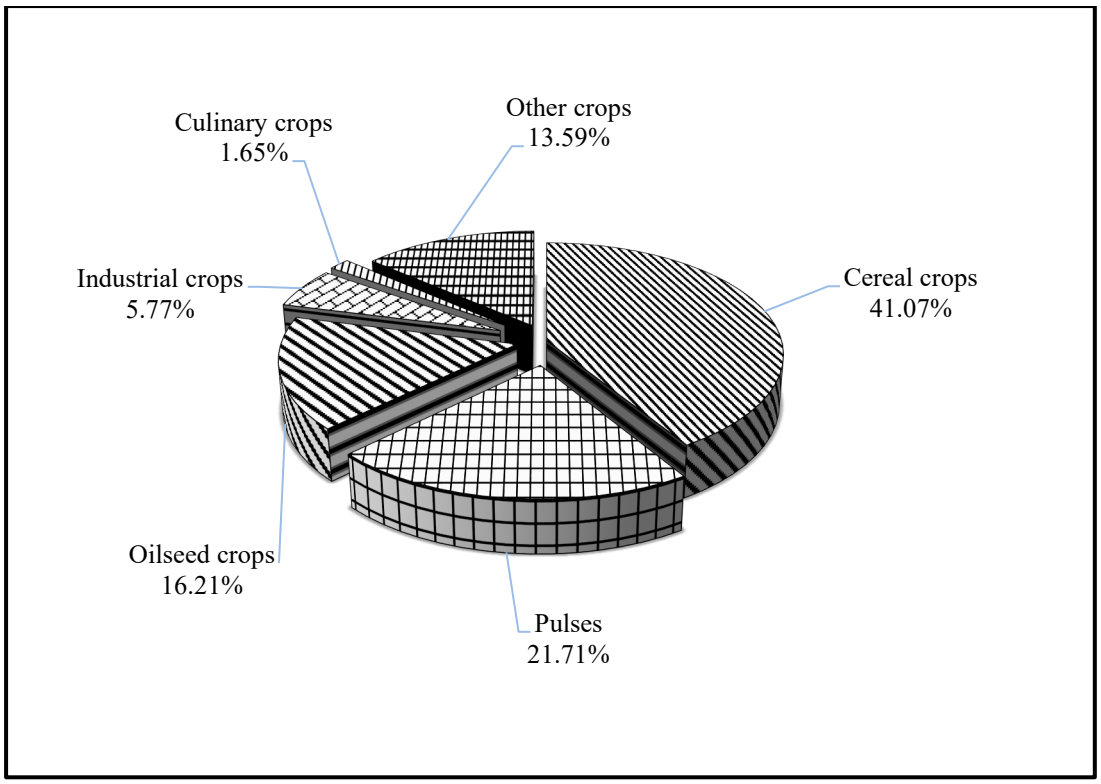

Figure 1.1 Shares of sown area for major crops in Myanmar during 2017-2018

Source: MOALI, 2018

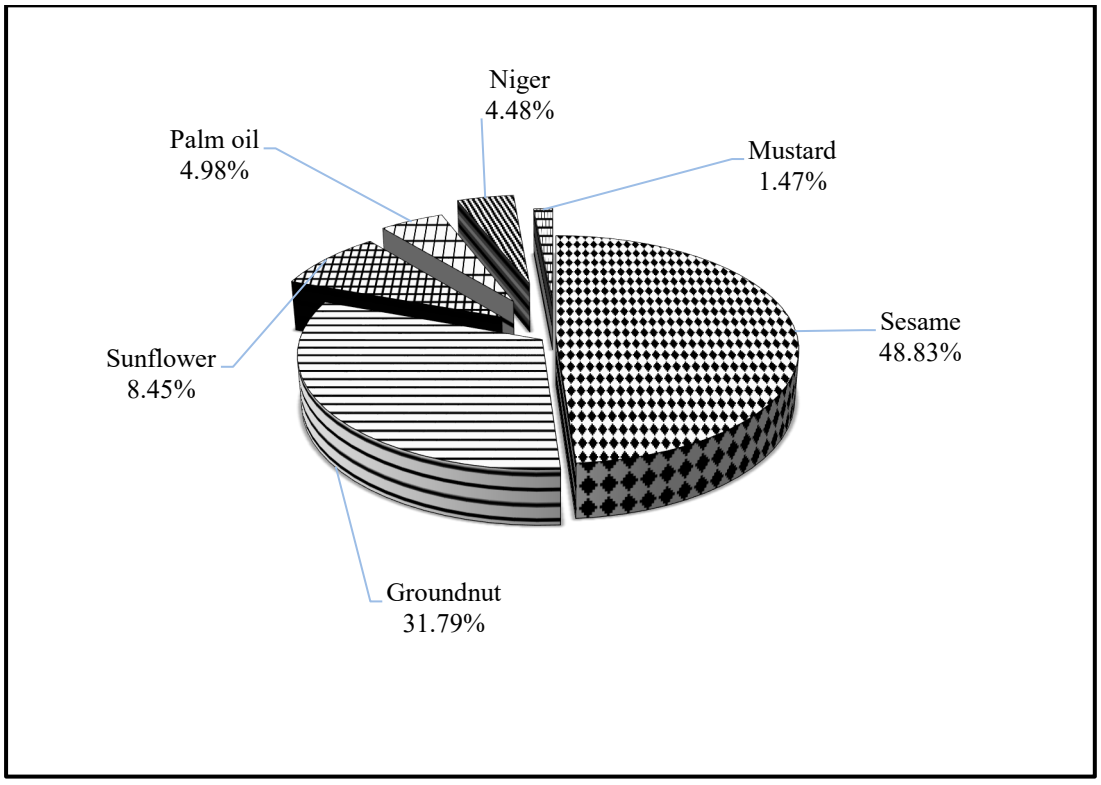

Figure 1.2 Shares of sown area for oilseed crops in Myanmar during 2017-2018

Source: MOALI, 2018

Sesame seeds are chemically composed of 44-57% oil, 18-25% protein, 13-14% carbohydrates and 3.4% of Sulphur containing amino acid methionine (Borchani, Besbes, Blecker & Attia, 2010). Sesame is rich in vitamin E and has a significant amount of linoleic acid that can control blood cholesterol levels. Further, the oil has medicinal and pharmaceutical values and is being used in many health care products. Sesame oil is famous for its stability as a result of its resistance to oxidative rancidity after long exposure to air (Global Agri Systems, 2010). Sesame oil is considered as prime vegetable oil in South East Asian dishes particularly in China and Japan (Wijnands, Biersteker, Hagedoorn & Louisse, 2014). Generally, the oil contains 35% monounsaturated fatty acids and 44% polyunsaturated fatty acids (Hansen, 2011). After oil extraction, the remaining meal contains high amount of proteins and calcium which is an ingredient in the animal feed industry. These qualities make sesame a prime commodity in the global market and therefore one with great potential for poverty alleviation, food and nutrition security, household income generation and an important earner of foreign exchange (Munyua, Orr & Okwadi, 2013).

Among 76 sesame producing countries in the world, sesame production is mostly dominated by smallholders in developing countries of the tropics and sub-tropics (Asian and African countries). Asia and Africa cultivated 49.66% and 46.50% of the global sesame from 2006 to 2017, respectively as shown in Figure (1.3) (Food and Agriculture Organization of the United Nations Statistics [FAOSTAT], 2018). As shown in Table (1.1), Sudan occupied the highest sesame cultivated area which was about 2,141,340 ha followed by India (1,800,000 ha) and Myanmar (1,478,160 ha) worldwide in 2017. The world's sesame production was 5,531,950 MT of which Asia's sesame production accounted for 2,195,090 MT which was 39.68% of the world total sesame production with a yield of 0.56 MT/ha in 2017. Myanmar produced the second highest sesame production (764,320 MT) in the world with a sesame yield of 0.52 MT/ha in 2017. Being as one of the leading sesame producing countries in the world, Myanmar occupied 13.81% of the total world production and 34.81% of Asia. In the world's sesame export, Myanmar occupied 1.29% of the total world's export and 1.86% of the total world's sesame export earnings in 2016. Myanmar also stood the largest producer in sesame among the neighboring countries followed by India, China and Bangladesh in 2017 as shown in Table (1.2) (FAOSTAT, 2018).

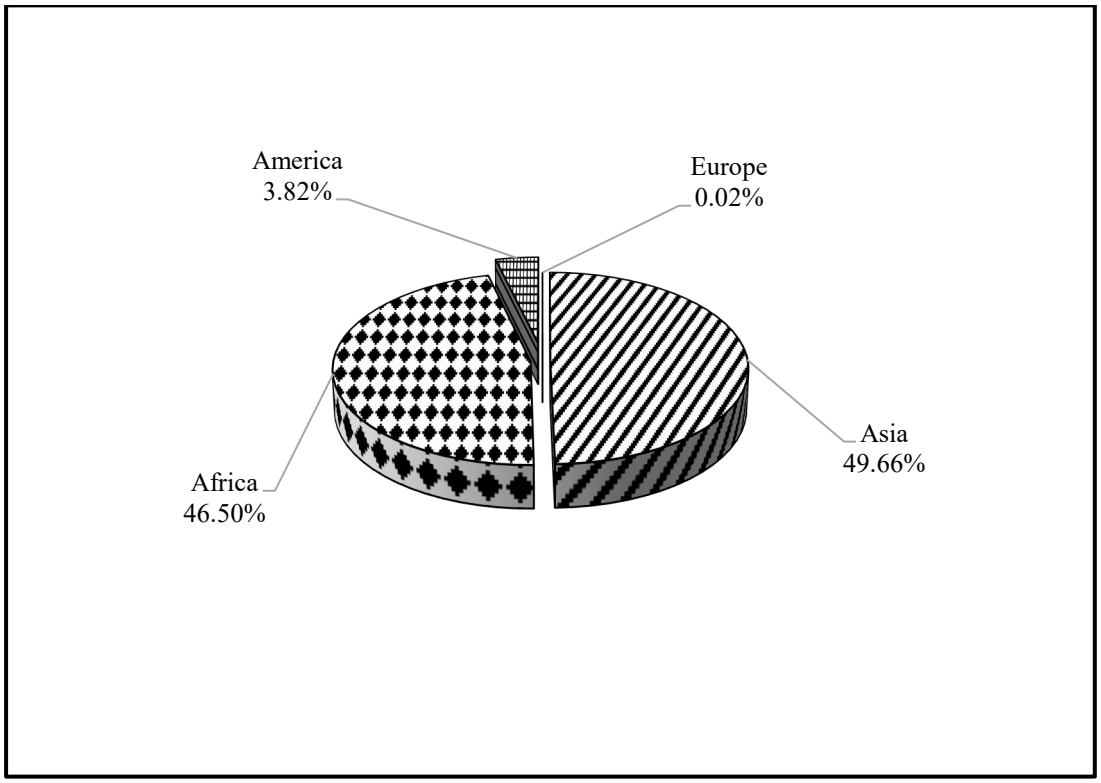

Figure 1.3 Production shares of sesame by regions in the world from 2006 to 2017

Source: FAOSTAT, 2018

Table 1.1 Harvested area, yield, production and export status of sesame by top eight global sesame producing countries in 2017

Countries	Harvested area ('000 ha)	Average yield (MT/ha)	Production ('000 MT)	Export *	
				Volume ('000 MT)	Value (Million US$)
World	9,983.17	0.55	5,531.95	1,895.58	2,069.27
Asia	3,952.06	0.56	2,195.09	460.94	610.41
Tanzania	750.00	1.07	805.69	133.75	129.57
Myanmar	1,478.16	0.52	764.32	24.51	38.41
India	1,800.00	0.42	751.32	325.91	415.20
Sudan	2,141.34	0.26	550.00	258.54	259.14
Nigeria	500.00	1.10	550.00	172.84	209.68
China	260.67	1.40	366.00	26.27	49.21
Ethiopia	293.65	0.79	231.19	382.05	383.59
Burkina Fuso	291.17	0.56	163.79	159.84	113.36

Note: Export data* are available for 2016
Source: FAOSTAT, 2018

Table 1.2 Sesame productions in Myanmar and neighboring countries in 2017

Countries	Harvested area ('000 ha)	Yield (MT/ha)	Production ('000 MT)
Myanmar	1,478.16	0.52	764.32
India	1,800.00	0.42	751.00
China	260.67	1.40	366.00
Bangladesh	37.52	0.91	34.00
Thailand	45.00	0.67	30.00
Cambodia	40.00	0.75	30.00
Viet Nam	37.04	0.80	29.75
Lao PDR	13.04	1.25	16.26

Source: FAOSTAT, 2018

1.2 Role of Sesame in Myanmar

Oilseed crops play a vital role based on Myanmar's higher consumption of cooking oil compared to the neighboring countries. In Myanmar, there are three main types of sesame: (1) white sesame is roasted and used in snacks and in salads (2) red sesame is mainly used for oil extraction (3) black is mainly exported to Japan and few in local consumption especially for sesame brittle (Lin, 2007).

Nearly ninety percent (88.94%) of the sesame were grown in the central dry zone of Myanmar: Magway, Mandalay and Sagaing Regions in 2017-2018. Magway Region stood as the largest sesame sown area in Myanmar which was contributed about 520,190 ha (34%) of the national total area of sesame cultivation. As the second largest sown area of sesame was found in Mandalay Region which contributed about sesame area of 430,860 ha (28.16%) and Sagaing Region occupied the third largest sown area, contributed about 409,770 ha (26.78%) of total sesame sown area, as shown in Figure (1.4) (Department of Agriculture [DOA], 2018). Among these three major sesames producing regions in Myanmar, Sagaing Region achieved relatively higher yield, 0.65 MT/ha as compared to Magway Region, 0.56 MT/ha and Mandalay Region, 0.32 MT/ha. Due to largest sesame sown area and relatively high yield, Magway Region contributed 283,070 MT as top sesame production region in Myanmar. In addition, Sagaing Region contributed total sesame production, 256,630 MT which was nearly double production of Mandalay Region (131,610 MT) in 2017-2018 as shown in Table (1.3) (DOA, 2018).

In Myanmar, sesame is grown in three seasons namely rain-fed or monsoon sesame (from mid-May to mid-August), summer or pre-monsoon sesame (from mid-February to mid-June) and winter or post-monsoon sesame (from mid-September to mid-December). As shown in Table (1.4), in 2017-2018, the sown area of rain-fed or monsoon sesame was accounted for about 1,161,100 ha which was 75.89% of the total sesame area. Total production of monsoon sesame was 517,210 MT which was 66.63% of total sesame production and yield was 0.45 MT/ha. Post-monsoon sesame (winter sesame) area was 330,830 ha, 21.62% of total sesame area. Since the yield of winter sesame was about 0.78 MT/ha, it was produced about 259,080 MT which was 33.37% of total production. In addition, 37,980 ha of sesame was grown in pre-monsoon sesame (summer sesame), 2.48% of total sesame area in 2017-2018 (DOA, 2018). The sown area and harvested area of monsoon sesame was higher than those of the summer and winter sesame.

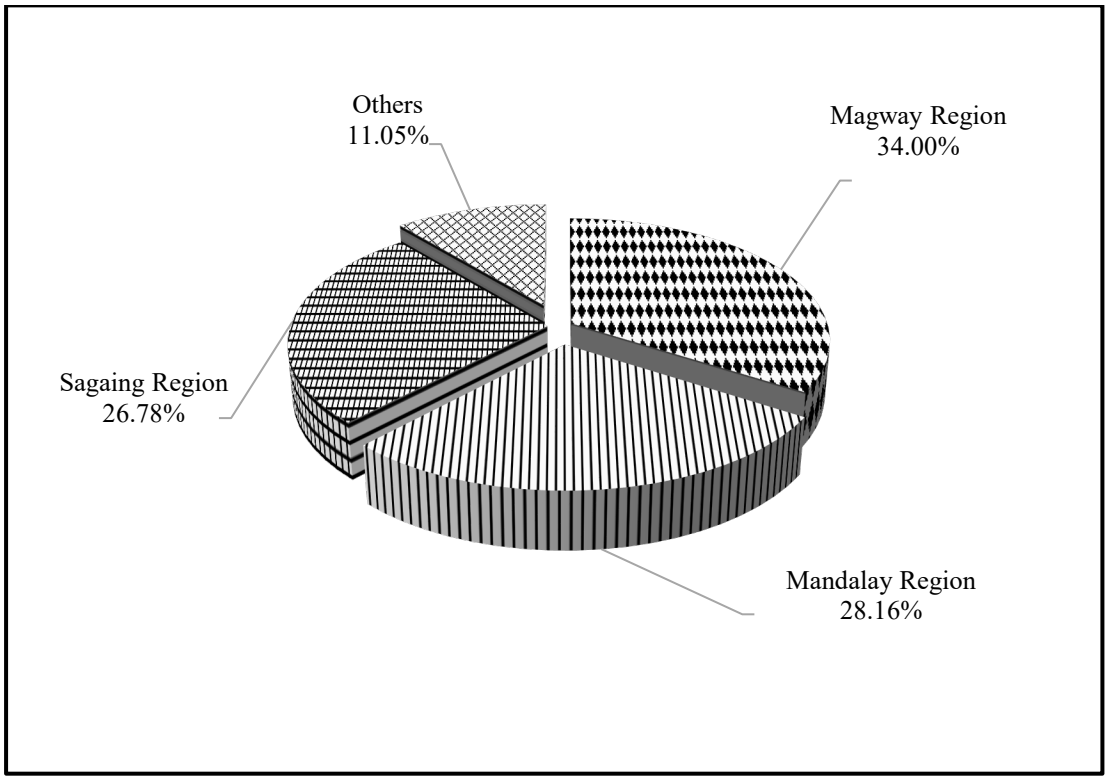

Figure 1.4 Major sesame cultivated regions in Myanmar in 2017-2018

Source: DOA, 2018

Table 1.3 Sown area, harvested area, yield and production of sesame in different States and Regions of Myanmar (2017-2018)

No.	States/Regions	Sown area ('000 ha)	Harvested area ('000 ha)	Yield (MT/ha)	Production ('000 MT)
1	Nay Pyi Taw Council	31.91	31.91	0.53	16.80
2	Kachin	6.87	6.87	0.73	5.02
3	Kayah	9.77	9.77	0.60	5.82
4	Kayin	17.57	17.57	0.80	13.89
5	Chin	2.22	2.22	0.49	1.09
6	Sagaing	409.77	392.14	0.65	256.63
7	Tanintharyi	0.40	0.40	0.39	0.16
8	Bago	70.62	66.26	0.64	42.67
9	Magway	520.19	506.81	0.56	283.07
10	Mandalay	430.86	415.38	0.32	131.61
11	Mon	0.86	0.86	0.76	0.66
12	Rakhine	1.59	1.68	0.52	0.83
13	Yangon	1.61	1.57	0.67	1.05
14	Shan	15.71	15.70	0.61	9.53
	Shan (South)	9.26	9.26	0.52	4.84
	Shan (North)	4.12	4.12	0.80	3.29
	Shan (East)	2.32	2.32	0.61	1.40
15	Ayeyarwady	90.94	9.86	0.76	7.47
	Union Total	**1,529.91**	**1,478.62**	**0.53**	**776.29**

Source: DOA, 2018

Table 1.4 Sown area, harvested area, yield and production of sesame for three different seasons in Myanmar (2017-2018)

Sesame	Sown area ('000 ha)	Harvested area ('000 ha)	Yield (MT/ha)	Production ('000 MT)
Pre-monsoon sesame (Summer sesame)	37.98	-	-	-
Monsoon sesame (Rain-fed sesame)	1,161.10	1,147.80	0.45	517.21
Post-monsoon sesame (Winter sesame)	330.83	330.82	0.78	259.08
Total	**1,529.91**	**1,478.62**	**0.53**	**776.29**

Note: (-) showed no data available
Source: DOA, 2018

As shown in Table (1.5), the sown area of sesame in Myanmar was gradually increased from 1,338,000 ha in 2005-2006 to 1,590,000 ha in 2017-2018. Sown area, 1,640,000 ha and total production of sesame, 943,000 MT in 2015-2016 were the highest across a decade. Yield/ha of sesame was also increased from 0.40 MT/ha in 2005-2006 to 0.54 MT/ha in 2017-2018. Consequently, total production also increased because of expansion of area and improved yield. The clear trend of increasing sown area and total sesame production can be seen in 2015-2016 across a decade. The export volume was high in 2012-2013 and 2013-2014 then it gradually went down less than 100,000 MT during 2014-2015 and 2015-2016. Then, export of Myanmar sesame was increasing again and reached 120,990 MT in 2017-2018. Myanmar is still one of the largest sesame producers in the world, but after local consumptions, it can export less than 15% of the total production due to many constraints along sesame supply chain (MOALI, 2018).

Sesame is one of the important export crops for Myanmar's foreign currency earning and Myanmar sesame seed has been exported yearly to the countries such as China, Japan, Singapore, Taiwan, Denmark, Republic of Korea, Malaysia, Hong Kong and India. The intake of foreign markets depends on the colors of the sesame and among the cultivated strains of Ordinary black, White, Red and Brown sesame. Black colored cultivar, "Sahmon Nat" that is mainly cultivated in Aunglan Township, Magway Region fetched the highest prices in Japanese markets and Japan has mainly imported that kind of sesame from Myanmar.

Sesame is mostly exported in the form of raw seed, roasted seed, powder and edible oil which is depending upon the international/foreign market demand. About 120,999.37 MT of sesame could be exported to different destinations and the export value was 147.00 million US$ in 2017-2018 (Ministry of Commerce [MOC], 2018). Major trading partners of Myanmar sesame during 2017-2018 were shown in Table (1.6). China was the major sesame importing country from Myanmar and imported about 99,611.48 MT followed by Japan and Singapore which imported about 9,722.66 MT and 4,732.44 MT respectively. Taiwan and Thailand imported Myanmar sesame about 3,067.30 MT and 2,037.28 MT respectively. Myanmar also exported sesame to Denmark, Malaysia, Hong Kong, India, Republic of Korea, Indonesia, Vietnam and Australia. China and Japan accounted for 80% to 90% of the export destination of Myanmar sesame.

Table 1.5 Sown area, harvested area, yield, production and export status of sesame in Myanmar (2017-2018)

Year	Sown area ('000 ha)	Harvested area ('000 ha)	Yield (MT/ha)	Production ('000 MT)	Export *	
					Volume ('000 MT)	Value (million US$)
2005-06	1,338	1,262	0.40	504	44.72	34.04
2010-11	1,585	1,584	0.54	862	79.70	114.35
2011-12	1,595	1,594	0.57	901	95.66	135.85
2012-13	1,553	1,552	0.56	863	135.95	235.73
2013-14	1,622	1,606	0.57	909	192.33	355.00
2014-15	1,581	1,572	0.59	930	91.07	180.89
2015-16	1,640	1,611	0.59	943	96.62	130.91
2016-17	1,636	1,610	0.58	927	108.72	146.78
2017-18	1,590	1,539	0.54	829	120.99	147.00

Note: Export data* are taken from MOC
Source: MOALI, 2018

Table 1.6 Trading partners of Myanmar sesame (2017-2018)

Countries	Export volume (MT)	Export value (Million US$)
China	99,611.48	117.29
Japan	9,722.66	15.26
Singapore	4,732.44	5.43
Taiwan	3,067.30	3.67
Thailand	2,037.28	2.56
Denmark	1,244.00	2.12
Malaysia	222.99	0.28
Hong Kong, China	203.70	0.27
India	114.00	0.07
Republic of Korea	18.00	0.03
Indonesia	18.00	0.02
Vietnam	5.00	0.00
Australia	2.52	0.00
Total	**120,999.37**	**147.00**

Source: MOC, 2018

There is little international demand for Myanmar's low-quality sesame oil production. Myanmar led worldwide in the production of sesame oil with its average production in the period 1993-2014 being 196,789 tons (World Atlas com, 2017). There exists significant profit potential in producing high quality sesame oil production for market such as Japan, China and Korea. Myanmar's current oilseed processing technology and infrastructure is simply incapable of producing abundant oilseeds products especially the edible oil to meet the global specifications. Currently, Myanmar is mainly exporting raw sesame seed in large quantities and sesame powder in few amounts.

As shown in Figure (1.5), during the last eight years, the export prices of sesame were highest in 2014 which were above 2,000 US$/ton for world and Asia respectively and 1,722.03 US$/ton for Myanmar. After that, export prices of sesame steadily decreased at the global and Asia level as well as in Myanmar. In 2017, export prices of sesame in the world and Asia were below 1,400 US$/ton respectively and that for Myanmar sesame was 1,416.33 US$/ton (FAOSTAT, 2018). Consequently, domestic annual prices of black and red sesame were 1,795,139.36 MMK/ton and 1,350,291.04 MMK/ton respectively in 2014. Domestic prices of black and red sesame slightly went down to 1,304,148.49 and 1,012,228.41 MMK/ton respectively in 2017, which were the lowest price during half of a decade. Then, prices of black and red sesame were increasing again and reached 2,295,960.40 MMK/ton and 1,739,342.23 MMK/ton respectively in 2018 as presented in Figure (1.6) (Agri-Business News, 2018).

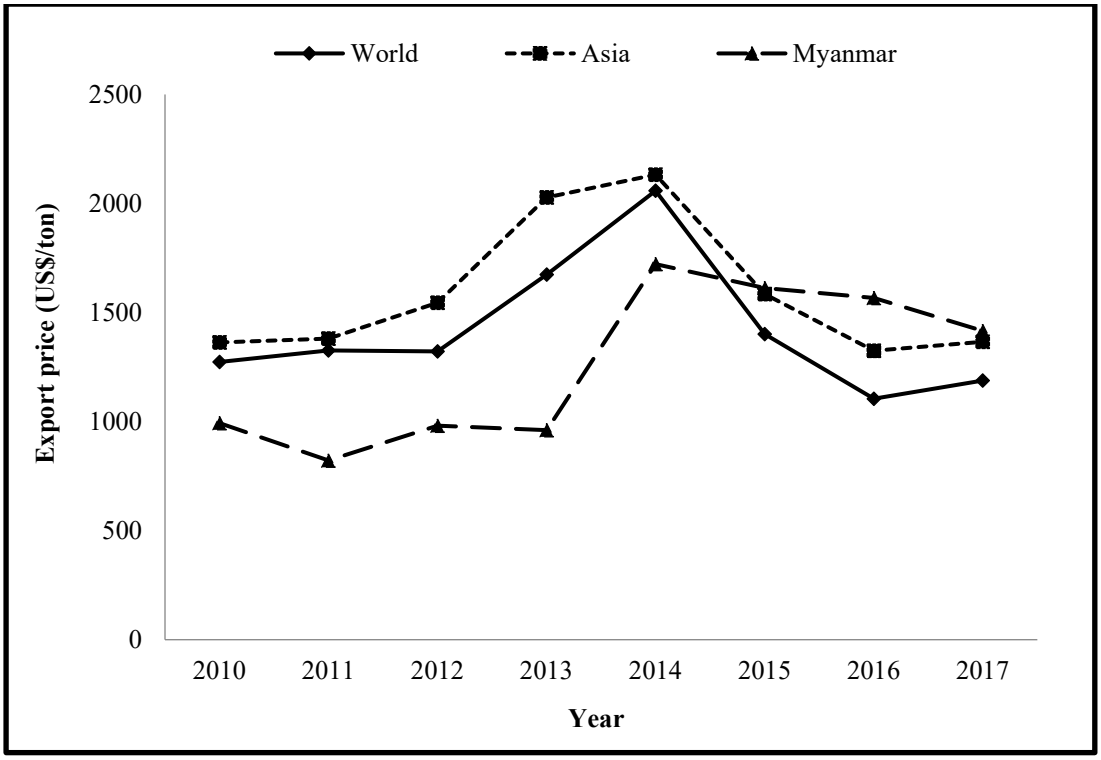

Figure 1.5 Export price per ton of sesame in world, Asia and Myanmar from 2010 to 2017

Source: FAOSTAT, 2018

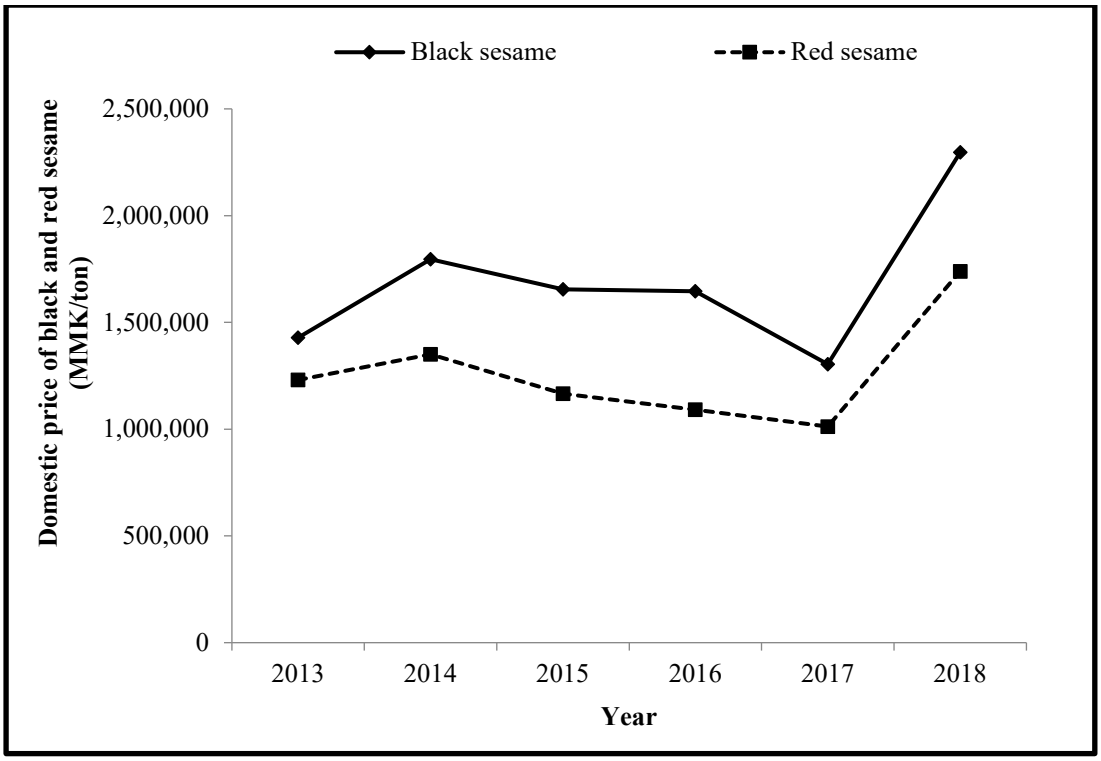

Figure 1.6 Annual average price of black and red sesame in domestic market from 2013 to 2018

Source: Agri-Business News, 2018

1.3 Rationale of the Study

Apart from the great natural potential of the country, the oilseed sector of Myanmar generally lacks the necessary technologies and institutions to strengthen its value chain and contribute to pro-poor development. Similar to many other developing countries, most of the smallholders do not have access to important inputs and technologies such as fertilizers and improved seeds. The major problems of the oilseed and edible oil sector in Myanmar are price uncertainty, unpredictable rainfall, low productivity and quality of sesame and lack of marketing laws and regulations (Theingi Myint, Ei Mon Thida Kyaw, Ye Mon Aung & Aye Moe San, 2017). The general lack of inputs hampers smallholders to improve volume, quality standard, marketing and in turn establishing contracts with agribusinesses.

Myanmar agribusiness (mostly consisting of exporters) faces difficulty in procuring produce from spot markets at required quality and quantity at the right time to satisfy the demand of the foreign markets. As a result, exporters have expressed an interest to engage in trade relationship with producers in a way to address those problems and minimize transaction costs. Moreover, farmers alone do not have any roles and responsibilities in production quality and standards to meet the standardization of markets especially for export. The imperfect market information, poor infrastructure, and having few links with buyers in the marketing chain are vulnerable for small farmers.

Sesame is an economically important not only for producing edible oil but also for exporting raw, roasted seeds and snacks. Only less than 15% of total sesame production could reach to export market due to many constraints along the supply chain. Traditional production practices and weak linkages among stakeholders are major barriers to expand export share in world market. Facilitating the production and marketing constraints along with considering food safety criteria become important role along Myanmar sesame supply chain.

During sesame supply chain management study conducted in Pwint Phyu and Pakokku Townships as well as in Mandalay and Yangon Regions under JICA-TCP and YAU during 2016, the research team found the interesting trend of sesame supply chain via contract farming system during the interviews with exporters. Pyitharyar contract farming scheme was launched in Aunglan Township, Magway Region since 2003 and covered 5,000 acres of sesame area and 1,300 contract households in 2017. The contract

company provided sesame seeds, capital, efficient pesticide spraying method and SPS (sanitary and phytosanitary) demonstration to contract farmers and also purchased black sesame seeds which were exported to Toyota Tsusho Food Corporation and Kanematsu Corporation in Tokyo, Japan (Theingi Myint et al., 2017).

Contract farming can be defined as agricultural production carried out according to an agreement between a buyer and farmers, which establishes conditions for the production and marketing of a farm products or products (Food and Agriculture Organization [FAO], 2012). Contract farming scheme generates favorable condition for farmers to access to credit providers, input suppliers, market information and technical services, and support farmers to improve their technical knowledge, and guaranteed markets to farmers (Minot, 1986). Contract farming can get some advantages such as technology, credit, market channels and market information while lowering transaction costs and it reduces the risk of production, price and marketing costs. Contract farming also ensures higher production of better quality, financial support in cash and/or kind technical guidance to the farmers. It is also linking the resource poor farmers to stable market along the provision of required inputs via agreements with supporters/ contacting firms and contract farmers.

Currently, many local wholesalers at Aunglan Township, Magway Region were providing sesame seeds and credit via informal contract agreements to sesame farmers as a consequence of Pyitharyar contract farming. Informal contract farming system was verbally agreements with local wholesalers and individual sesame farmers to provide seed, credit, market information and purchase sesame seed by wholesalers. There was no statistical study and limited growing literature about informal sesame contract farming system of Myanmar. Therefore, an empirical research is essentially and statistically needed to analyze to get better understanding of sesame contract farming system in Aunglan Township, Magway Region.

This study will point out production and marketing constraints and performances of sesame supply chain stakeholders under informal contract system and conventional one in order to clearly understand which one is better for supply chain stakeholders. The strength and weakness of contract and conventional systems may show the incentives for improvement in each stage of sesame supply chain. Proper information will be provided to the various stakeholders along sesame supply chain. Decision making on future investment in sesame industry will be helped by valuable information on production and marketing costs, profits and margins of various

stakeholders. The findings of this study will also help to the government in making better information about promoting and supporting of contract farming system as well as the development of sesame sector.

1.4 Objectives of the Study

The study is generally to know performances of sesame contract farming system in the study area and its specific objectives are:

1. To identify sesame supply chain stakeholders and their socio-economic characteristics under contract and non-contract systems in the study area
2. To investigate the marketing activities, constraints, costs and margins of sesame supply chain stakeholders under contract and non-contract systems and
3. To determine the factors influencing the profit of sesame production by sampled farmers in the study area

1.5 Hypothesis of the Study

Based on the objectives, the hypothesis for this study is as follows:

1. Socio-economic characteristics of sesame supply chain stakeholders under contract and non-contract systems in the study area are significantly different.
2. The marketing activities, constraints, costs and margins of various stakeholders along the sesame marketing channels vary under contract and non-contract systems.
3. Sampled farmers are profitable from monsoon sesame production in the study area.

CHAPTER II
LITERATURE REVIEW

2.1 Concept of Contract Farming

The agriculture sector is experiencing restructuring worldwide due to trends like globalization, market liberalization, population growth, rising incomes in emerging economies and thus changing consumption patterns that influence the requirements for agricultural production (Binswanger-Mkhize, Byerlee, McCalla, Morris & Staatz, 2011; Reardon, Barrett, Berdegue & Swinnen, 2009). The concept of contract farming changes in consumer demands due to globalization and higher industry standards necessitate more vertical integration of value chains and tighter linkages between farmers and agribusinesses. Contract farming can be a helpful tool for the integration of (small scale) farmers in such strictly aligned value chains (Shepherd, 2005).

Contract farming is as a means to incorporate small farmers into growing markets for processed goods and export commodities. Because the contracts often involve the provision of seed, fertilizer, and technical assistance on credit and a guaranteed price at harvest, that solves a number of constraints on small-farm productivity, including risk and access to inputs, credit, and information. And then, contract farming is an institutional solution to the problems of market failure in the markets for credit, insurance, and information (Grosh, 1994; Key & Runsten, 1999).

Contract farming is an institutional arrangement where downstream agribusiness firms allot production of primary agricultural products to farmers under contracts (Bellemare, 2012). Contract farming can be defined as an agricultural production system carried out according to an agreement between a buyer and farmers, which establishes conditions for the production and marketing of a farm product or products. The nature of contracts starts with oral or written and many contracts include provisions for product price, quantity, quality and delivery. Some assign exclusive buying rights to the firm, while others keep it open. Many provide desired or required inputs, technical advice and machinery services (Huh, Athanassoglou & Lall, 2012; Melese, 2012).

2.2 Definition of Contract Farming

Although there are many definitions in contract farming, it usually involves specifications of the price, quantity and quality of produce, production conditions,

delivery and grading requirements (Runsten & Key, 1996). Baumann (2000) who refers to contract farming as "a system where a central processing or exporting unit purchases the harvests of independent farmers and the terms of the purchase are arranged in advance through contracts. The terms of the contract vary and usually specify how much produce the contractor will buy and what price they will pay for it. The contractor frequently provides credit inputs and technical advice. Furthermore, Baumann (2000) argues that contracting is fundamentally a way of allocating risk between producer and contractor. The farmer normally takes the risk of production and the contractor takes the risk of marketing. Eaton and Shepherd (2001) concluded that with effective management, contract farming can be a means to develop markets and to bring about the transfer of technical skills in a way that is profitable for both the contractors and farmers.

Contract farming is an agreement between farmers and processing and/or marketing firms for the production and supply of agricultural products under forward agreements, frequently at predetermined prices (Eaton & Shepherd, 2001). This arrangement usually involves the purchaser in providing a degree of production support through the supply of inputs and the provision of technical advice. According to Singh (2002), contracts usually involved advance agreement between producers and purchasers on some or all of four parameters, namely, price, quality, quantity, and time of delivery. Singh (2005) defined contract farming as a system for the production and supply of agricultural and horticultural produce by farmers/primary producers, who provide a standardized quality of an agricultural commodity, at a specified time, price and in specified quantity to a recognized purchaser under an advance contract. Minot (2007) also defined as "Agricultural production carried out according to a prior agreement in which the farmer commits to producing a given product in a given manner and the buyer commits to purchasing it". Often, the buyer provides the farmer with technical assistance, seeds, fertilizer and other inputs on credit and offers a guaranteed price for the output. Contract farming is defined as: a contractual arrangement between a farmer and a firm, whether oral or written, which provides resources and/or specifies one or more conditions of production, in addition to one or more marketing conditions, for an agricultural product (land owned or controlled by the farmer), which is non-transferable and gives the firm, not the farmer, exclusive rights and legal title to the crop (Hamilton, 2008; Rehber, 2007).

The United States Department of Agriculture defines contract farming as the growing and marketing of farm products under such circumstances that selective terms of the market-quantity, grade, size, inspection, timing, or pricing are specified to both the grower and the processor or shipper before production is undertaken (Bijman, 2008). Setboonsarng (2008) referred to contract farming as a "contract between a farmer and a purchaser established in advance of the growing season for a specific quantity, quality, and date of delivery of an agricultural output at a price or price formula fixed in advance". Catelo and Costales (2008) defined contract farming as "A binding arrangement between a firm (contractor) and an individual producer (contractee) in the form of a 'forward agreement' with well-defined obligations and remuneration for tasks done, often with specifications on product properties such as volume, quality, and timing of delivery".

Prowse (2012) described contract farming as a form of vertical integration within agricultural commodity chains that provides the firm with greater control over the production process as well as quantity, quality, characteristics and the timing of what is produced. The definition of contract farming is "a contractual arrangement for a fixed term between a farmer and a firm, agreed verbally or in writing before production begins, which provides material or financial resources to the farmer and specifies one or more product or process requirements for agricultural production on land owned or controlled by the farmer, which gives the firm legal title to (most of) the crop"(Prowse, 2012; Ton, Vellema, Desiers, Weituschat & D'Haese, 2016).

Therefore, from all these definitions, it is clear that contract farming refers to arrangement and commitment between producers and processors to provide input and outputs with pre-agreed price regarding with the specific time, quality and quantity.

2.3 Models and Type of Contract Farming

2.3.1 Models of contract farming

Contract farming normally involves farmers, intermediaries and marketing/trading or processing firms who play a vital role in producing and marketing in the agricultural sector. Although there are many contract farming models contract farming practices and models differ depending on the kind of crop, situational and geographical conditions, and the socio-cultural context. This diversity is the result of the technical requirements of production and the associated production and transaction costs (Simmons, Winters & Patrick, 2005). Eaton and Shepherd (2001) have

distinguished as five models according to the type of contractor, the type of product, the intensity of vertical coordination between farmer and contractor, and the number of key stakeholders involved.

2.3.1.1 The centralized model

This model can be considered as the classical model that involves a contractor and farmers. The firm purchases necessary produce from a large number of farmers with predetermined quantity and quality of product are strictly controlled. The firm has control over the production process and is supported to provide inputs and technical supports. According to Bijman (2008), the contracts are often made with large farmers because of requirement of large quantities of uniform product. Most of the products traded under this model require a high degree of processing is needed such as sugarcane, tea, coffee, cocoa, rubber, milk, poultry, and vegetables for the canning industry (Key & Runsten, 1999).

2.3.1.2 The nucleus estate model

The nucleus estate model is not only sources from independent farmers but also has its own production facilities (an estate plantation). A common approach is to commence with a pilot project and then introduce farmers to the technology and management techniques of a particular crop. This model is mainly used for perennial crops, (oil palm production in Indonesia) and is sometimes used only for research and breeding purposes (dairy operation in Indonesia) and also for other crops (Baumann, 2000; Bijman, 2008).

2.3.1.3 The multipartite model

The multipartite model involves legal bodies, farmers, government agencies, foreign and domestic private companies as a joint venture. Sonntag, Huang, Rozelle and Skerritt (2005) mentioned that this model is common in China where government departments as well as township committees have set up joint ventures with domestic and foreign investors to establish a processing unit and to make contracting with local farmers. Joint venture model is also commonly seen between public agencies and private companies (example the governments of Mexico, Kenya and West Africa have invested in contract system with private companies). This model involves many organizations which are responsible for credit provision, production management, processing and marketing (Eaton & Shepherd, 2001). The model is fit for smallholders because the integrated effort of many players could reduce the burden of contracting parties (Asian Development Bank [ADB], 2005).

2.3.1.4 The informal model

The informal model is characterized by individual entrepreneurs or small companies contracting informally often as verbally with farmers on a seasonal basis, particularly for crops (fresh fruits and vegetables) which require only a minimal amount of processing, such as sorting, grading and packaging (Eaton & Shepherd, 2001). An informal contractual relationship provides fewer options for vertical coordination than a more formal relationship. In this model material input and technical advice is commonly limited to provide seeds and basic fertilizers, grading and quality control. However, farmers make contract under this model to achieve credit and might get lower price than normal market price. It often requires government support services such as research and extension. Due to its non-formal nature and limited control over products, it often suffers from extra contractual side-marketing and qualities of products.

2.3.1.5 The intermediary model

The intermediary model involves three parties, a processor or major trader formally contracts with a collector (or middlemen) who informally contracts with a number of farmers. This model is commonly practiced throughout Southeast Asia countries (Baumann, 2000). As there is no direct link between contractor and farmers, this model has several disadvantages for vertical coordination and for providing services (Eaton & Shepherd, 2001).

2.3.2 Types of contract farming

Eaton and Shepherd (2001) indicated that the type of contract is significantly dependent upon the nature of the product, the primary processing required, market demand (in terms of supply reliability), quality incentives, payment arrangements, the level of control and capital. Though many different types of contract are found in the literature, they tend to be based on market requirements, product management and resource supply. Michel and Lawrence (as cited in Minot, 1986) have categorized conventional agricultural contracts into three types as (i) market-specification contracts, (ii) production-management contracts, and (iii) resource-providing contracts.

2.3.2.1 Market-specification contracts

Pre-harvest verbal of written market agreements is made between a farmer and a contractor regarding with the specification of quantity, quality, price, the selling time and the sale location of the final product. The contractor can reduce the uncertainty and

market risks as well as the coordination costs as compared with spot market. The farmer takes over almost all the risks associated with the production activities due to dealing with most management decisions. This type of contract is mostly used in informal contract farming model.

2.3.2.2 Production-management contracts

Production-management contracts provide high power to a contractor to control the production process, input supplies and technological guidelines. Farmers assign a substantial part of their decision rights to the contractor not only over production by agreeing to follow recommended production approaches and input usage, but also cultivation and harvesting practices. Thus, the product quality can be increased and production cost can be decreased since the production steps are under supervision stages. However, in this case inefficient farmers may be a risk for the contractors. Production management contract specifies cultivation practices to achieve quality, timing and least-cost production, thus even more economizing on coordination costs. It may also support skills development of the producer, and thereby reduce future transaction costs.

2.3.2.3 Resource providing contracts

The contractor not only provide guaranteed market outlet for the product, but also provides key inputs on a in kind-credit base and the cost of which is repaid upon product delivery by farmer. This type can include production-management, thus shifting most production decision, rights and risks to contractor. On the other side, if this contract only focuses on providing inputs and market outlet, leaving most of production decisions as well as a significant part of the risk with farmers. This contract reduces farmers' risk of getting input on time and production cost, and benefits contractor from reliable supplies of desired quality and quantity of product with lower prices at the right time. Minot (1986) mentioned that a key success under this type is timely delivery of inputs and this contract is typically applied for the quality product which depends on the type and quality of input used. The selection among any of these three basic types depends on the type of products, the characteristics of the contractors and market conditions. However, there are many alternative typologies of contracts with has been developed from the perspective of farmers and contractors, that can derive from above three main categories. Singh (2002) described that there are at least four specifications in every contract which are price, quality, quantity and time.

However, most contracts include more provisions than just these four. Bijman (2008) listed the specifications that can provide for contract farming arrangements as follow;

- the duration of the contract
- the quality standards to be applied
- quality control (when, how, who is responsible, who pays)
- the quantity that the farmer is obliged or allowed to deliver
- the cultivation/raising practices required by the contractor
- the timing of delivery
- packaging, transport and other delivery conditions
- price or price determination mechanism (such as fixed prices, flexible prices based on particular (spot) markets, consignment prices, or split price)
- technical assistance
- procedures for paying farmers and reclaiming credit advances
- insurance
- procedures for dispute resolution

2.3.3 Formal and informal contract farming

Contract farming is categorized into by making a distinction between formal (or written) and informal (or verbal) contracts. In agriculture, contracts are often simple and verbal (Bogetoft & Olesen, 2004). Strohm and Hoeffler (2006) mentioned that the political and economic environment dictate whether a formal/written contract or a verbal contract based on trust is to be established.

Key and Runsten (1999) argue that it is the manner in which both parties in a contract observe the rights and obligations to each other that is important in determining the sustainability of the relationship rather than the formality or informality with which the contract farming arrangement is established. Because of most contracts are informal and incomplete, the agreement contains variables that cannot easily be verified by the court in case of contract break. While contract partners know whether the agreement has been honored or not, and the actual quality is equal to the one described in the contract. Formal contracts can either take the form of simple registration with a firm, to detailed agreements signed by both parties. Simple registrations are commonly found in the centralized model and in the informal model.

Generally, written contract clearly mentions the role of the farmer and company. Acreage, sowing dates, inputs, and services provided by the company,

contract duration, details of the delivery arrangement, rates for different grades of produce, payment schedule, a method of payment, conflict resolution mechanisms, etc. Most of the vegetable and fruit contracts are exclusive in nature, i.e., a farmer cannot sell the produce to any other party without the consent of the contracting party in written contracts (Narayanan, 2011; Roy, 1963; Singh & Asokan, 2005).

Even if parties are able to write complete contracts, it may be less costly to engage in simple informal contracting and rely on self-enforcement instead of third-party protection. Moreover, in many developing countries, notably in Sub-Saharan Africa, there is no tradition of written contract. The traditionally used informal agreements and understandings are still commonly used and respected (Fafchamps, 2004). According to Baker, Gibbons and Murphy (2002), relational contracts are informal agreements involving unwritten codes of conduct that powerfully affect the behaviors of firms. Eaton, Meijerink and Bijman (2008) termed relational contracts as self-enforcing contracts, whereby the parties have economic and social incentives to honor it in all incidents. Verbal contracts are usually used in the informal model of contract farming. These frequently suffer from misunderstandings and confusion (Eaton & Shepherd, 2001). In general, informal contracts are mainly undertaken by smallholders with market intermediaries in the interest of getting assured supply of intermediate inputs and livestock services on credit. Guaranteed outlet for the output could be an additional feature such as the Indian dairy case (Birthal et al., 2006), but could also be a missing component of pig production in Vietnam (Huong, Mergenthaler, Kaufmann & Valle-Zárat, 2007; Son, Lapar, Tiongco & Costales, 2007). Informal arrangements may as well exist and they involve casual verbal agreements between contracting parties and regularly repeated marketing transactions, without any written contracts or formal agreements.

2.4 Reasons to Participate into Contract Farming

The main objective of contract farming is to overcome the certain problems and constraints the smallholders face in their farming and marketing activities (Bijman, 2008; Eaton & Shepherd, 2001). Many literatures indicated that there are different reasons for the contractor and farmers to involve in contract farming and both parties generally choose contracts instead of vertical integration or spot market in which transaction and risk can be minimized. Masakure and Henson (2005) explored four factors which are motivating contracting motivations, namely market uncertainty,

indirect benefits (e.g. knowledge acquisitions), income benefits, and intangible benefits (e.g. status prestige as a source of self-satisfaction and social esteem) in Zimbawe. Guo, Jolly and Zhu (2005), in China, found that farmers enter contract farming arrangements to obtain advantages as price stability, market access, and technical assistance to improve product quality. Specialization and commercialization along with distance from market and government supports were shown to be major predictors of the livelihood of contract farmers.

Contracting firms also have different reasons to engage into contracts. Eaton and Shepherd (2001) found that the main potential reasons for firms to enter into contract farming which are production reliability, quality consistency, overcoming land constraints and reduction of transaction costs and risk in comparison with spot markets. Contract farming gives the chances to firms to expand and diversify their process as the firms has the control over input supply and production process in order to ensure the opportunity for uniform product and better response to market demand (Hall & Langemeier, 1994). Both parties motivate to engage in contract farming activities because of lower transaction costs, a framework for risk sharing and management, thus helping increase agricultural productivity and eliminating poverty (Will, 2013).

2.5 Advantages and Disadvantages for Farmers and Contractors

The advantages and disadvantages of contract farming for farmers and contractors that have been explained in the different literatures and summarized in Table (2.1).

2.5.1 Advantages for farmers

Farmers have advantages of contract farming which include access to production services and credit, technology transfer, reduction of risk and uncertainty, opportunities to diversify into new and more lucrative crops, and guaranteed markets (Kumar & Kumar, 2008; Nagaraj, Chandrakanth, Chengappa, Roopa & Chandakavate, 2008; Swain, 2009). Under contract scheme, uncertainties associated with searching for product markets are shifted the contractor side and the purchased price is specified by the contracting firm (Singh, 2002).

Table 2.1 Advantages and disadvantages of contract farming

Advantages	Disadvantages
Farmers - Stable market access - Access to provision of timely inputs, credit and technical assistance - Reduced production risk - Introduction of higher quality and value crops - Increased and stable income	**Farmers** - Reneging by contractor and weak claiming position in case of buyer default - Price determination - Rigidity in farming activities - Domination by monopolies - Risk of monoculture practices - Risk of indebtedness
Contractors - Reduction of the risk of product availability - Reduction of coordination cost (reducing screening and selection cost than spot market) - Quality consistency - Reduction of price risk for agreed quota based on pre-agreed prices	**Contractors** - Risk of contractual hold-up - High infrastructure, high risks and costs in organizing supply from dispersed farmers - Insufficient and inadequate inputs, farm management skills and technologies leading to inconsistent supplies

Source: authors' summarization based on Eaton and Shepherd (2001), Simmons (2002), Bijman (2008) and Will (2013).

Production of smallholders in the remote areas reduces due to lack of inputs and production resources in time. Not only farmers but also contractors get benefits from timely delivery of quality input supply, thus leading to ensure delivery of the timely quality products. Both parties can be benefited by the provision of technical assistance to the farmers. If production is failed due to uncontrollable circumstances including poor weather or diseases, farmers can share the risk of total income loss with the contractor. In contract farming, contracting firms allows farmers to access credit to finance production inputs through enforced agreements. Simmons (2002) pointed out that small scale farmers sometimes use the contract agreement as insurance to have credit from local sources.

Due to the limitation of government extension services in most developing countries, technical support and information transfer from the contracting firm is one of the main reasons for farmers to join contracts (Eaton & Shepherd, 2001). The information involves production requirements in specific markets, time of planting and harvesting to meet markets, management of product quality and other related information. In this way, contract farming can improve farmers from managerial advice, technical support, and their production skills to achieve the desired quality and quantity of yields. Various empirical studies prescribe that income of the contract farmer is higher than the same-crop-growing non-contract farmer and income stability is obtained when farmers get a predetermined price for their crops, especially in long term contract. Perry, Banker, Morehart and Johnson (1996) stated that farmers expect to achieve stable income via contract farming because of reduction of risks and uncertainty compared to spot markets. Contract farming offers the opportunity to farmers to learn basic concepts about how to run the efficient use of farm resources, improved methods of input application, record keeping, knowledge about the importance of quality, and the characteristics of different markets especially export markets.

2.5.2 Disadvantages for farmers

The disadvantages are farmers' loss of autonomy that is increasing dependency and chance of becoming exploited, and increased production risk (Kirsten & Sartorius, 2002; Singh, 2002). Contractors might renege on contractual terms if market circumstances change, for instance, if market prices at product delivery time are substantially different from contracted prices, contractors may force renegotiation or

may just reject product delivered at that time. Da Silva (2005) showed that complex price determination system when contractors intentionally avoid transparency in price context, that makes difficult to understand for the farmers and can confuse whether the contract is proper or not. Under contract system, smallholders' farmers are mostly unavoidable to grow only the prescribed crop and they lose their choices of own farming activities because they do not have enough resources to adjust production mixes. Intensified production of single crop can also be harmful for the farmers' fields by increasing the chances of diseases leading to destroy of ecosystem. ADB (2015) said that the easy access to credit for smallholders increases the risk of indebtedness and the debt amount gradually increases at last.

2.5.3 Advantages for contractors

Contractors also attain in the categories of reduced risk, fewer market failures and reduced transaction costs from contract farming. Contractor or buyer can be reliable source of supply, which meets requirements in terms of uniform quality, quantity, and timing. Contractor can influence the production process indirectly by providing inputs and technical assistance, and directly by managing the production. Therefore, it contains less screening and selection cost than spot market. Moreover, contractors can easily coordinate their own processing activities and better adjusting with the demand of their own customers, which ultimately reduce their coordination cost.

2.5.4 Disadvantages for contractors

Contractors mostly face contractual hold-up problem where alternative markets are widely available and contractual enforcement is weak. Farmers sell all or part of total production to another third party when this perceived price is higher than the contracted price. Bijman (2008) described that managing a commercial relationship with a large number of partners is a complex task, requiring investments in personnel, in controls and in monitoring systems. It is found in many literatures that farmers use supplied inputs in alternative crop and livestock activities; even sometimes they resell the inputs. It is a common problem in resource provision contract and not sure for contractors to obtain quality consistent products if the crops are sensitive to applied input dosages.

Contract farming can be concluded that reduction of uncertainty and/or specific investments due to spot market transactions and offers an efficient alternative

organizational structure and promote production and marketing agriculture. When efficiently organized and managed, contract farming reduces rick and uncertainty for both farmers and contractors as compared to spot market.

2.6 History of Contract Farming in Myanmar

In 1991, the national scheme to increase large scale commercial entrepreneurial activity and investment in the country's agriculture sector was introduced. The Central Committee for the Management of Cultivable Land, Fallow Land, and Waste Land awarded for companies wanting to cultivate large plots, up to 5,000 acres, with a possible total expansion per application to 50,000 acres. These companies awarded this land were granted a range of economic concessions including 30 year leases, automatic permission to export up to 50% of the crop (with the remained required to be sold domestically), tax exemptions for imported machinery, insecticides, and fertilizer; the provision of "no-cost" infrastructure for the operation (apparently built at the states' expense); and guaranteed access to, and the availability of loans, to entrepreneurs. Although these large-scale contracts aiming to increase agricultural economic activity, these did not contain legal provisions concerning the relationship between farmers and contracting companies or land use (Baker, 2011).

In Myanmar, cross border farming activities have been increasing since 2000s particularly in Thailand, China and Bangladesh bordering areas and the cultivation of soybeans, paddy, onions, maize, tea, sugarcane and corn production. Chinese border has also been stimulated by China's opium substitution campaign. In early 2009, leaders of Wa ethnic group claimed receiving income opportunities for former poppy growers by developing 33,000 ha of land for rubber production, 13,000 ha for tea and 6,600 ha for sugarcane through contracts with Chinese companies. Dolly Kyaw, Theingi Myint and Walsh (2015) mentioned that the opportunities and requirement of farmers between Myanmar and Thailand and the result of contract on socio-economic benefits of resource poor farmers in Myawaddy (border town of Thailand). In this region, most of resource-poor farmers of Myanmar seem to content rely on informal, individually or group verbal contracts with Thailand traders and input providers from Thailand for growing maize crop then followed by non-contracted green gram to deal with soil sustainability issues. More opportunities for income generation among poorer farmers would empower them to start to improve their own standards of living. Nevertheless, cross border contract farming has improved the resources available to farmers to a certain extent.

In 2008, Bangladesh have been awarded 50,000 acres of land for the cultivation of soybeans, paddy, onions, maize, tea, and sugarcane. Myanmar farmers are excluded from the farming process, as the agreement with Bangladesh specifies that 10,000 Bangladesh farmers will be brought in from Chittagong (Tribune, 2008). But, origin of the 50,000 acres of land is unclear and the government advertised property as cultivable, undeveloped, waste, or free land for communities' poorest farmers by grazing animals and gathering fuel wood or medicinal plants. Although they can provide valuable livelihood sources to the poor, these uses tend to be undervalued in official assessments because they are not marketed, (Von Braun & Meinzen-Dick, 2009).

Thailand has signed contracts for large swaths of northern Myanmar for farming projects, in which Thailand supplies inputs while Myanmar supplies "land and labor" (S.H.A.N, 2005). Farmer's land was confiscated to fight the planting of opium, but never received compensation or an opportunity to work different land. Moreover, Thailand and the state-owned Myanmar Sugarcane Enterprise near Bago Division in 2005 signed 2,000 acres contract for sugarcane, with 100% Thai ownership over the project. Job creation was promised, but few details were provided to determine if these jobs were hired day labor or tenant farmers, or if the project functioned to promote the livelihoods of farmers involved (Xinhua, 2005). In the same year Myanmar and Thailand supposedly signed a contract for the growth of a range of crops on over 17.5 million acres of land in Shan and Kachin States.

Since 1991, commercial plantation farming in Myanmar planned a range of investors from Myanmar's neighboring countries, and offered major land concessions in exchange for promises by contractors to support the country's food security. However, no major study has been done on the environmental or economic impacts of these projects, and circumstantial accounts indicate that many of these instances of commercial farming have embodied unequal, abusive and corrupt forms of contract farming, and can negatively impact small land farmers or farmers already below the poverty line (Baker, 2011). In Myanmar, as a target for developing technical skills as well as reducing poverty, a small farming contract that includes the provision of technical training, credit, and other extension services, could enhance possible shortcomings in the existing extension services available in Myanmar (Cho & Boland, 2004).

Myanmar Government has actively promoted contract farming for encouraging farmers and businessmen from China, Thailand, Bangladesh, India, and Kuwait

participated as a win-win situation since 2005. Foreign investors provide Myanmar farmers with new equipment and farming inputs in exchange for high-quality agricultural products. The Myanmar Rice Federation (MRF), established in 2009 by 44 RSCs facilitated the development of rice supply chains, together with associations for producers, millers, and traders. The RSCs contracted farmers under the oversight of MRF to provide credit, inputs such as seeds and fertilizers, and mechanization services to farmers. They also worked closely with the extension and research staff of the Ministry of Agriculture and Irrigation as well as with ground officers of the Ministry of Commerce to increase productivity along the supply chain, and simultaneously facilitate agribusiness and trade.

2.7 Empirical Evidence of Contract Farming in Myanmar

Soe Tun (2012) explored the community-based comparison study of rice contract farming with 3,600 farmers from 46 townships of Yangon, Magway, Bago, Ayeyarwady, Sagaing Regions and Mon and Rakine States. Gross margin analysis and simple mean comparison was applied to find out the impact of contract farming on rice producers. The research found that contract farming is suitable for farmers and the government should encourage Public-Private Partnership model in Myanmar.

Byerlee, Dolly Kyaw, U San Thein and Kham (2014**)** reported monopsony contract farming agreements between a Thai sugar company (Nawaday Sugar Factory) and farms surrounding the mill in Myanmar. Initially larger farms with better assets were invited to be part of their program. The mill supplies certified varieties and fertilizers, payable after cane delivery and extension advice. After the sugarcane procurement price increased from K 13,500 in 2007-08 to K 30,000 per ton in 2012-13, small farmers (under 2 ha) also entered contracts. To enhance mechanization, tractor dealers forged a commercial link with a private bank for financing tractor purchases based on a guarantee by the sugar factory of credit worthiness, with loan repayments deducted by the mill. In a similar way, larger farmers could afford to buy the five to seven-ton truck for cane transport. These arrangements have allowed a sense of trust to develop over years between farmers and the mill.

Byerlee et al. (2014) also noted that commercial maize production is based on independent small and medium farmers (SMFs) who are linked closely with agribusiness companies, through the purchase of hybrid seed and through the sale of their maize to feed mills and exporters. Farmers can also receive extension services and

technical assistance from the companies who run a large number of demonstrations. The Charoen Pokphand Group (CP) also conducts a relatively large contract seed production enterprise in Southern Shan State, and exports seed. Especially smaller farmers, receive inputs on credit from export companies, input dealers, and local traders in an informal contract farming system. Some feed mill companies also assure high quality maize for their mills through contract farming. Traders associations, wholesalers and agents are performing aggregation, drying and storage services for export markets. In rubber contract farming, one private investor in Myanmar, would be to contract for management and quality upgrading with existing growers and their existing trees. This would reduce risks since financing would be short term and the emphasis on higher quality products such as latex concentrate would reduce side selling. Once strong farmer organizations and mutual trust are established between a company and the farmer organization, support to out growers could move to long-term financing to upgrade to high yielding rubber clones.

Dolly Kyaw et al. (2015) studied cross border contract farming (CBCF) in Myawaddy, CBCF conducted by the Mekong Institute in 2015. Traders in Thailand and maize farmers may be written or verbal in nature and it may involve a single farmer or household or a group of farmers. Total 151 maize farmers composed of 80 contract and 71 independent farmers were randomly interviewed from six villages. Traders can provide cash loans at the beginning of a new round of the contract. These loans are popular but expensive at interest rates of 5% per month and they are obliged to accept market prices for their goods. Providing mechanisms for low-cost cash advances at the village level would give greater bargaining power to those farmers. Farmers receive market price only for their products irrespective of whether they exceed quality specification or not and there is no incentive and no opportunity for them to become part of value-adding supply chains. CBCF encourages the use of vacant and unused land, including uplands and deforested areas. Farmers believe that opening a wholesale market at Myawaddy would provide some opportunities in this regard.

Theingi Myint, Nan Ei Mon The and Ei Mon Thida Kyaw (2016) studied contract farming in Ayeyarwady Region. Total 740 rice farmers composed of 465 contract and 275 non-contract farmers were interviewed from selected 51 villages and were compared the situations between 2010 and 2015. Contract farmers achieved supporting credit and technology from RSC while non-contract farmers received credit from MADB. According to results, there were no statistically significant difference in

both years. Monsoon rice, summer rice, black gram and vegetables grown by contract farmers got more profit as compared to non-contract farmers in 2010. Although, non-contract farmers achieved better production of monsoon rice than contract farmers in 2015, contract farmers had more profit from the other crops than non-contract farmers.

Shwe Yee Win Lei (2016) also verified empirically the cost and return analysis of winter and rain-fed cabbage and cauliflower production between contract and non-contract farmers in Kalaw Township. The benefit cost ratio of rain-fed cabbage production of non-contract farmers (3.02) was more profitable than winter cabbage production of non-contract farmers (2.64) and contract farmers (2.38). In the benefit cost ratio of non-contract farmers, rain-fed cauliflower production (3.55) was more profitable than winter cauliflower production (3.01) during the study period. Therefore, the results showed that rain-fed cabbage and cauliflower of non-contract farmers was economically more attractive for farmers than winter cabbage and cauliflower production during the study period.

Aye Moe San (2017) studied about rice contract farming system practiced by Gold Delta and Khittayar Hinthar Rice Specialization Companies in Ayeyarwady and Bago (West) Region of Myanmar. Total 403 smallholder households (220 contract and 183 non-contract) were randomly interviewed in nine villages from two townships. The results reveal that young and more educated household head have significant effect on contract participation decision. Farm characteristics such as output price, costs of fertilizers and experienced production shocks and institutional characteristics such as access to extension and participation into local farmer-based organization determined the probability to participate in contract scheme. Regional difference also showed different probability of contract participation. The results indicated that rice contract farming system could contribute significant positive impacts on smallholder livelihoods in terms of increasing monsoon paddy profit as well as crop and annual household incomes.

2.8 Empirical Evidence of Sesame Contract Farming in the World

Melse (2010) mentioned that exporters in the Ethiopian sesame sector may not have sufficient capacity to implement a formal contract that can address the challenges of both poor farmers and exporters. For instance, a centralized or nucleus model of contract needs a strong financial as well as institutional capacity to enable provision of all required inputs on credit, extension and other services, to establish a dependable

monitoring system and so on. Therefore, the sesame value chain can be pro-poor by implementing a multipartite contract model.

Van der Mheen-Sluijer and Cecchi (2011) reviewed many literatures and studied detail on sesame contract farming arrangement in one of the most important sesame producing areas of Ethiopia in order to know whether contract farming can decrease the transaction risks and costs, and can benefit for poor farmers from the sesame value chains in Ethiopia. The findings revealed that working with a myriad of small farmers will increase the transaction costs of the contracting firm. Thus, Ethiopian companies suggested that contract farming is only viable for them if they can sell the sesame to a high value market that offers a premium price. In addition, contract farming with a producer organization may considerably reduce the transaction costs for the company. In addition, the study suggested that only the marketing cooperatives, not just any cooperative, in Ethiopia will be an effective and efficient instrument to reduce transaction costs. There is no single study about sesame contract farming in Myanmar. Therefore, this study will initiate to fill the research gap.

CHAPTER III
RESEARCH METHODOLOGY

3.1 Study Area

3.1.1 Description of the study area

Magway Region is located in dry zone of central Myanmar. Magway Region is situated approximately between North Latitude from 18˚50′ and 22˚47′ and East Longitude between 93˚47′ and 95˚55′. It is commonly bordered by Sagaing Region to the north, Mandalay Region to the east, Bago Region to the south, and Rakhine State and Chin State to the west. Magway Region is the second largest of Myanmar's seven regions, with an area of 44,821 square kilometer (17,305.3 square mile) and total population was 3,944,000 with 88 per km^2 population density (Department of Planning [DOP], 2018). Magway Region covers 25 townships and 1,696 ward village tracts. Upland occupies 0.65 million hectares of total arable land (1.01million hectares) in the region and the rest lands are paddy land (lowland), alluvial land (Kaing-kyun myay), hill-side cultivated land (Taungya-myay) and horticulture land. Multiple cropping is practiced in the paddy land and upland. The major crop is sesame and over one million hectares is put under the crop.

Aunglan Township is located in Thayet District, North Latitude 19˚22′ and East Longitude 95˚13′ and it is the southernmost Township in Magway Region. Aunglan Township is one of the six Townships in Thayet District. Aunglan Township is situated between North Latitude 18˚58′ and 19˚29′ and East Longitude 90˚07′ and 95˚96′. According to population census in 2014, total population of Aunglan Township was 235,222 and population density was 51-100 persons per km^2, rural residents of the township were about 78% (Aunglan Township) of total population and mainly depend on monsoon sesame production. The major crops produced in this township are monsoon sesame, groundnut, green gram and paddy. It is situated on the eastern bank of the Ayeyarwady River. It is bordered by Sinpaungwe Township to the north, Yedashe Township of Bago Region to the east, Paukkaung Township and Pyay Township of Bago Region to the south, and Kamma Township and Thayet Township to the west. Aunglan Township is made up of 9 quarters, 91 village tracts and 247 villages and possesses a tropical climatic condition and produces a large quantity of sesame and groundnut for edible oil, it is also known as a major oilseed producing region of Myanmar (General Administration Department [GAD], 2018). Aunglan

Township mainly produces top export sesame variety named Sahmon Nat which goes especially to Japanese market.

3.1.2 Climatic condition of the study area

Myanmar possesses tropical and sub-tropical climates with three general seasons. There are three seasons in Myanmar, (i) the raining season from middle of May to middle of October, (ii) the dry cold season from middle of October to middle of February and (iii) the hot season from middle of February to middle of May. In general, average temperature of the central region is between 37˚C and 40˚C in summer, especially April which is the hottest month. In winter, the average temperature is 21˚C and the lowest temperature is 18˚C. The range of the total rainfall of the central region is from 812.8 mm to 863.6 mm. The average relative humidity is about 72.2% in Magway Region.

Aunglan Township is situated 25.91 meter/85 feet above sea level. As Aunglan Township is one of the places in the central dry zone, the same climatic casualty of central dry zone is found in the study area. The maximum temperature was increased from 43˚C in 2009 to 49.90˚C in 2018 during ten years while minimum temperature was decreased from 12.40˚C in 2009 to 9.30˚C in 2018 as presented in Figure (3.1) (DOA, 2018). The average monthly temperature was from a minimum of 16˚C (in January) to a maximum of 43˚C (in April and May) in 2017 as illustrated in Figure (3.2) (DOA, 2017).

Figure (3.3) showed total annual rainfall from 2009 to 2018 in the study area. Among them, the highest precipitation 1,399.03 mm in 2017 and the lowest precipitation 807.97 mm in 2014 were found in Aunglan Township (DOA, 2018). A maximum precipitation of 284.73 mm was found in July and minimum precipitation of 0 mm was found in February, March, November and December in 2017 as presented in Figure (3.4) (DOA, 2017). During July 2017, heavy rain occurred 2 to 3 weeks before harvesting stage of monsoon sesame at the period of growing season, which will cause great yield losses in that year.

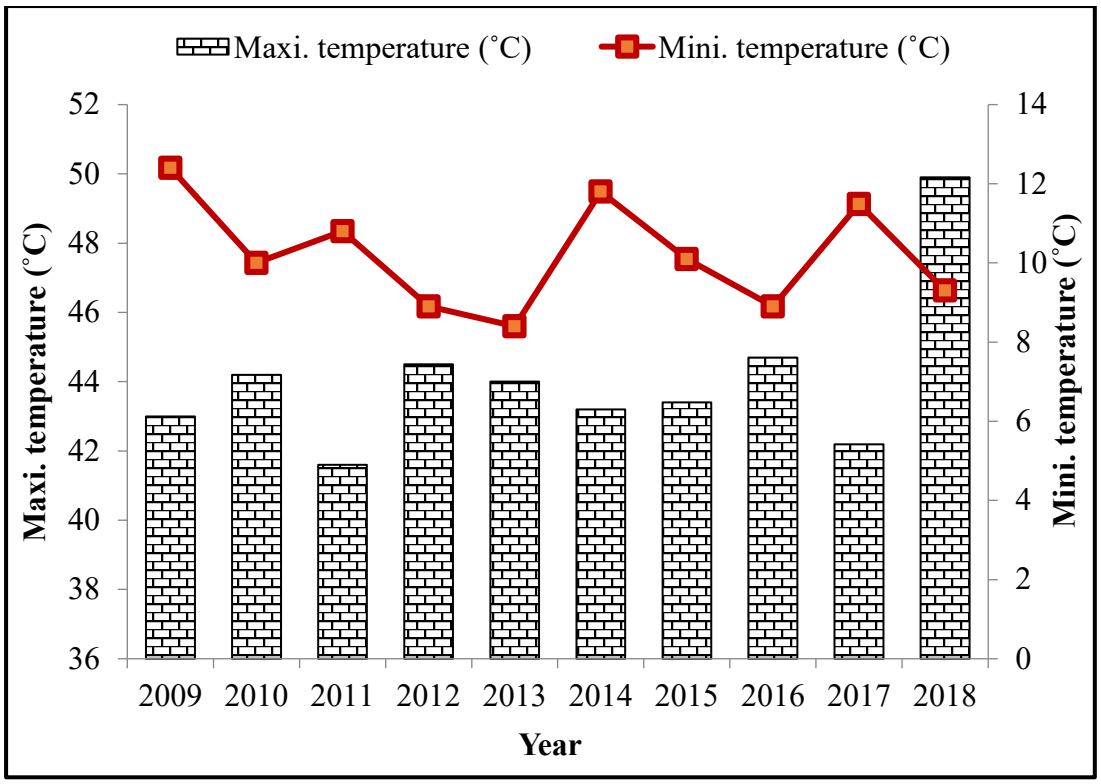

Figure 3.1 Minimum and maximum temperature in Aunglan Township from 2009 to 2018

Source: DOA, 2018

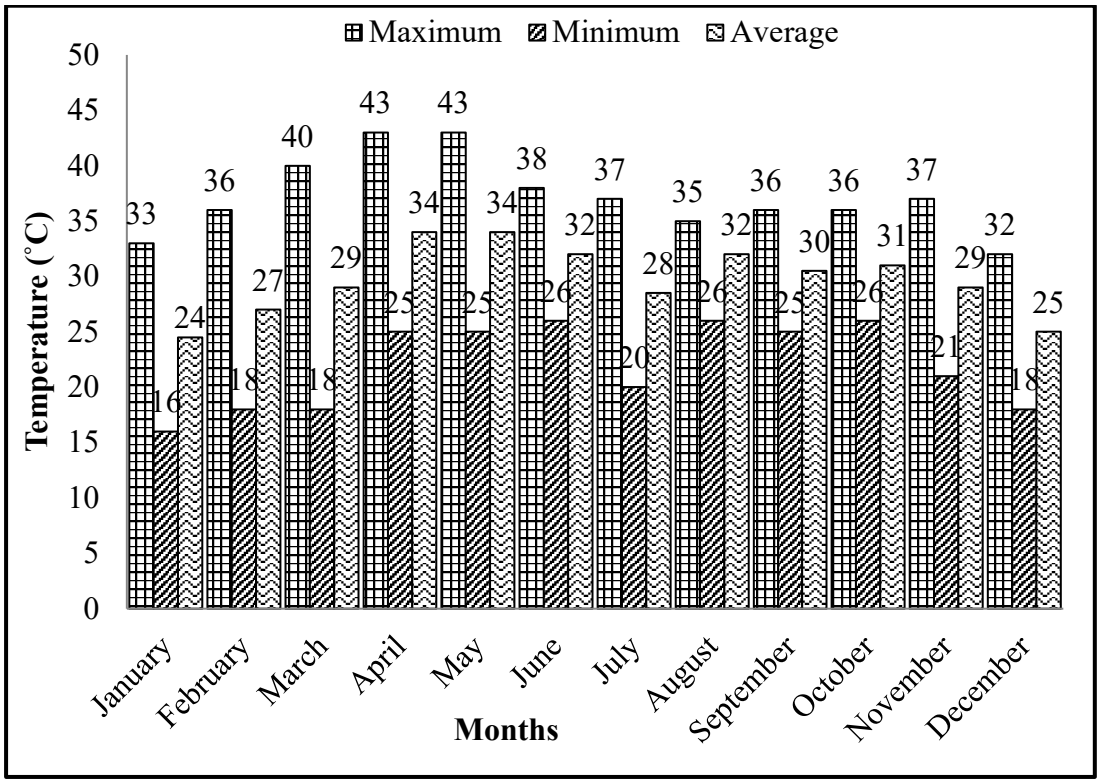

Figure 3.2 Temperature (˚C) in Aunglan Township in 2017

Source: DOA, 2017

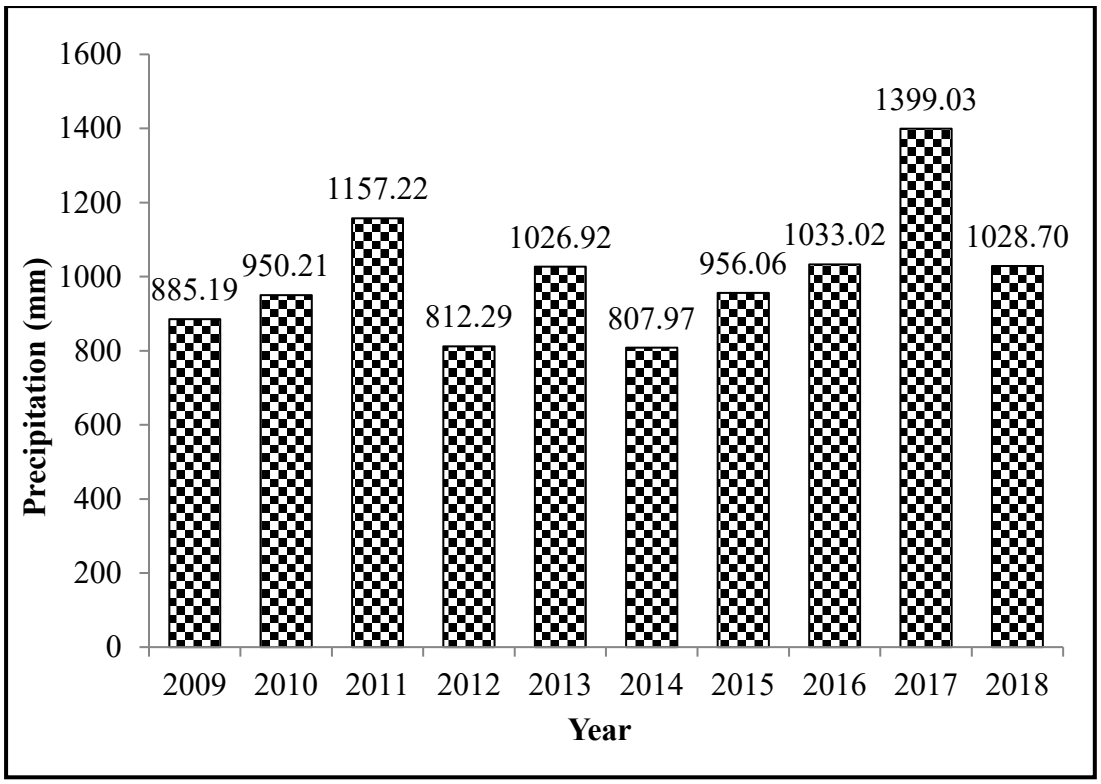

Figure 3.3 Annual total precipitation (mm) in Aunglan Township from 2009 to 2018

Source: DOA, 2018

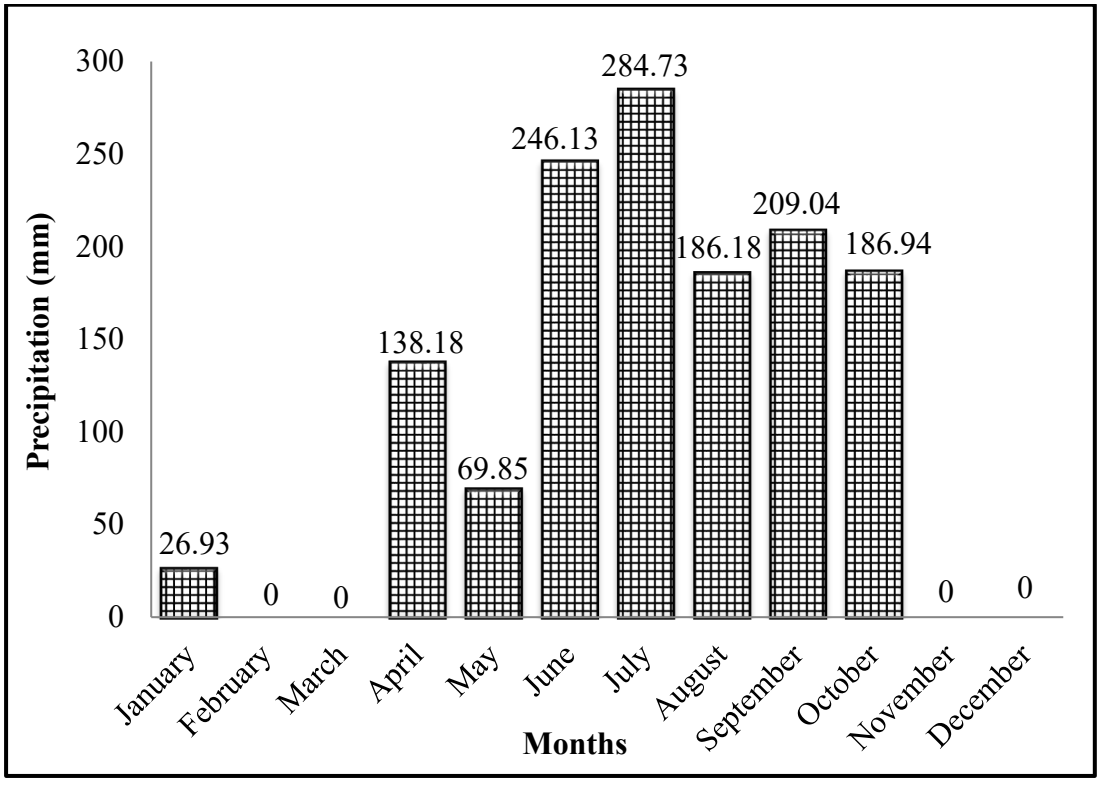

Figure 3.4 Precipitation (mm) in Aunglan Township in 2017

Source: DOA, 2017

3.1.3 Land utilization and crops production

During 2016-2017, Aunglan Township occupied a land area of about 267,820 ha in which the cultivable area covered 85,110 ha (31.78%), wild land covered 30 ha (0.01%), forest land covered 45,960 ha (17.16%), virgin land covered 114,700 ha (42.83%) and reserved and others occupied 22,020 ha (8.22%). Total cultivable area of Aunglan Township was divided into lowland (16,700 ha), upland (66,380 ha), alluvial soil/Kaing-Kyun (2,000 ha) and orchard (30 ha) which were 6.24%, 24.79%, 0.74% and 0.01% of total net sown area, respectively, as shown in Table (3.1) (DOA, 2017).

There were over ten crops grown in Aunglan Township. Pulses, groundnut, cotton, vegetable and culinary crops were cultivated in winter season. Sesame, groundnut, pulses, sweet corn and paddy were grown in monsoon season. Only paddy was grown in summer season. Among these crops, rain-fed sesame is the dominant crop for monsoon season at the township level as shown in Table (3.2) (DOA, 2017).

The sown area of monsoon sesame in Aunglan Township which gradually increased from 14,960 ha in 2012-2013 to 26,120 ha in 2017-2018 (Table 3.3). However, yield/ha of monsoon sesame slightly decreased from 0.72 MT/ha in 2012-2013 to 0.64 MT/ha in 2017-2018. Total production increased 10,812.73 MT in 2012-2013 to 16,431.69 MT in 2017-2018 due to the expansion of sown area (DOA, 2018). The sown area of summer sesame recorded a decrease from 140 ha in 2012-2013 to 10 ha in 2015-2016. Production of summer sesame also decreased from 134.87 MT in 2012-2013 to 10.31 MT in 2015-2016 as presented in Table (3.4) (DOA, 2018). The sown area and production of summer sesame significantly decreased than the monsoon sesame and ceased since 2016-2017.

Annual sesame production of Magway Region and Aunglan Township were shown in Figure (3.5). Sesame production in Magway Region was the highest (399,120 MT) in 2013-2014 and then slightly decreased to 283,070 MT in 2017-2018. However, sesame production of Aunglan Township was gradually increased from 10,930 MT in 2012-2013 to 16,430 MT in 2017-2018 (DOA, 2018).

There were different sesame varieties grown in Aunglan Township as presented in Figure (3.6). Among them, the largest share was Sahmon Nat (83.70%) followed by Sinyadanar-3 (9.88%), Red sesame (6.40%) and Black theik pan (0.02%) respectively (DOA, 2018). Specification of these varieties were shown in Appendix (1).

Table 3.1 Land utilization in Aunglan Township in 2016-2017

No.	Type of land	Area ('000 ha)	Share in total crop area (%)
1.	Net sown	85.11	31.78
	(a) Lowland	16.70	6.24
	(b) Upland	66.38	24.79
	(c) Kaing-Kyun	2.00	0.74
	(d) Orchard	0.03	0.01
2.	Wild land	0.03	0.01
3.	Forest land	45.96	17.16
4.	Virgin land	114.70	42.83
5.	Reserve and others	22.02	8.22
	Total	**267.82**	**100.00**

Source: DOA, 2017

Table 3.2 Cultivation of sesame and other crops in Aunglan Township in 2016-2017

Crops	Area ('000 ha)	Share in total crop area (%)
Pulses	52.93	33.62
Groundnut	28.95	18.39
Paddy	20.69	13.14
Monsoon sesame (Rain-fed sesame)	20.38	12.95
Cotton	11.67	7.41
Sugarcane	7.53	4.78
Others	7.05	4.48
Sweet corn	6.02	3.82
Vegetable	1.66	1.05
Culinary	0.56	0.36
Total crop area	**157.44**	**100.00**

Source: DOA, 2017

Table 3.3 Monsoon sesame sown area, harvested area, yield and production in Aunglan Township from 2012-2013 to 2017-2018

Year	Sown area ('000 ha)	Harvested area ('000 ha)	Yield (MT/ha)	Production (MT)
2012-2013	14.96	14.96	0.72	10,812.73
2013-2014	14.98	14.98	0.72	10,827.67
2014-2015	14.98	14.98	0.72	10,838.20
2015-2016	15.03	14.73	0.69	10,232.78
2016-2017	20.38	20.25	0.64	14,089.64
2017-2018	26.12	25.55	0.64	16,431.69

Source: DOA, 2018

Table 3.4 Summer sesame sown area, harvested area, yield and production in Aunglan Township from 2012-2013 to 2017-2018

Year	Sown area ('000 ha)	Harvested area ('000 ha)	Yield (MT/ha)	Production (MT)
2012-2013	0.14	0.14	0.98	134.87
2013-2014	0.04	0.04	0.98	41.61
2014-2015	0.04	0.04	0.98	41.76
2015-2016	0.01	0.01	0.73	10.31
2016-2017	-	-	-	-
2017-2018	-	-	-	-

Source: DOA, 2018

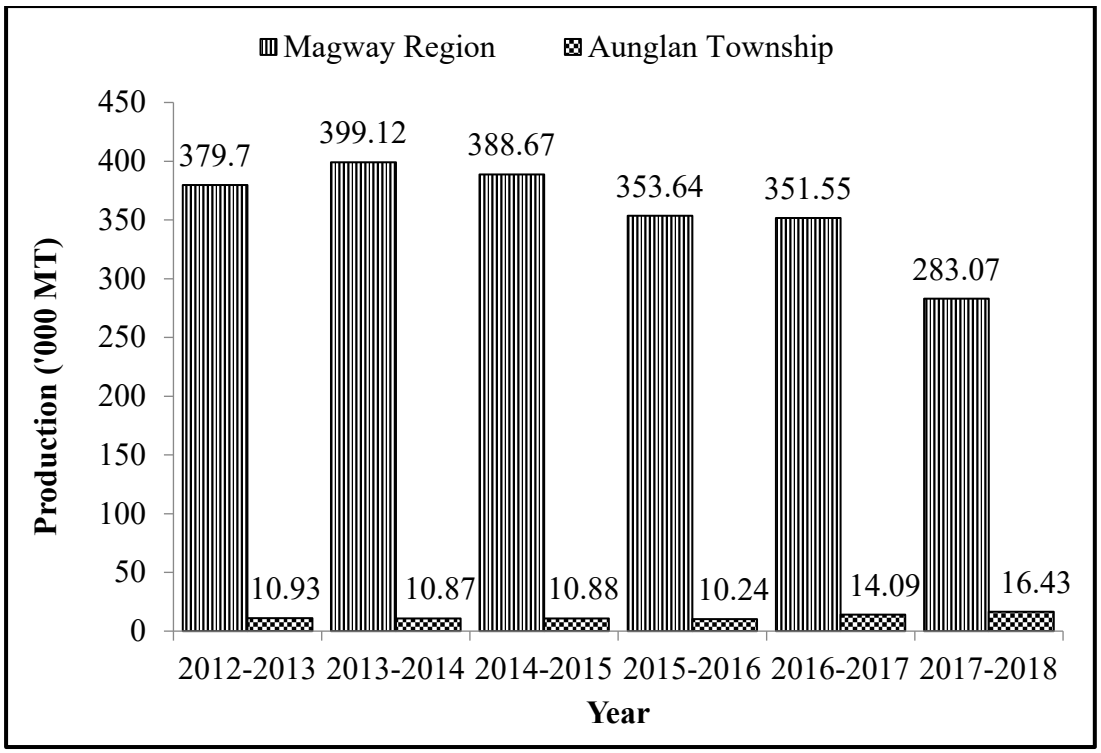

Figure 3.5 Annual sesame production of Magway Region and Aunglan Township in 2012-2018

Source: DOA, 2018

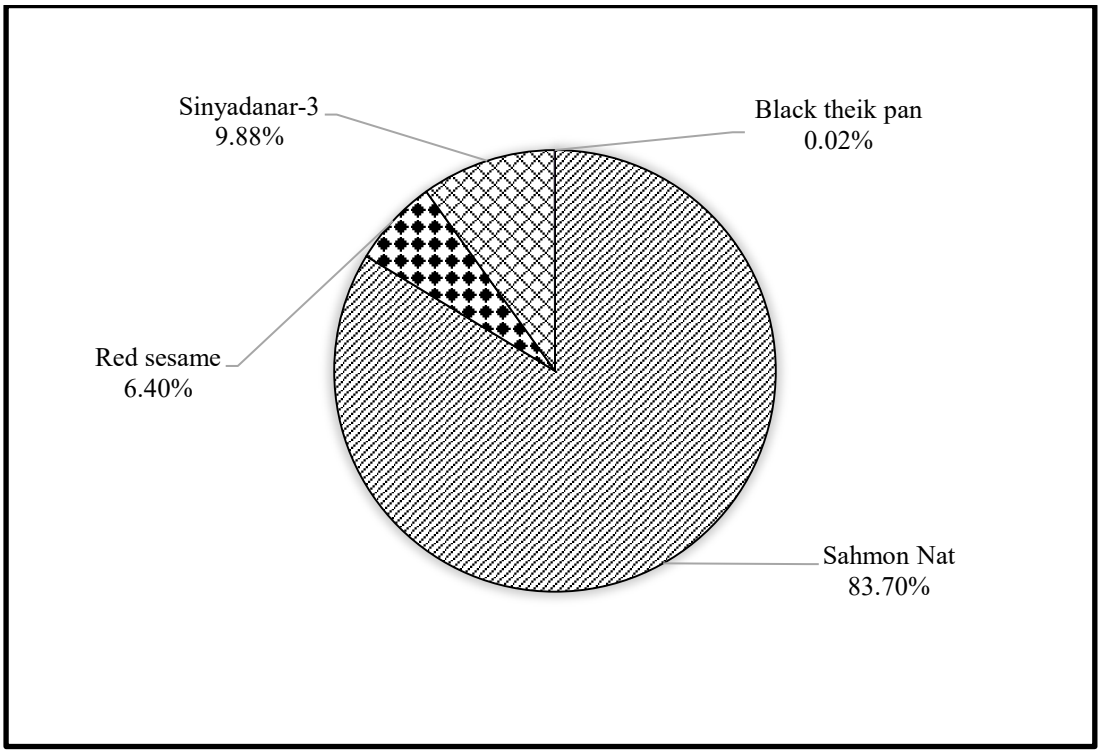

Figure 3.6 Sown area of different sesame varieties in Aunglan Township in 2017-2018

Source: DOA, 2018

3.2 Sampling Procedure, Data Collection and Sampling Method

In this study, an earlier reconnaissance survey was conducted to clarify sampled stakeholders in Aunglan Township during November 2017. For information about informal contract farming activities, situation of the study area was gathered by means of direct observation and discussion with the field supervisors of Department of Agriculture (DOA) and some supply chain stakeholders in Aunglan Township. Thereafter, the study villages and stakeholder participations were noted. This study focused only on contracting with Sahmon Nat variety producers, thus, stakeholders included farmers, wholesalers, food processors and exporters as that variety is not used for edible oil.

Field survey for collecting primary data was carried out to access the current performance of sesame farmers and other supply chain stakeholders such as local wholesalers and food processors in Aunglan Township and exporters in Yangon Region. Different sets of structured questionnaires were applied for different stakeholders to fit with real situation. Stratified random sampling procedure was applied to gather primary data such as farm and household characteristics, socio-economic condition, production and marketing activities and constraints faced by the different supply chain stakeholders. One household was considered as one sampling unit. Sampled households were differentiated into contract and non-contract households based on their verbal agreement with local wholesalers (i.e., participation into informal contract system) during 2017-2018 monsoon sesame cultivation. Within Aunglan Township, one village each from five village tracts respectively were randomly chosen and total number of sampled households were 102 households composed of 60 contract and 42 independent households. Sampled farm households and other stakeholders were individually interviewed with different set of structured questionnaires during December 2017 and February 2018. Also 14 wholesalers and 2 food processors in Aunglan Township and 5 sesame exporters in Yangon Region were also interviewed. The number of sampled households and other stakeholders from the different strata in each stage of supply chain was shown in Table (3.5). A total of 102 sampled households were interviewed from five villages as presented in Table (3.6). Farmers related questionnaire was used to collect farmer's socio-economic data such as age of household heads, gender, education level, family size, farm ownership, farm size, household's experience in sesame production, sesame sown area, harvested area, yield, cultural practices, crop production, output price, labor costs, transportation costs, marketing costs, access to government extension service and credit, amount of marketed surplus and seed rate per acre, production cost of sesame and post-harvest practices, constraints of sesame production, etc.

Table 3.5 Number of sampled farm households and other stakeholders in the study area

Stakeholders	Number
Farm households	102
▪ Contract	60
▪ Non-contract	42
Wholesalers	14
Food Processors	2
Exporters	5
Total	**123**

Table 3.6 Number of sampled farm households from villages in Aunglan Township in 2017-2018

Name of village	Total sampled farm households (No.)	
	Contract	Non-contract
Yae Paw	28	2
San ka Lay	7	13
Ma Au Khon	4	12
Kun Laung	4	2
Ywar Ma Htone	17	13
Total (No.)	**60**	**42**

The market related questionnaire was used to collect detailed measures of prices and quantity, purchased and sold system, marketing costs of various stakeholders, storage facilities, transport facilities and access to market information, etc. Exporters were interviewed to investigate purchasing, marketing activities and costs, export policies and regulations, constrains, challenges and possible solution in export, etc.

Secondary data such as temperature and rainfall, land use pattern, cropping pattern, crop yield, rural and urban population, sesame export volume and value and sesame export companies were collected from published official records of Ministry of Agriculture, Livestock and Irrigation (MOALI), Ministry of Commerce (MOC), Food and Agriculture Organization the United Nations Statistics (FAOSTAT) and Union of Myanmar Federation of Chambers of Commerce and Industry (UMFCCI) and other related publication.

3.3 Data Analysis Methods

3.3.1 Descriptive analysis

The data collected from the various stakeholders were analyzed by using STATA 14 statistical software. The descriptive analysis was employed by using graph, diagrams, charts, frequencies, percentages, means, ranges and standard deviations in examining socio-economic characteristics of stakeholders.

3.3.2 Cost and return analysis

Enterprise budgeting developed by (Olson, 2003) was used in economic analysis for the estimation of cost, return and profit per unit area of sesame production of farmers in the study area. Total variable costs were taken into account: material input cost, hired labor cost, family labor cost and interest on cash cost. Both cash and non-cash items were included in the estimation of material cost and labor cost. Family labor is non-cash labor cost item. Non-cash items for material cost were own reserved seeds, working animals, farm yard manure (FYM) and so on. Cash payment for labor included hired labor, payment for land preparation (custom-hired tractor or working animals).

The first measurement was the difference between total gross benefits and total variable cash costs, excluding opportunity costs. This value was referred to as “return above variable cash cost”. The second measurement was the deduction of the opportunity cost and total variable cash costs from gross benefit. This return was referred to as “return above variable costs” or “gross margin”. The return per unit of invested capital could be calculated by gross benefits per total variable costs. The return per unit of cash expensed could be calculated by gross benefits per total cash costs.

Enterprise budgets require less data than the whole farm budget, and when realistic and accurate cost allocations can be made by enterprise, the comparative profitability of enterprises can be measured. Enterprise budgets can also be used to derive break-even prices and break-even yields. In order to calculate the break-even price for covering variable costs, take the total variable costs and divide by the quantity of sold (Smith, McCorkle, Outlaw & Hanselka, 2013). Expressions for estimating returns to various factors were described in Table (3.7).

3.3.3 Method of marketing cost and marketing margin analysis

3.3.3.1 Marketing channel

Kohls and Uhl (2002) defined marketing channels as alternative routes of product flows from producers to consumers. Their marketing channel starts at the farm's gate and ends at the consumer's front door. The marketing channel approach focuses on firm's selling strategies to satisfy consumer preferences. Market performance is a function of the number of scale and role of market intermediaries who provide services involving the transfer of producer to end user. Marketing channel showed the flow of oilseed crops from the production site (producers) to intermediaries and on to the consumers.

Kotler (2003) conducted that a marketing channel is a business structure of interdependent organizations that reach from the point of product or origin to the consumer with the purpose of moving products to their final consumption or destination. Given this situation, considerable marketing channel research focused on organizational responsibility for managing channel how interrelationships among a firm and its channel members can be managed better (Achrol & Stern, 1988).

3.3.3.2 Method of marketing margin analysis

Marketing margin for a particular commodity is the difference between what the consumer pays for the final product and the amount the producer receives (Abbott & Makeham, 1986; Amobi, 1996; Arene, 2003; Hays, 1975; Olukosi & Isitor, 1990). Marketing margin reflects the costs and profit of middlemen (Minot & Goletti, 2000; Olukosi & Isitor, 1990).

The costs are incurred mainly in adding utilities of time, form, place and possession. Costs include payment for all initial assemblage, storage, processing, transporting, warehousing and retailing charges. The profit range accruable to the market participants gives an indication of market performance (Achoga & Nwagbo, 2004).

Table 3.7 Estimating return to factors of production

Factors	Units	How to calculate
Return above variable cash cost	MMK/ha	RAVCC = TGB - TVCC
Return above variable cost	MMK/ha	RAVC = TGB - TVC
Return per unit of capital invested	MMK	TGB/TVC
Return per unit of cash expensed	MMK	TGB/TVCC
Break-even yield	MT/ha	TVC/average price per kg
Break-even price	MMK/kg	TVC/average yield per hectare
Gross margin	MMK/ha	GM = TGB - TVC
Net profit	MMK/ha	TGB - TVC
Benefit cost ratio	Ratio	BCR = TGB/TVC

Source: Olson, 2003

Where,

TGB = Total gross benefit
GM = Gross margin
TVC = Total variable cost
TVCC = Total variable cash cost
BCR = Benefit cost ratio
RAVC = Return above variable cost
RAVCC = Return above variable cash cost

Ghorbani (2008) mentioned that marketing margin are important indices in the evaluation of supply chain performance. It is the difference in the price paid by consumers and that received by the producers. Marketing margins are also calculated at different points along the supply chain and then compared with consumer price. It is calculated in relation to the price paid by the consumer and expressed in percentage (Teka, 2009).

Marketing margin is examined for a common means of measuring market efficiency. This is an attempt to evaluate economic or price efficiency. Marketing margins are differences between different levels of marketing channels. They capture the proportion of final selling price that marketing agents provides services for getting the added value in the various levels. Response of marketing margins to price changes at any levels is also indicative of the efficiency of the channel (Guvheya, Mabaya & Christy, 1998).

An empirical analysis of marketing margin should be first and foremost an economic analysis of determinant of farm and retail price for a given commodity. The volume of marketing reflects the efficiency of marketing system. The higher marketing margin reflects, the fewer share of producer and more benefits to marketing middlemen and vice-versa. The number of middlemen involved in various channel of the marketing has a strong effect on the marketing margin. In marketing channel, the commodity types handled by the middlemen are different. Therefore, the percentage of profit per cost price was used in this study to compare the performance of intermediaries.

The following indicators are used in the analysis by (Olufokunbi, 1982).

1) Gross marketing margin = Average selling price - Average buying price
2) Profit = Gross marketing margin - Total marketing cost
3) Cost price = Buying price + Total marketing cost
4) Profit per cost price ratio = Profit/cost price

3.4 The Determinant Factors on Monsoon Sesame Profit of the Selected Farm Households

Ordinary least square (OLS) multiple regression technique was used to analyze the determinant factors of monsoon sesame profit of the selected farm household in Aunglan Township. The dependent variable was profit of sesame by sampled farmers and independent variables were yield, age of household heads, schooling year of household heads, sown area, family size, total family labor cost, total hired labor cost,

total material cost, availability of non-farm income, access to credit, access to production practices, access to market information and type of sesame farmers. The regression function used was as specific below:

$$LnY = \beta_0 + \beta_1 LnX_1 + \beta_2 LnX_2 + \beta_3 LnX_3 + \beta_4 LnX_4 + \beta_5 LnX_5 + \beta_6 LnX_6 + \beta_7 LnX_7 + \beta_8 LnX_8 + b_1 D_{1i} + b_2 D_{2i} + b_3 D_{3i} + b_4 D_{4i} + b_5 D_{5i} + \mu$$

Where:

Y = Monsoon sesame profit per hectare (MMK/ha)

X_1 = Monsoon sesame yield (kg/ha)

X_2 = Age of household heads (Year)

X_3 = Schooling year of household heads (Year)

X_4 = Sown area (ha)

X_5 = Family size (No.)

X_6 = Total family labor cost (MMK/ha)

X_7 = Total hired labor cost (MMK/ha)

X_8 = Total material cost (MMK/ha)

D_{1i} = Availability of non-farm income (1 = Yes, 0 = No)

D_{2i} = Access to credit (1 = Yes, 0 = No)

D_{3i} = Access to production practices (1 = Yes, 0 = No)

D_{4i} = Access to market information (1 = Formal, 0 = Informal)

D_{5i} = Type of sesame farmers (1 = CF, 0 = Non-CF)

β_0 = Constant

β_I, b_i,…are Parameter estimate (coefficient) and

μ = Error term, Ln = Natural logarithm, D = Dummy variables

3.5 Empirical Model for the Factors Influenced the Monsoon Sesame Profit

In this study, the selected variables to determine the influencing factors on monsoon sesame profit of sampled farm households included were yield, age of household heads, schooling year of household heads, sown area, family size, total family labor cost on the farm, total hired labor cost on the farm, total material cost on the farm, availability of non-farm income, access to credit, access to production practices, access to market information and type of farmers. A complete decision of the variables specified and types of measures that have been employed were as shown in Table (3.8).

Table 3.8 Expected signs of the independent variables in monsoon sesame profit

Independent variables	Units	Expected signs
Yield	kg/ha	(+)
Age of household heads	Year	(+/-)
Schooling year of household heads	Year	(+/-)
Sown area	ha	(+/-)
Family size	No.	(+)
Total family labor cost on the farm	MMK/ha	(-)
Total hired labor cost on the farm	MMK/ha	(-)
Total material cost on the farm	MMK/ha	(-)
Availability of non-farm income (Dummy variables)	-	(+/-)
Access to credit (Dummy variables)	-	(+/-)
Access to production practices (Dummy variables)	-	(+/-)
Access to market information (Dummy variables)	-	(+/-)
Type of farmers (Dummy variables)	-	(+/-)

CHAPTER IV
RESULTS AND DISCUSSION

4.1 Identifying Stakeholders of Sesame Supply Chain in Aunglan Township

The supply chain can be defined as "the interconnection of all the functions that starts from the manufacturing of raw material into the finished product and ends at the final customer" (Surbhi, 2018). A supply chain map is also useful in identifying and categorizing key market players and support organizations. It creates a link between the channel partners like suppliers, manufacturers, wholesalers, food processors, exporters and customers.

Figure (4.1) showed the main stakeholders of Sahmon Nat supply chain in the study area which included farmers, wholesalers, processors and exporters. Sahmon Nat variety was not used as cooking oil, thus, there was no oil miller as a stakeholder in this study. Majority of sesame farmers sold out raw sesame seeds immediately after harvest to wholesalers in Aunglan Township because of the nearest buyers, inexpensive transportation costs and convenient road infrastructure. Only a few farmers sold out raw sesame within one month after harvest. Wholesalers sold raw sesame seeds to exporters in Yangon after cleaning, drying and grading and food processors in Aunglan. In the study area wholesalers took place in the important role in the distribution of sesame from farmers to food processors and exporters. Food processors sold sesame brittle to snack wholesalers, retailers and consumers in different regions. Exporters exported the raw sesame to Japan, Taiwan and China.

4.2 Socio-economic Characteristics of Sampled Farm Households

4.2.1 Demographic characteristics of sampled household heads in Aunglan Township

Age and farming experience of sampled household heads in farming are some of the important factors that was assumed to determine decision making of their farming system. Demographic characteristics of sampled household heads producing sesame in the study area was shown in Table (4.1). The average age of contract farm household heads were 47.63 years and that of non-contract farm household heads were 49.24 years. This implies that majority of household heads were within the middle age and hence they could engage actively in sesame production sector.

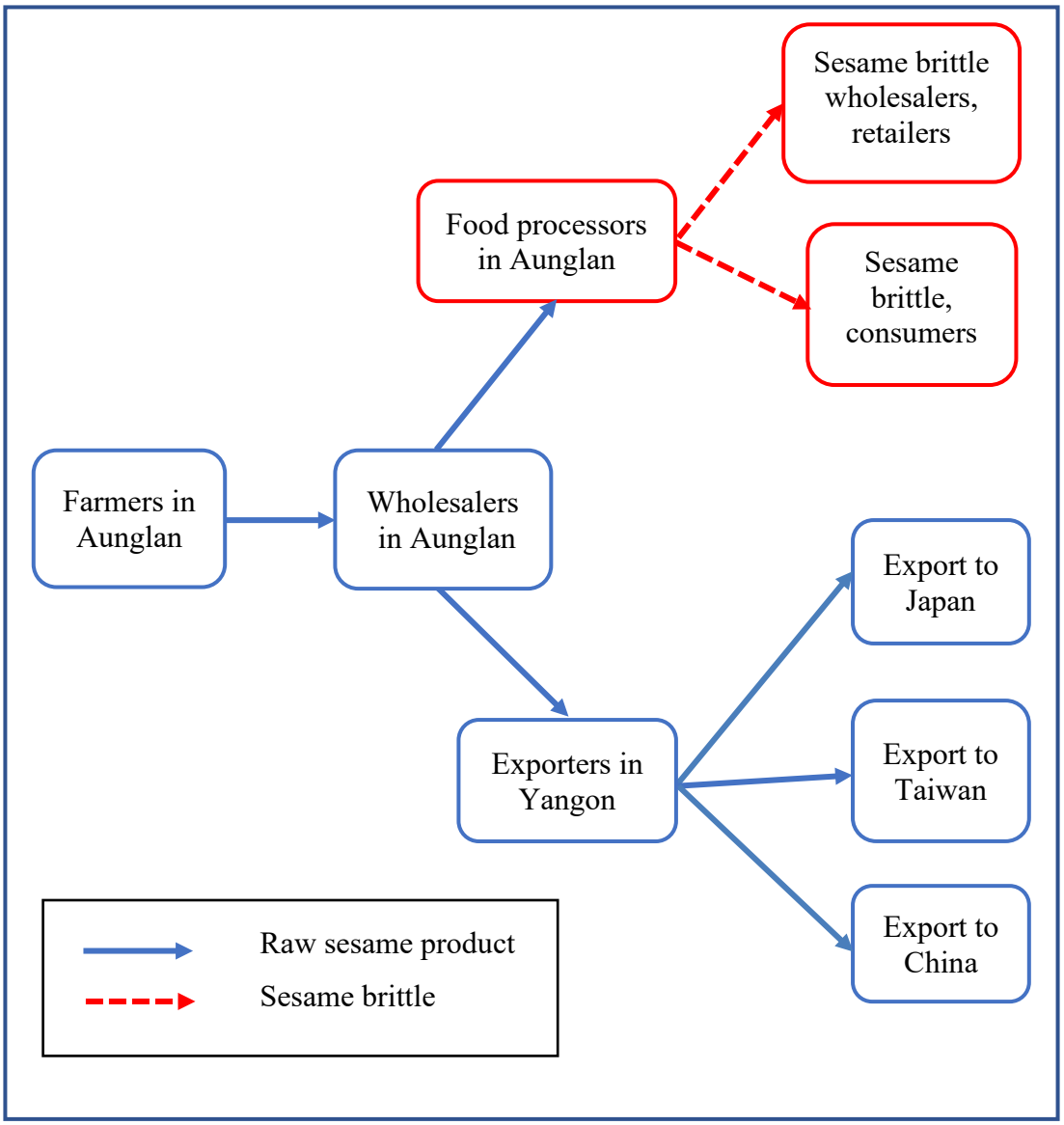

Figure 4.1 Main stakeholders involved along sesame (Sahmon Nat) supply chain in the study area

The average experience in farming for contract household heads were 25.25 years while that of non-contract household heads were 26.19 years. Hence it could be concluded that the sampled household heads had enough experience on the production of sesame. There was no significant difference in age and farming experience between contract and non-contract farm household heads in the study area. Education enables farmers to have access to information on new agricultural innovation which can be adopted to enhance their productivity. Both groups occupied secondary education level, however, non- contract household heads had significant high schooling years which were 6.71 years in comparison with contract household heads which were 5.25 years.

4.2.2 Gender status of household heads in Aunglan Township

The study results revealed that the majority of sampled household heads were male, which were 100% of contract households and 92.86% of non-contract households. There was no female headed household in contract household group. However, only a few household heads, 7.14% of sampled non-contract households were female as presented in Figure (4.2). Therefore, female headed households are generally very rare and male headed households are common in agricultural farming activities. It showed that monsoon sesame production is dominated by male farmers.

4.2.3 Family size and agricultural labors of sampled farm households in Aunglan Township

Labor achievement of household is generally related to family size and that will allow a household to get different agricultural activities in time. The more the number of workers available in a farm household the less the requirement for hired labor. Family size, family members with respect to different age groups and agricultural labors were not statistically significant differences between sampled contract and non-contract households as shown in Table (4.2). The average family size of sampled contract and non-contract farm households was composed of about 4 family members ranging from the smallest 2 to the highest 10 persons. The majorities of family members which were 3.08 and 3.57 persons of sampled contract and non-contract farm households respectively were working age family members (between 15 and 65 years old), in which 2.28 persons of contract and 2.36 persons of non-contract households involved in agricultural activities. The remaining of young (less than 14 years old) and aged (above 65 years old) family members were only a few numbers for both sampled contract and non-contract farm households.

Table 4.1 Demographic characteristics of sampled farm household heads in Aunglan Township

Items (Year)	Contract farmers (N=60)	Non-contract farmers (N=42)	Total (N=102)
Avg. age	47.63 (29 - 72)	49.24 (32 - 74)	48.29 (29 - 74)
t-test		0.78^{ns}	
Avg. farming experience	25.25 (5 - 58)	26.19 (2 - 55)	25.64 (2 - 58)
t-test		0.38^{ns}	
Avg. schooling year	5.25 (2 - 14)	6.71 (2 - 14)	5.85 (2 - 14)
t-test		2.22**	

Note: The values in the parentheses represent range. *, ** and ***are significant at 10%, 5% and 1% level respectively, ns is not significant differences.

Table 4.2 Family size and agricultural labors of sampled farm households in Aunglan Township

(Unit = Number)

Items	Contract farmers (N=60)	Non-contract farmers (N=42)	Total (N=102)
Avg. family size	4.20 (2 - 8)	4.50 (2 - 10)	4.32 (2 - 10)
t-test		0.94^{ns}	
Family member (≤ 14 years)	0.82 (0 - 3)	0.55 (0 - 2)	0.71 (0 - 3)
t-test		1.76^{ns}	
Family member (15 - 60 years)	3.08 (1 - 6)	3.57 (1 - 7))	3.28 (1 - 7)
t-test		1.77^{ns}	
Family member (≥ 65 years)	0.33 (0 - 2)	0.43 (0 - 2)	0.37 (0 - 2)
t-test		0.70^{ns}	
Avg. agricultural labor	2.28 (1 - 6)	2.36 (1 - 7)	2.31 (1 - 7)
t-test		0.33^{ns}	

Note: The values in the parentheses represent range. *, ** and ***are significant at 10%, 5% and 1% level respectively, ns is not significant differences.

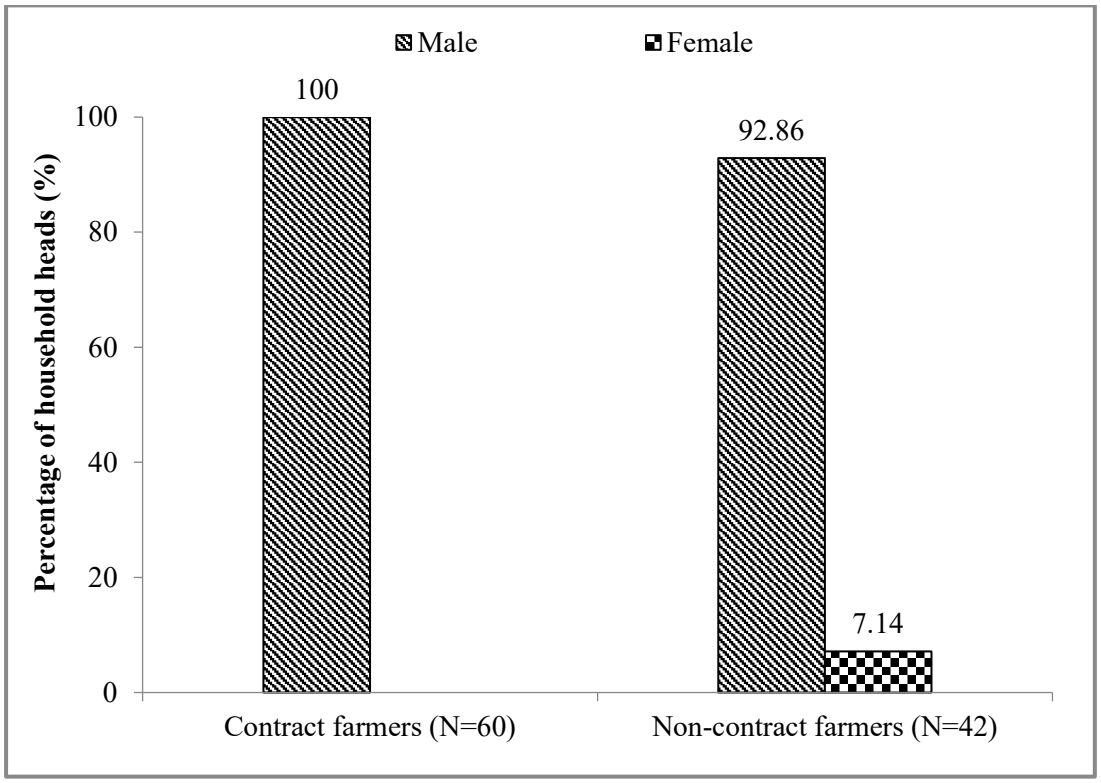

Figure 4.2 Gender status of household heads in Aunglan Township

4.2.4 Land holding assets by sampled farm households

Land is a basic asset for rural household livelihood in agricultural countries. If land holding is very small, crop production cannot be done in economically efficient level. In this study area, land holding size per household means only cultivable land.

The average land holdings and different types of lands by sampled farm households were shown in Table (4.3). Sampled farm households had the cultivated land in average 7.33 ha, in which own lands were 7.15 ha and only 0.17 ha were rent-in conditions. Among the cultivable land, upland type was in majority which were 6.47 ha and lowland and alluvial land type were less than 1 ha respectively for both groups of sampled farm households in the study area. The result showed that average farm size and different types of land area were no significant differences between sampled contract and non-contract farm households in the study area.

4.2.5 Comparison of sampled farm households in the ownership of farm and livestock assets

Table (4.4) showed the ownership of farm and livestock assets by sampled farm households in the study area. Sampled farm households owned manual farm assets more than farm machineries. All sampled contract and non-contract farm households possessed ploughs, harrows and bullock carts while less than 10% of sampled households had farm machineries such as tractors, power tillers and pulse splitting machine. More than 90% of sampled households possessed sprayers. Around 26% of sampled households owned generators for water pumping while about 17% and 12% of them had mechanized threshers and fodder cutting machines respectively. Very few numbers, about 1% each of sampled households had Htaw lar gyi (small truck) and inter-cultivators respectively.

In the context of livestock possession by sampled farm households, livestock rearing looked like a relatively small scale in the study area. However, nearly 100% of sampled farm households owned cattle for farming activities. Less than 10% of sampled farm households raised pig and poultry.

Table 4.3 Land holding assets of sampled farm households in Aunglan Township

(Unit = Hectare)

Items	Contract farmers (N=60)	Non-contract farmers (N=42)	Total (N=102)
Avg. farm size	7.23 (2.02 - 21.05)	7.47 (1.62 - 32.39)	7.33 (1.62 - 32.39)
t-test	0.20^{ns}		
Own	6.93 (2.02 - 21.05)	7.47 (1.62 - 32.39)	7.15 (1.62 - 32.39)
t-test	0.46^{ns}		
Rent-in	0.30 (0 - 13.77)	0.00	0.17 (0 - 13.77)
t-test	1.27^{ns}		
Lowland	0.67 (0 - 2.83)	0.65 (0 - 3.24)	0.66 (0 - 3.24)
t-test	0.09^{ns}		
Upland	6.56 (1.21 - 20.24)	6.76 (0.81 - 32.39)	6.47 (0.81 - 32.39)
t-test	0.16^{ns}		
Alluvial soil (Kaing-Kyun)	0.00	0.06 (0 - 2.43)	0.02 (0 - 2.43)
t-test	1.00^{ns}		

Note: The values in the parentheses represent range. *, ** and ***are significant at 10%, 5% and 1% level respectively, ns is not significant differences.

Table 4.4 Farm and livestock assets owned by sampled farm households in Aunglan Township

(Unit = Frequency)

Items	Contract farmers (N=60)	Non-contract farmers (N=42)	Total (N=102)
Plough	60 (100.00)	42 (100.00)	102 (100.00)
Harrow	60 (100.00)	42 (100.00)	102 (100.00)
Bullock cart	60 (100.00)	42 (100.00)	102 (100.00)
Sprayer	58 (96.67)	39 (92.86)	97 (95.10)
Generator	14 (23.33)	13 (30.95)	27 (26.47)
Thresher	8 (13.33)	9 (21.43)	17 (16.67)
Fodder cutting machine	6 (10.00)	6 (14.29)	12 (11.76)
Tractor	5 (8.33)	6 (14.29)	11 (10.78)
Power tiller	2 (3.33)	1 (2.38)	3 (2.94)
Pulse splitting machine	1 (1.67)	2 (4.76)	3 (2.94)
Htaw lar gyi (small truck)	1 (1.67)	0.00	1 (0.98)
Inter-cultivator	1 (1.67)	0.00	1 (0.98)
Cattle	59 (98.33)	41 (97.62)	100 (98.04)
Pig	7 (11.67)	2 (4.76)	9 (8.82)
Poultry	2 (3.33)	2 (4.76)	4 (3.92)

Note: The values in the parentheses represent percentage.

4.2.6 Source of credit of sampled farm households in Aunglan Township

Access to credit can mitigate the financial constraints of both contract and non-contract households. Credit is used for production and raise chances of household to obtain productive resources (agro-inputs) which will help farmers to increase production. The sampled farm households received credit from different sources as shown in Table (4.5). Some households received credit from only one source while other took from two credit sources and other had three sources. In the context of taking credit from one source, majorities of sampled contract households (38.33%) took seasonal agricultural credit from Myanmar Agricultural Development Bank (MADB) only, followed by township wholesalers, which was taken by 13.33% of sampled contract households. Meanwhile, about 45.24% of sampled non-contract households acquired credit from MADB only which was followed by credit taken from township wholesalers (2.38%). MADB provided 50,000 MMK per acre with 0.08% interest rate per year for upland crops. Less than 2% each of contract households took credit from agro-input dealers alone, cooperatives alone and money lender alone.

Regarding taking credit from two sources at the same time almost 15% of sampled farm households acquired credit from MADB and cooperatives. In which, about 21% of non-contract households and 10% of contract households took credit from MADB and cooperatives simultaneously. About 11.67% of contract households received credit from MADB and township wholesaler at the same time. Regarding taking credits from three sources at the same time, majority of sampled farm households received credit from three different sources (MADB, agro-input dealers & cooperatives). Only few farm households which were 3.33% of contract and 2.38% of non-contract households had never borrowed credit. The interest rates ranged from 1.50% to 4% interest rate per month when sampled farm households took credit from township wholesalers, agro-input dealers, cooperatives and money lenders.

4.2.7 Access to production practices and adoption of GAP by sampled farm households in Aunglan Township

Sampled farm households in the study area received information related to sesame production practices from different sources like Department of Agriculture (DOA) and agro-input (fertilizers, pesticides, foliar, plant growth hormone, etc.) dealers. Meanwhile, few households which were about 6% of total sample did not get information about production practices from any sources. Majority of both contract and non-contract households which were more than 50% of each group respectively got information about production practices in association with not only DOA but also agro-input dealers.

Table 4.5 Source of credit by sampled farm households in Aunglan Township

(Unit = Frequency)

Sources of credit	Contract farmers (N=60)	Non-contract farmers (N=42)	Total (N=102)
Access from one source			
MADB	23 (38.33)	19 (45.24)	42 (41.18)
Township wholesaler	8 (13.33)	1 (2.38)	9 (8.82)
Agro-input dealer	1 (1.67)	0.00	1 (0.98)
Cooperative	1 (1.67)	0.00	1 (0.98)
Money lender	1 (1.67)	0.00	1 (0.98)
Access from two sources			
MADB and Cooperative	6 (10.00)	9 (21.43)	15 (14.71)
MADB and Township wholesaler	7 (11.67)	0.00	7 (6.86)
MADB and Money lender	0.00	3 (7.14)	3 (2.94)
MADB and Agro-input dealer	1 (1.67)	0.00	1 (0.98)
Township wholesaler and Cooperative	2 (3.33)	0.00	2 (1.96)
Access from three sources			
MADB, Agro-input dealer and Cooperative	3 (5.00)	7 (16.67)	10 (9.80)
MADB, Cooperative and Money lender	2 (3.33)	2 (4.76)	4 (3.92)
MADB, Township wholesaler and Cooperative	3 (5.00)	0.00	3 (2.94)
Nil	2 (3.33)	1 (2.38)	3 (2.94)

Note: The values in the parentheses represent percentage.

In case of access to one source of information, contract households (30%) used DOA, whereas non-contract households (19%) contacted agro-input dealers for production practices information as shown in Table (4.6). It can be assumed that non-contract households relied more on agro-input dealers for this information.

Sampled farm households received information about production practices in different ways such as through the meeting, training or field demonstration. Contract households had more involvement in training, meeting and field demonstration as compared to non-contract households. About 81.67% and 78.57% of contract and non-contract households obtained sesame production practices by attending meeting. More than 50% of contract households and about 38% of non-contract households participated in training to get production practices while only 1.67% of contract households got production practices by exploring demonstration field.

Encouraging sesame farmers to adopt good agricultural practices (GAP) by DOA was started one year ahead before this study in Aunglan Township. Therefore, it was not widely adopted by farm households in the study area. It can be observed that above 50% of contract households and less than 3% of non-contract households followed good agricultural practices (GAP) in sesame production and below 50% of contract and about 97% of non-contract households did not follow GAP. It is really needed for all sesame farmers to use GAP guidelines into a farm's operation and information on agrochemicals such as how to use and how to follow recommended practices. For sesame production, this manual displays a set of guidelines that can help improve the quality and safety to the produce grown.

4.2.8 Access to market information by sampled farm households in Aunglan Township

In the study area, sampled farm households had different sources to get access to market information as shown in Table (4.7). Wholesalers who were buyers or next stakeholders of farmers along sesame supply chain were considered as formal source in offering market information to farmers in this study. Farmers also achieved market information from neighboring farmers as well as from social media. These two sources were also considered as informal market information sources for sampled farmers for this study. Majority of contract households (55%) accepted market information mainly from township wholesalers while majority, almost (41%) of non-contract households jointly received market information from township wholesalers and neighboring

farmers. It is evident that township wholesalers and their neighboring farmers were found to be the most reliable and accessible information sources for sesame farmers.

4.2.9 Composition of annual household income by sampled farm households in Aunglan Township

Farm households not only in this study but also across the country are principally depending large extent over on-farm production for their livelihood. Farm households normally diversify income into more sources rather than relying on a single source. Different income sources which contributed to household income for sampled farm households were presented in Table (4.8).

Annual household income was derived from crop income, non-farm income, livestock income and remittance income. Crop income was the sum of earnings by selling various crops from farm after deducting production cost. Non-farm income was income from wages and salaries of staffs of government and companies, drivers and merchants. Livestock income was received from sale of products from cow, pig or chicken by deducting their feed expenditure. In addition, remittance income was contributed to the household income sent by those family members currently staying outside of the house. Detail information of annual household income of sampled farm households were presented in Appendix (3).

Both 100% of sampled farm households received the highest contribution income from their crop when compared to incomes from livestock, non-farm and remittance. Contract households obtained higher income than non-contract households (2,343,988 > 1,466,528 MMK per household per year). There were 18.33% and 26.19% of contract and non-contract households earned from livestock. About 16.67% and 35.71% of contract and non-contract households got income from non-farm. In addition, only 5% of contract and 4.76% of non-contract households who earned incomes from remittance. There was significantly different in crop incomes at 5% level and other incomes were not significantly different in both groups of farmers.

Table 4.6 Access to production practices and adoption of GAP by sampled farm households in Aunglan Township

(Unit = Frequency)

Sources of production practices	Contract farmers (N=60)	Non-contract farmers (N=42)	Total (N=102)
Access from one source			
DOA	18 (30.00)	4 (9.52)	22 (21.57)
Agro-input dealer	5 (8.33)	8 (19.05)	13 (12.75)
Access from two sources			
DOA and Agro-input dealer	33 (55.00)	28 (66.67)	61 (59.80)
Nil	4 (6.67)	2 (4.76)	6 (5.88)
Type of service received			
Meeting	49 (81.67)	33 (78.57)	82 (80.39)
Training	35 (58.33)	16 (38.10)	51 (50.00)
Field demonstration	1 (1.67)	0.00	1 (0.98)
GAP adoption			
Adopter	33 (55.00)	1 (2.38)	34 (66.67)
Non-adopter	27 (45.00)	41 (97.62)	68 (33.33)

Note: The values in the parentheses represent percentage.

Table 4.7 Access to market information by sampled farm households in Aunglan Township

(Unit = Frequency)

Sources	Contract farmers (N=60)	Non-contract farmers (N=42)	Total (N=102)
Access from one source			
Township wholesaler	33 (55.00)	12 (28.57)	45 (44.12)
Neighboring farmer	5 (8.33)	12 (28.57)	17 (16.67)
Social media	1 (1.67)	0.00	1 (0.98)
Access from two sources			
Township wholesaler and Neighboring farmer	18 (30.00)	17 (40.48)	35 (34.31)
Township wholesaler and Social media	2 (3.33)	0.00	2 (1.96)
Neighboring farmer and Social media	0.00	1 (2.38)	1 (0.98)
Access from three sources			
Township wholesaler, Neighboring farmer and Social media	1 (1.67)	0.00	1 (0.98)

Note: The values in the parentheses represent percentage.

Table 4.8 Composition of annual household income by sampled farm households

(MMK per year)

Type of income	Contract farmers (N=60)		Non-contract farmers (N=42)		t-test
	No.	Avg. income	No.	Avg. income	
Crop income	60 (100.00)	2,343,988	42 (100.00)	1,466,528	1.97**
Livestock income	11 (18.33)	115,500	11 (26.19)	345,000	1.90ns
Non-farm income	10 (16.67)	442,833	15 (35.71)	844,524	1.48ns
Remittance income	3 (5.00)	146,667	2 (4.76)	157,143	0.07ns
Total HH income	60 (100.00)	3,048,988	42 (100.00)	2,813,195	0.39 ns

Note: The values in the parentheses represent percentage, *, ** and***are significant at 10%, 5% and 1% level respectively, ns is not significant differences.

Figure (4.3) (a) and (4.3) (b) presented the annual household income composition of sampled contract and non-contract households in the study area. Crop income was main source of income for both contract and non-contract households which contributed to 76.88% and 52.13% of household income respectively. Non-farm income was the second source of income, which had 14.52% and 30.02% of household income for both farmer groups. Livestock income and remittance were 3.79% and 4.81% of household income for contract households respectively and those for sampled non-contract households were 12.26% and 5.59% of household income respectively.

4.3 Cropping Patterns and Information of Monsoon Sesame Production by Sampled Farm Households in Aunglan Township

4.3.1 Crop calendar and cropping patterns

In Aunglan Township, sesame, green gram and groundnut are grown as the first crops in monsoon season. Farmers prepared their land and grew sesame or green gram or groundnut during the monsoon season and harvested in the mid of August for sesame and green gram and at the end of September for the groundnut as shown in Table (4.9). Pigeon pea was grown with groundnut or green gram by some farmers as intercropping. After harvesting sesame or green gram or groundnut, most of the farmers grew pulses including green gram and cow pea and some of the farmers grew winter season groundnut and cotton. Winter season crops were harvested at the end of December and January of next year.

Different cropping patterns grown by sampled contract and non-contract households in Aunglan Township were presented in Appendix (4). Sesame was dominant crop among the cultivated crops by sampled farm households. Among different cropping patterns, 22 farmers (36.67%) of sampled contract households and 10 farmers (23.81%) of sampled non-contract households mostly grew monsoon sesame and monsoon green gram followed by winter crops.

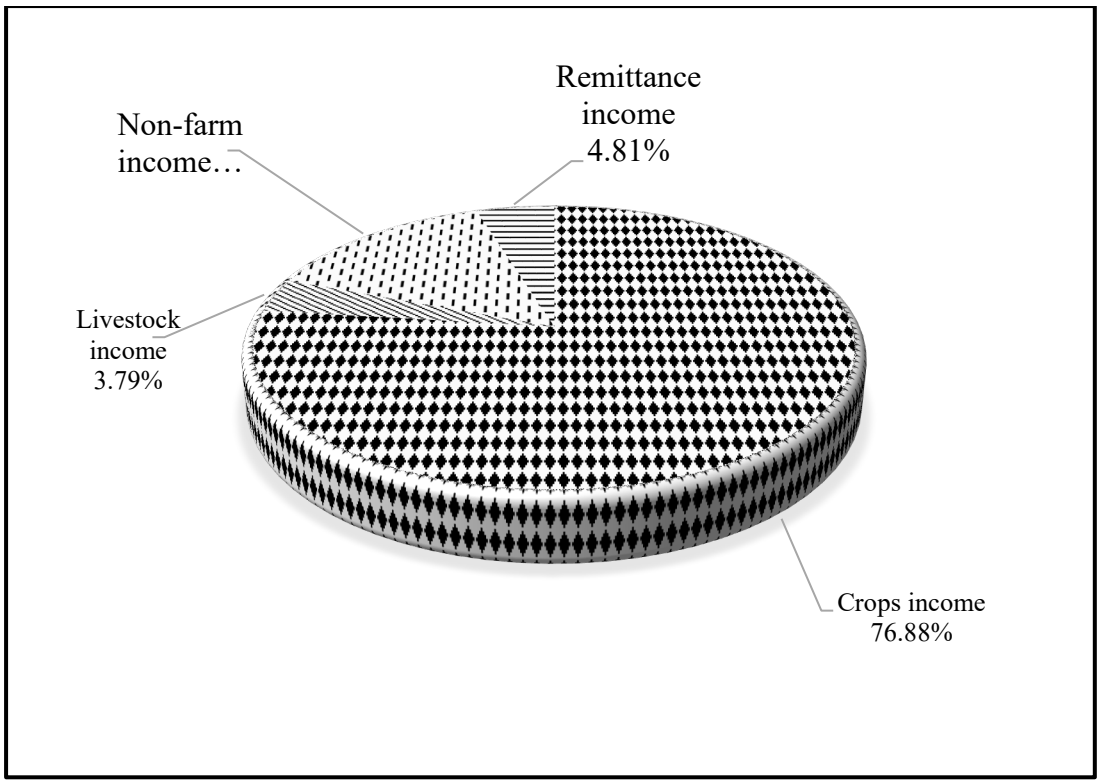

Figure 4.3(a) Household income composition by sampled contract farm households (N=60)

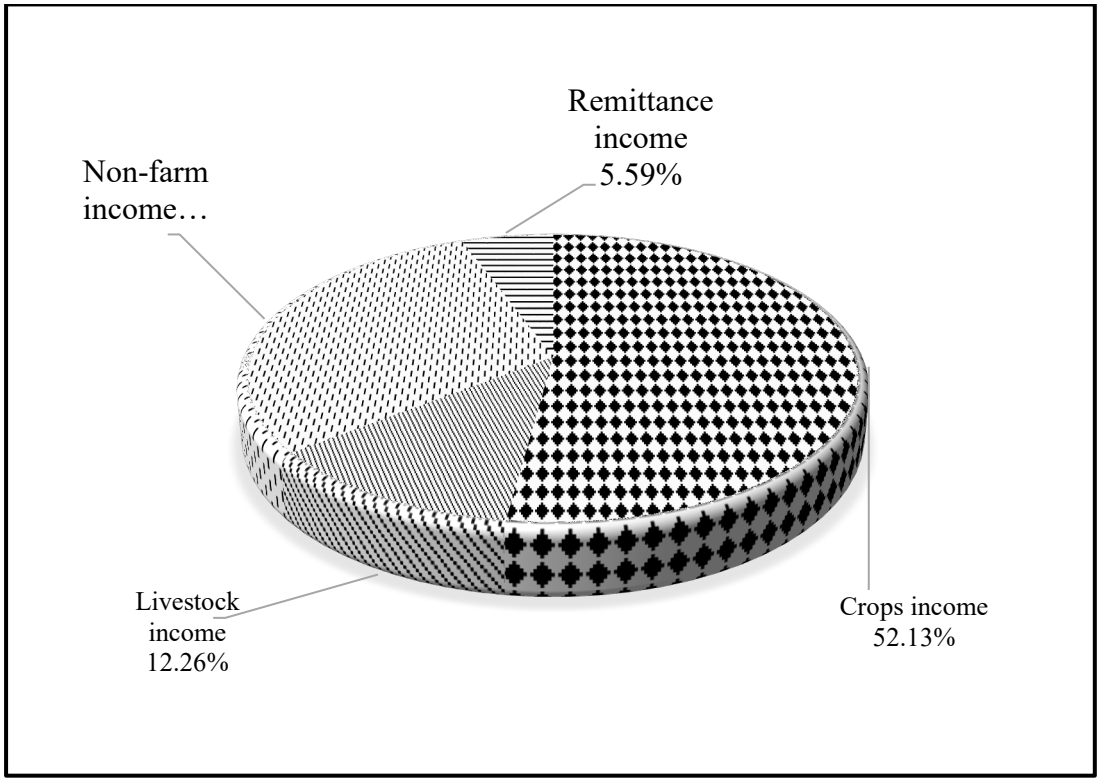

Figure 4.3(b) Household income composition by sampled non-contract farm households (N=42)

Table 4.9 Crop calendar of different cultivated crops by sampled farm households in the study area in 2016-2017

Crops	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monsoon												
Sesame												
Green gram												
Groundnut												
Pigeon pea												
Paddy												
Sweet corn												
Winter												
Pulses												
Groundnut												
Cotton												
Summer												
Paddy												

Source: DOA, 2017

4.3.2 Monsoon sesame production of sampled farm households in Aunglan Township

Monsoon sesame production information by contract and non-contract households was shown in Table (4.10). Average sown area of sesame was 3.49 ha for contract households within the range between 0.61 ha and 12.15 ha and that for non-contract households was 2.95 ha ranging from 0.20 ha to 16.19 ha. Average sesame yield of sampled contract and non-contract households was 266.26 kg/ha ranging from 60.49 kg/ha to 502.07 kg/ha and 247 kg/ha ranging from 30.25 kg/ha to 907.35 kg/ha respectively. Thus, total sesame production of both groups was 951.44 kg and 738.05 kg for contract households and non-contract households in average respectively.

After harvesting, farmers used to reserve seeds from their production for the next planting season as well as home consumption especially for medicine. The average home consumption and reserved seed was 1.02 kg and 39.80 kg for contract households respectively and 7.58 kg and 31.20 kg for non-contract households respectively. After deducting household consumption and reserved seed from total production, the average marketed surplus of sesame was 910.99 kg and 699.28 kg for sampled contract and non-contract households respectively. Market price of sesame was 1,656 MMK/kg and 1,644 MMK/kg for sampled contract and non-contract households respectively. The results showed that there were no significant differences between two groups of farmers in the sown area, yield, total production, consumption, reserved seed, marketed surplus and market price in the study area.

4.3.3 Utilization of seed, FYM and agrochemicals of monsoon sesame production by sampled farm households

Utilization of seed, FYM and agrochemicals of monsoon sesame production by sampled farm households was shown in Table (4.11). Sampled contract households used 6.09 kg/ha of seeds on average which was less than 6.48 kg/ha of non-contract farm households. The minimum and maximum seed rate was 3.78 kg/ha and 11.34 kg/ha for contract households and 3.78 kg/ha and 7.56 kg/ha for non-contract households respectively. Contract households applied FYM as above 2 ton/ha while non-contract households applied less than 2 ton/ha. Contract households used compound fertilizer almost 50 kg/ha but non-contract households used less than 40 kg/ha for compound. The average rate of urea fertilizer used by contract and

non-contract households were 21.98 kg/ha and 29.29 kg/ha respectively. The average rate of 19.90 kg/ha and 16.47 kg/ha of gypsum was applied by contract and non-contract households respectively. Average amount of fungicide was 0.09 kg/ha for contract and 0.02 kg/ha for non-contract households respectively. As overall, contract households utilized more farm yard manure (FYM), compound fertilizer, gypsum and fungicide in comparison with non-contract households. The usage of urea and foliar fertilizer of non-contract households were a slightly higher than that of contract households in the study area. There was significant difference in the use of fungicide, however, there was no significant difference in usage of other inputs between sampled farmer groups.

4.3.4 Labor utilization and machinery use in sesame production

There were two types of labor: animal labor and human labor in monsoon sesame production. Animal labor was mostly used in land preparation. Human labor was used in sowing, thinning and weeding, fertilizer and pesticide application, harvesting, drying, threshing and transportation from farm to home. There were two sources of labor used for sesame production such as family labor and hired labor. There were a few sampled farmers using machine for land preparation in the study area.

Different labors (human, animal & machinery) usage of sampled farm households for each activity of monsoon sesame production and allocation were expressed in Appendix (5) and (6). The percentage share of labor used for contract and non-contract farm households was clearly illustrated in Figure (4.4) (a) and (4.4) (b). The largest proportion of labors were used by contract households (39.63%) and non-contract households (39.61%) in harvesting, drying and threshing practices. Thinning and weeding (man/day) was the second largest labor use for both types of farmers (23.28% and 22.58%). The third largest labor share was found in land preparation (animal/day) which took about 10% and 12% in contract and non-contract households. Small portion of labor shares were used in pesticide and fertilizer application and land preparation (man/day & machine/day) and sowing by both types of farmers.

Table 4.10 Information about monsoon sesame production by sampled farm households in Aunglan Township

Items	Units	Contract farmers (N=60)	Non-contract farmers (N=42)	Total (N=102)	t-test
Cultivated area	ha	3.49 (0.61 - 12.15)	2.95 (0.20 - 16.19)	3.27 (0.20 - 16.19)	1.07^{ns}
Yield	kg/ha	266.26 (60.49-502.07)	247.00 (30.25-907.35)	258.33 (30.25-907.35)	0.72^{ns}
Total production	kg	951.44 (73.47 - 2,938.80)	738.05 (12.25 - 3,673.50)	863.57 (12.25 - 3,673.50)	1.53^{ns}
Home consumption	kg	1.02 (0 - 61.23)	7.58 (0 - 195.92)	3.72 (0 - 195.92)	1.02^{ns}
Reserved seed	kg	39.80 (0 - 122.45)	31.20 (0 - 195.92)	36.25 (0 - 195.92)	1.13^{ns}
Marketed surplus	kg	910.99 (73.47 - 2,938.80)	699.28 (12.25 - 3,575.54)	823.81 (12.25 - 3,575.54)	1.58^{ns}
Market price	MMK /kg	1,656 (1,511 - 1,797)	1,644 (1,511 - 1,768)	1,651 (1,511-1,797)	1.06^{ns}

Note: The values in the parentheses represent range. *, ** and***are significant at 10%, 5% and 1% level respectively, ns is not significant differences.

Table 4.11 Utilization of seed, FYM and agrochemicals of monsoon sesame production by sampled farm households

Items	Units	Contract farmers (N=60)		Non-contract farmers (N=42)		t-test
		No. (%)	Amount (Range)	No. (%)	Amount (Range)	
Seed	kg/ha	60	6.09	42	6.48	1.25^{ns}
		(100.00)	(3.78-11.34)	(100.00)	(3.78-7.56)	
FYM	ton/ha	36	2.27	25	1.90	0.96^{ns}
		(60.00)	(0 - 9.90)	(59.52)	(0 - 6.20)	
Urea	kg/ha	31	21.98	25	29.29	1.20^{ns}
		(51.67)	(0 - 74.10)	(59.52)	(0- 123.50)	
Compound	kg/ha	51	48.93	29	36.17	0.89^{ns}
		(85.00)	(0 - 123.50)	(69.05)	(0- 123.50)	
Gypsum	kg/ha	34	19.90	18	16.47	0.59^{ns}
		(56.67)	(0 - 118.56)	(42.86)	(0 - 74.10)	
Insecticide	liter/ ha	48	0.38	33	0.47	1.83^{ns}
		(80.00)	(0 - 1.24)	(78.57)	(0 - 1.24)	
Fungicide	kg/ha	25	0.09	8	0.02	1.49*
		(41.67)	(0 - 0.62)	(19.05)	(0 - 0.49)	
Herbicide	liter/ ha	15	0.18	11	0.17	0.74^{ns}
		(25.00)	(0 - 1.61)	(26.19)	(0 - 1.24)	
Foliar	liter/ ha	40	0.44	32	0.60	1.83^{ns}
		(66.67)	(0 - 1.48)	(76.19)	(0 - 1.24)	

Note: *, ** and***are significant at 10%, 5%, 1% level respectively and ns is not significant differences.

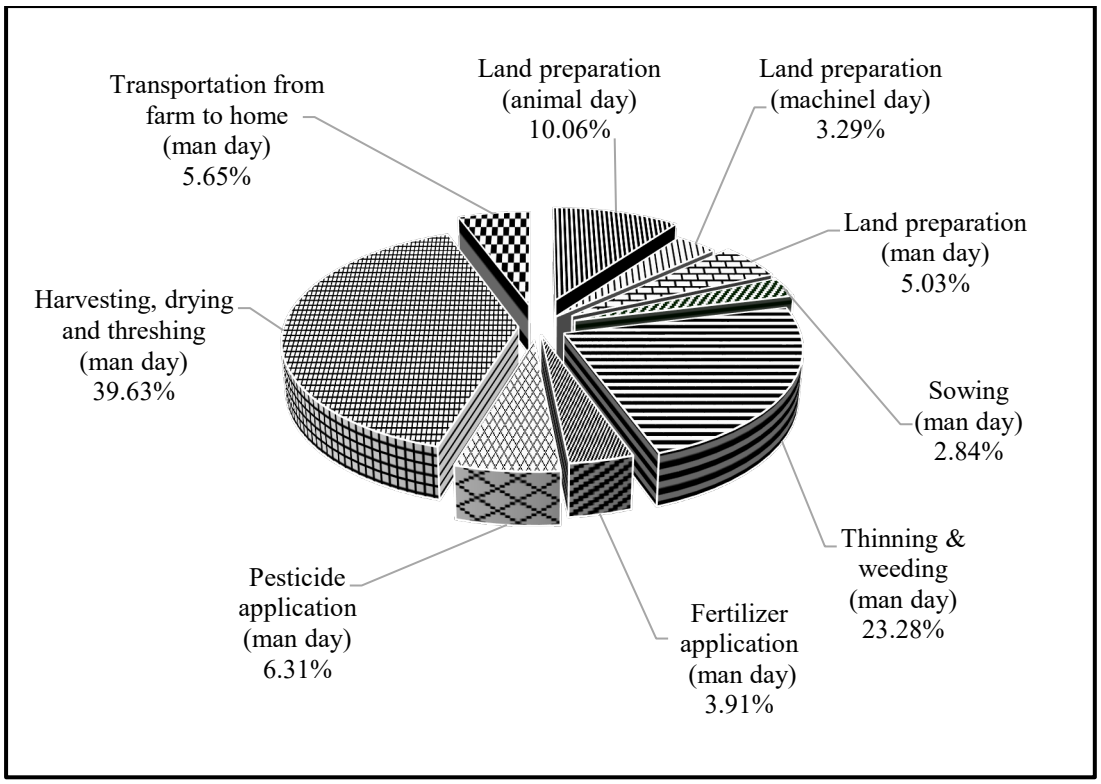

Figure 4.4(a) Contribution of labor in sesame production for contract farm households (N=60)

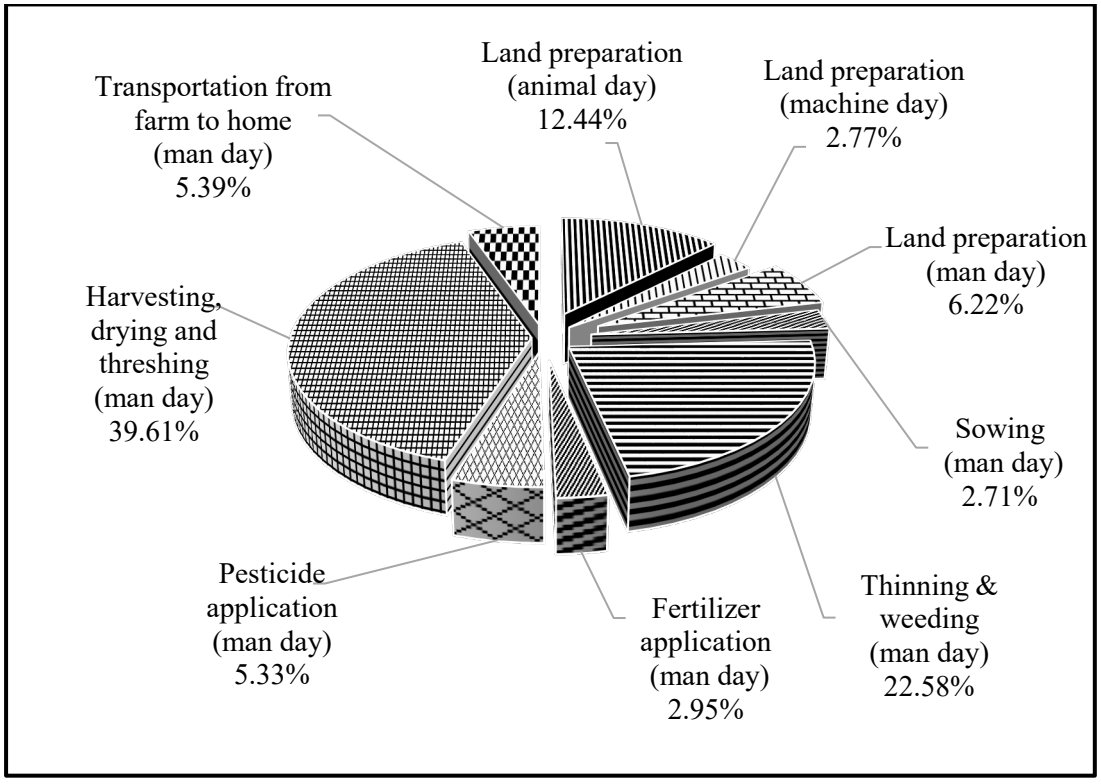

Figure 4.4(b) Contribution of labor in sesame production for non-contract farm households (N=42)

4.4 Cost and Return Analysis of Monsoon Sesame Production by Sampled Farm Households in Aunglan Township

Cost and return analysis of monsoon sesame production was determined by enterprise budgeting. An enterprise budget is an estimate of the costs and returns associated with the production of a product or products-referred to as an enterprise (Smith et al., 2013). Detail calculation of cost and return in monsoon sesame production of contract and non-contract farm households were shown in Appendix (7), (8) and (9) respectively.

Figure (4.5) illustrated that effective yield and price of contract and non-contract farm households for monsoon sesame production during 2017 monsoon season. Effective yield was computed by deducting the reserved seed and home consumption from total yield and effective price was computed by deducting transportation cost from market price. Effective yield of sesame (261.03 kg/ha and 237.04 kg/ha) and effective price (1,643 MMK/ha and 1,630 MMK/ha) were received by sampled contract and non-contract farm households respectively. As a result of higher yield and price from a hectare monsoon sesame production showed better for contract households as compared to non-contract households.

Figure (4.6) presented different cost of sesame production by sampled farm households in the study area. Total material cost included cost of seed, FYM and other agro-inputs used in monsoon sesame production. Opportunity cost of family labor was also counted by referring the wage rate of hired labors. Interest on paid hired labor cost and material cash cost was also included. Total variable cost or total production cost of monsoon sesame per hectare was then calculated by combining total material cost, family and hired labor costs and total interest on cash costs. By deducting the opportunity cost of family labor and own input cost, total variable cash cost was derived.

Contract farm households used high dose of agro-inputs such as FYM, compound fertilizer, gypsum and fungicide, thus, total material cost was slightly higher for contract farm households which was 75,736 MMK/ha as compared to that of non-contract farm households which was 71,392 MMK/ha. Total family labor cost for non-contract farm households was 49,576 MMK/ha while contract farm households spent 47,527 MMK/ha for family labor as opportunity cost. The hired labor cost for contract and non-contract farm households were 159,319 MMK/ha and 154,360 MMK/ha

respectively. Total variable cost per hectare of monsoon sesame was 301,371 MMK/ha for contract farm households and 293,307 MMK/ha for non-contract farm households respectively. Thus, total variable cost was higher in contract as compared to non-contract farm households. It was due to higher cost on some inputs and hired labor spent by contract farm households. Total interest on cash cost for contract and non-contract households were 18,788 MMK/ha and 17,979 MMK/ha respectively. Total variable cash cost per hectare of monsoon sesame was 227,549 MMK/ha for contract households and 217,745 MMK/ha for non-contract households in the study area. This is due to that contract households spent more costs for material inputs (agro-inputs) and hired labor costs especially in harvesting stages than that of non-contract households.

Total gross benefit was calculated by multiplying effective sesame yield and effective price received by sampled farm households respectively. Total gross benefit was about 428,958 MMK/ha for contract farm households while that for non-contract farm households was 386,589 MMK/ha. Return above variable costs (RAVC) for contract and non-contract households were 127,588 MMK/ha and 93,282 MMK/ha respectively. In addition, return above variable cash costs (RAVCC) were 201,410 MMK/ha for contract farm households and 168,844 MMK/ha for non-contract farm households as presented in Figure (4.7). Due to better effective yield and price received by contract households as compared to non-contract households, contract households achieved higher gross benefit, return above variable cost and variable cash cost, although they paid higher production cost.

As a consequence of better returns by contract households, the return per unit of cash expensed and return per unit of invested capital were also better for them as compared to those of non-contract households as illustrated in Figure (4.8). That means farmers can earn profit about more than one unit from a given crop by investing sesame production: if they invested a unit cash expense. Return per unit of cash expenses was 1.89 for contract households while that of for non-contract households was 1.78. Return per unit of invested capital or benefit cost ratio were 1.42 and 1.32 for contract and non-contract farm households respectively. The bigger the BCR values, the more profit received by farmers. Contract households was slightly more profitable comparison with non-contract households in monsoon sesame production in the study area.

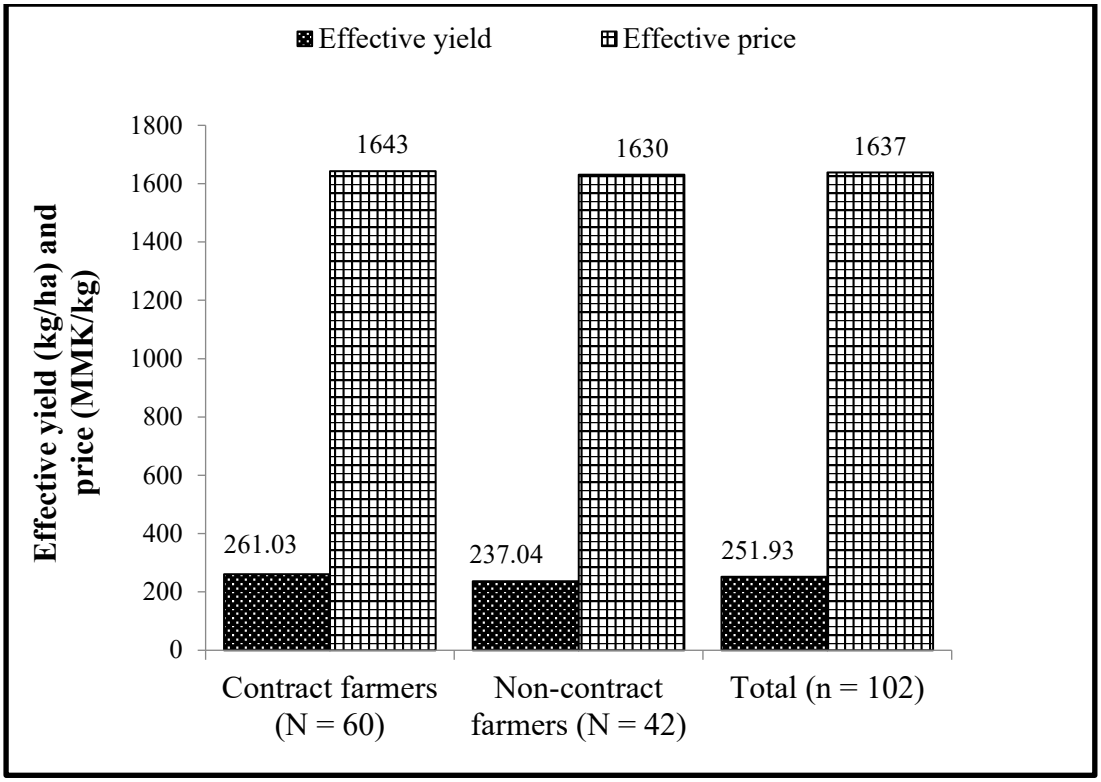

Figure 4.5 Effective yield and price of monsoon sesame production by sampled farm households

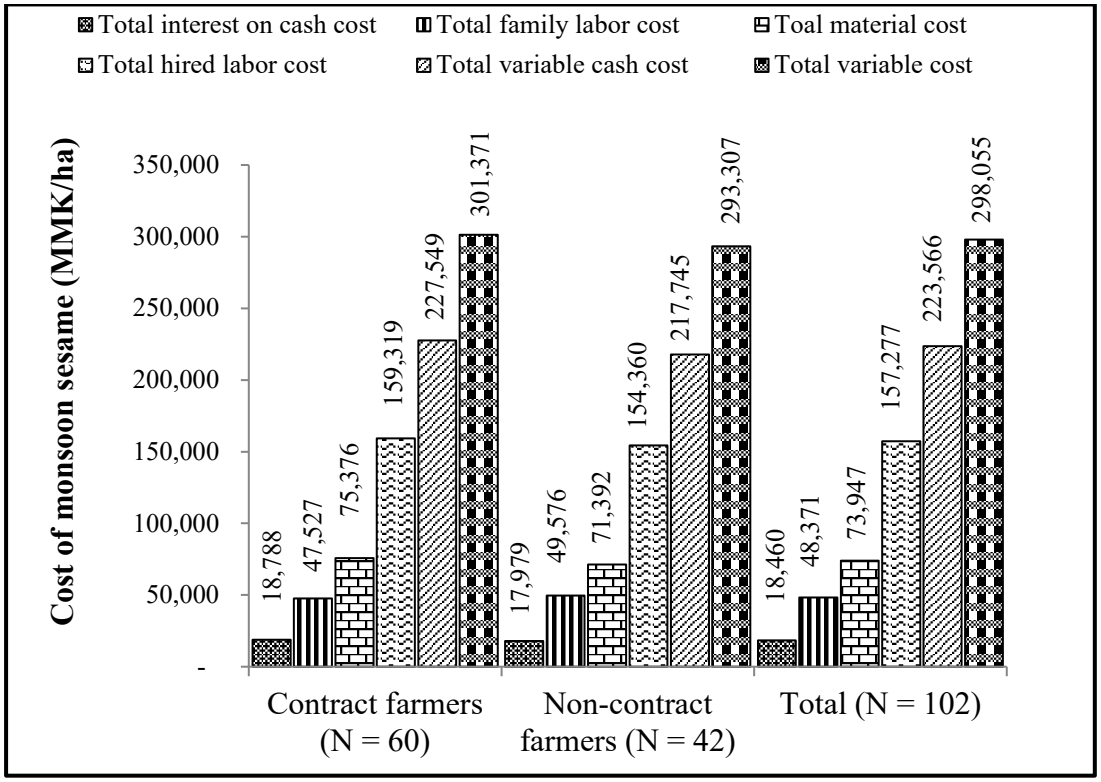

Figure 4.6 Cost of monsoon sesame production per hectare by sampled farm households

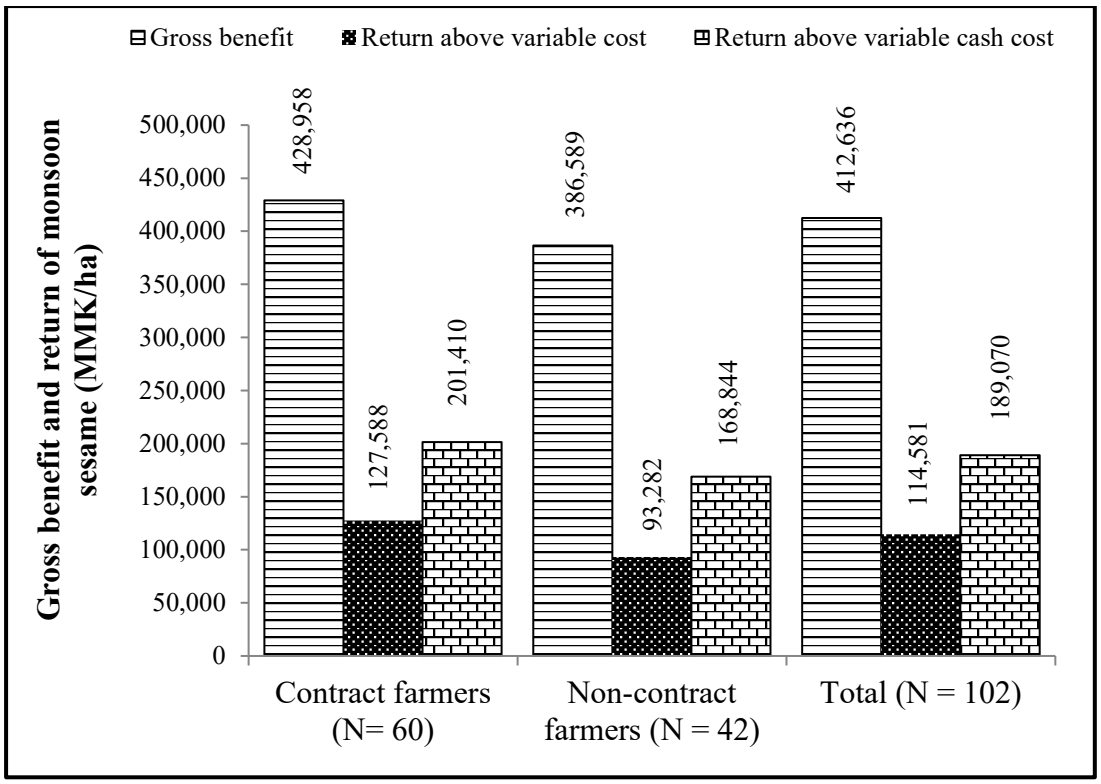

Figure 4.7 Returns of monsoon sesame production per hectare by sampled farm households

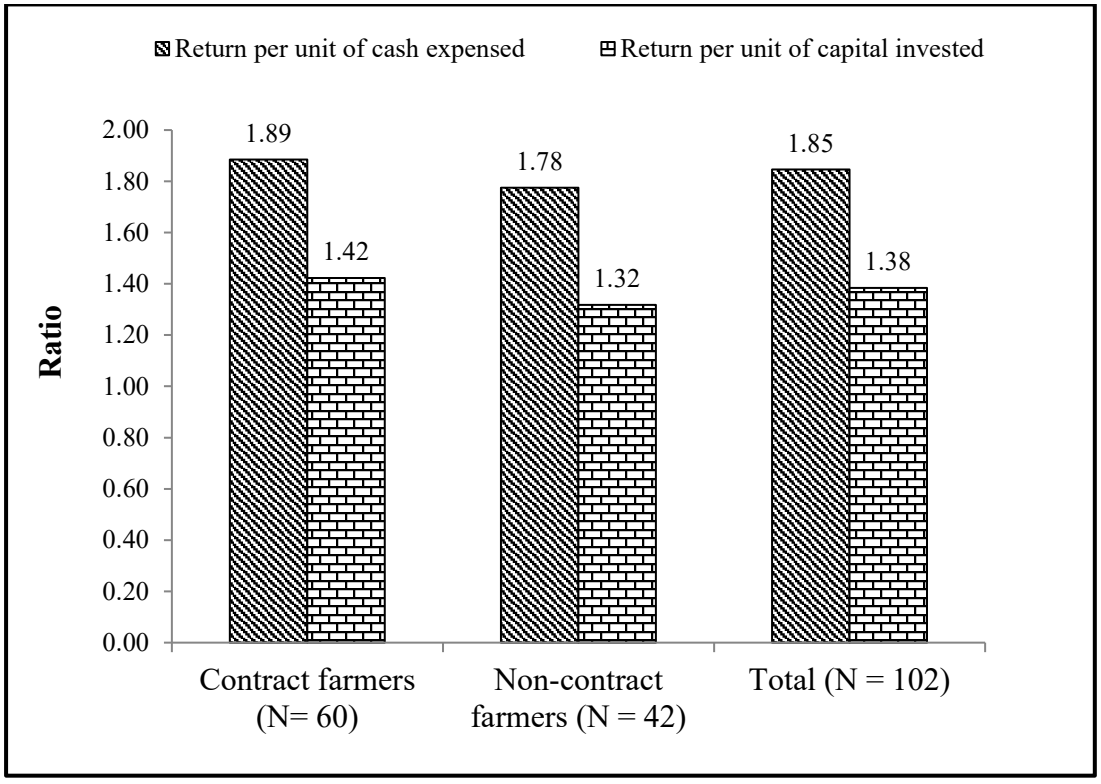

Figure 4.8 Return per unit of cash and capital invested in monsoon sesame production by sampled farm households

The break-even yield and price received by sampled farm households were presented in Figure (4.9). The break-even yield was the yield which can cover the total variable cost at the current sesame price and break-even price was the price which can cover the total variable cost at the current yield of sesame production. The break-even yield of contract and non-contract farm households were 183.39 kg/ha and 179.84 kg/ha respectively. It indicated that contract and non-contract farm households can cover their total monsoon sesame production costs when they start to achieve above yield at the current monsoon sesame price. Similarly, contract and non-contract farm households can get benefit over their total production cost when they started to get sesame price 1,154 MMK/kg and 1,237 MMK/kg at the current yield. The results revealed that break-even yield of contract farm households was slightly higher than non-contract farm households in order to cover their production cost for monsoon sesame per hectare in the study area.

4.5 General Characteristics and Marketing Activities of Supply Chain Stakeholders

4.5.1 General characteristics of township wholesalers, food processors and exporters

General characteristics of the stakeholders such as township wholesalers, food processors and exporters were described in Table (4.12). Average age of township wholesalers was around 45.14 years old which range from the youngest 32 to the oldest 64 years old. Average age of food processors was about 60 years old ranging from 52 to 69 years old while that of exporters was about 54 years old within the youngest 40 years to the oldest 65 years old.

Township wholesalers had business experience of 19.36 years on average ranging from 5 to 40 years while food processors experienced in their snack business for about 16 years and exporters had about 15 years of experiences on sesame export. Half of township wholesalers and all exporters were graduates while one food processor had high school level and another food processor had only secondary education level.

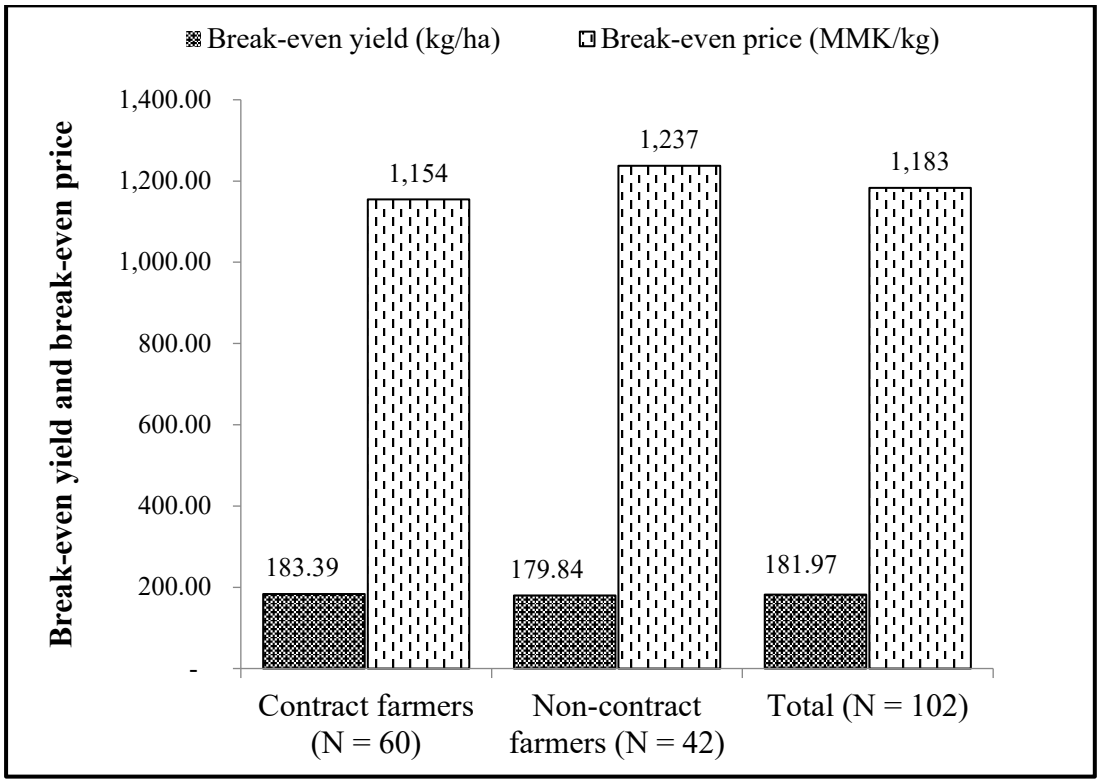

Figure 4.9 Break-even yield and price of monsoon sesame production by sampled farm households

Table 4.12 Age, experience and education level of township wholesalers, food processors and exporters

Items	Wholesalers (N=14)	Food processors (N=2)	Exporters (N=5)
Avg. age (year)	45.14 (32 - 64)	60.50 (52 - 69)	54.00 (40 - 65)
Avg. experience (year)	19.36 (5 - 40)	15.50 (2 - 29)	15.00 (12 - 18)
Avg. education level			
Primary level	1 (7.14)	0.00	0.00
Secondary level	1 (7.14)	1 (50.00)	0.00
High school level	5 (35.71)	1 (50.00)	0.00
Graduate level	7 (50.00)	0.00	5 (100.00)

Note: The values in the parentheses represent range and percentage.

4.5.2 Marketing activities of farmers, township wholesalers, food processors and exporters

Marketing activities included purchasing, selling, grading, weighting, and transportation activities by sampled farmers, township wholesalers, food processors and exporters.

4.5.2.1 Farmers

The selling information by sampled contract and non-contract households were shown in Table (4.13). Due to the nature of informal contract system, repayment type can be in kind or in cash, it was not fixed between local wholesalers and contract households. About 98% of sampled contract households directly sold raw sesame (in kind) to connected wholesaler while the remaining contract households sold raw sesame to open market and repaid in cash to connect wholesalers. All non-contract households sold to normal (unconnected) wholesalers in open market. Majority of sampled farm households (98.04%) sold raw sesame seed immediately after harvest and only less than 2% of sampled farm households sold out their commodity within one month by using cash down system. In the study area, none of sampled farmers used grading system before selling and their weighing measurement in selling was one basket equals fifteen viss.

The modes of transportation used by sampled farm households were shown in Table (4.14). There were two kinds of transportation and most of farmers used light truck when selling the product. About 80% of sampled contract households and 54.76% of sampled non-contract households used light truck in the study area. In addition, 20% of contract farm households and 45.24% of non-contract farm households also used tricycle. About 95% of contract farm households and 92.86% of non-contract farm households sold to wholesalers within Aunglan and only 5% of contract farm households and 7.14% of non-contract farm households sold to wholesalers in Pyalo as presented in Table (4.15).

Table 4.13 Selling information of sampled farm households

Main buyers of sesame	Unit	Contract farmers (N=60)	Non-contract farmers (N=42)	Total (N=102)
Sold to connected buyers				
• Connected wholesaler	No.	59 (98.33)	-	59 (57.84)
• Normal wholesaler in open market	No.	1 (1.67)	42 (100.00)	43 (42.16)
Product selling time				
• Immediately after harvest	No.	59 (98.33)	41 (97.62)	100 (98.04)
• Within one month	No.	1 (1.67)	1 (2.38)	2 (1.96)
Product selling form				
• Raw	No.	60 (100.00)	42 (100.00)	102 (100.00)
Types of selling				
• Cash down	No.	60 (100.00)	42 (100.00)	102 (100.00)
Use of grading method in selling				
• No	No.	60 (100.00)	42 (100.00)	102 (100.00)
Weighing measurement in selling				
• 1 Basket = 15 viss	No.	60 (100.00)	42 (100.00)	102 (100.00)

Note: The values in the parentheses represent percentage.

Table 4.14 Mode of transportation to the market by sampled farm households

Mode of transportation	Unit	Contract farmers (N=60)	Non-contract farmers (N=42)	Total (N=102)
By light truck	No.	48 (80.00)	23 (54.76)	71 (69.61)
By tricycle	No.	12 (20.00)	19 (45.24)	30 (30.39)

Note: The values in the parentheses represent percentage.

Table 4.15 Market destinations of sampled farm households

Market	Contract farmers (N=60)	Non-contract farmers (N=42)	Total (N=102)
Aunglan	57 (95.00)	39 (92.86)	96 (94.12)
Pyalo	3 (5.00)	3 (7.14)	6 (5.88)

Note: The values in the parentheses represent percentage.

4.5.2.2 Township wholesalers

Marketing activities of sampled wholesalers in Aunglan Township were mentioned in Table (4.16). Sampled wholesalers mostly bought raw material from farmers in Aunglan and Sinpaungwe Townships, Magway Region. Most of wholesalers (85.71%) sold immediately after purchase while some of wholesalers (14.29%) sold within one month. About 64.29% of township wholesalers applied only cash down payment in purchasing while about 35.71% of township wholesalers used both cash down and advance payment to farmers before planting or during planting time. Majority of wholesalers (71.43%) used both cash down and credit system (for a week) and a few of wholesalers (28.57%) used only cash down system when they sold out again to connected stakeholders. All wholesalers applied visual grading way/method to check quality of sesame based on their business experiences. They classified into high, medium and low-quality standard sesame in buying and selling. Majority of wholesalers (85.71%) used fan air drying and only a few of wholesalers (14.29%) used sun drying method to get dry and purified sesame seed after buying from farmers. There were no technical tests or instruments to determine seed dryness and purity in marketing activities at the stage of wholesaling in local market. Sampled wholesalers used to sell by putting 45 viss (3 baskets) into 1 bag of sesame seed to exporters. They transported their raw product by 6-wheel and 12-wheel trucks to next buyers.

Domestic market destination of Sahmon Nat variety by sampled wholesalers was presented in Table (4.17). Nearly half of wholesalers sold to big wholesalers within Aunglan and a few of wholesalers sold to Mandalay. About 21.43% of wholesalers sold to Yangon and Mandalay while 7.14% each of wholesalers sold to Yangon and Aunglan, Mandalay and Aunglan, Mandalay and Magway, Magway and Aunglan.

Table 4.16 Marketing activities of township wholesalers

Activities	No. (%)
Type of purchasing system	
• Use only cash down system	9 (64.29)
• Both cash down and advance payment	5 (35.71)
Type of selling system	
• Both cash down and credit	10 (71.43)
• Use cash down system	4 (28.57)
Product selling form	
• Raw	14 (100.00)
Product selling to	
• Connected stakeholders	14 (100.00)
Product selling time	
• Immediately after purchase	12 (85.71)
• Within one month	2 (14.29)
Type of grading system	
• Setting the quality by personal experience based	14 (100.00)
• Fun air drying for purity, dryness	12 (85.71)
• Sun dry	2 (14.29)
Weighing measurement in selling	
• 45 viss/bag	14 (100.00)
Mode of transportation	
• By trucks (6-wheel, 12-wheel)	14 (100.00)

Table 4.17 Market destinations of sampled township wholesalers

Market	No. (%)
Sold to one market	
Aunglan	6 (42.86)
Mandalay	1 (7.14)
Sold to more than one market	
Yangon and Mandalay	3 (21.43)
Yangon and Aunglan	1 (7.14)
Mandalay and Aunglan	1 (7.14)
Mandalay and Magway	1 (7.14)
Magway and Aunglan	1 (7.14)

4.5.2.3 Food processors

Processing activities of sampled food processors in the study area was shown in Table (4.18). Average working period was 10 months/year and average working hour was 9 hours/day for sampled food processors. Wage rate in male and female labor were not different. Utilization of daily labor was 7.5 persons who could produce 270 snack boxes/day and get 108 snack boxes/basket in processing.

Marketing activities of food processors in Aunglan Township was shown in Table (4.19). Food processors bought mainly roasted white sesame and a few Sahmon Nat by cash down system from the wholesalers in Pakokku and Aunglan. They employed both cash down payment and credit when selling snacks. They sold the value-added products (brittle) immediately after processing to both connected stakeholder and open market not only in Aunglan but also to Yangon, Mandalay, Nyaung U and Ayeyarwady Region by transportation with express buses.

Table 4.18 Processing activities of food processors

Items	Units	Average	Range
Working period	Month/year	10	8 - 12
Working hours/day	Hour/day	9	8 - 10
Wage rate	MMK/day		
• Male		4,000	4,000
• Female		4,000	3,500 – 4,500
Amount of labor	No.	7.5	5 - 10
Amount of snack box/basket	No.	108	106 - 110
Amount of snack box/day	No./day	270	220 - 320

Table 4.19 Marketing activities of food processors

Activities	No. (%)
Type of purchasing system	
• Use cash down system	2 (100.00)
Variety of purchasing system	
• Roasted white sesame and Sahmon Nat	2 (100.00)
Product purchasing from	
• Wholesalers in Aunglan and Pakokku	2 (100.00)
Type of selling system	
• Both cash down and credit	2 (100.00)
Snacks selling to	
• Yangon, Mandalay, Aunglan and Nyaung U	1 (50.00)
• Yangon, Ayeyarwady Region and Aunglan	1 (50.00)
Mode of transportation	
• Express buses	2 (100.00)

4.5.2.4 Exporters in Yangon

Marketing activities of sampled exporters was shown in Table (4.20). Exporters used cash down system and advance payment via commission agents with 0.05% fee in purchasing sesame. After buying the raw material, exporters graded sesame quality based on personal experiences and they also applied color sorter and cleaning machine compulsorily to export good quality seed with international standards: FFA = 2, chemical residue = 0.005, moisture content = 7 - 8% and color = 5 - 10%. Before selling product, they took one to four months to prepare for exportation procedure. They sold out raw sesame to connected stakeholders by both cash down system and credit system (for a week). The weighting system in purchasing was (1bag = 45viss), although; kilogram/ton in selling system (19 ton = 1 container). They exported raw sesame to Japan, Taiwan by ship and China by 12-wheel truck.

4.5.3 Summarized marketing activities of sesame supply chain stakeholders

Marketing activities of sesame (Sahmon Nat) supply chain stakeholders including sesame farmers, township wholesalers, food processors and exporters were presented in Table (4.21).

Table 4.20 Marketing activities of exporters in Yangon

Activities	No. (%)
Type of purchasing system	
• Both cash down and advance payment	2 (40.00)
• Use cash down system with commission fee 0.05%	3 (60.00)
Type of selling system	
• Use cash down and credit (for a week)	5 (100.00)
Type of grading system	
• Setting the quality by personality experience based	5 (100.00)
• Fun air drying for purity, dryness, odor	5 (100.00)
• Application of color sorter and cleaning machine	5 (100.00)
Weighing measurement	
• 19 Ton = 1container	5 (100.00)
Mode of transportation	
• By ship, truck (12-wheel)	5 (100.00)
Market destination	
• Japan, Taiwan and China	5 (100.00)

Table 4.21 Summarized marketing activities of sampled sesame supply chain stakeholders in the study area

Activities	Farmers (N=102)	Wholesalers (N=14)	Food processors (N=2)	Exporters (N=5)
Transaction (purchasing)		Cash down & advance	Only cash down	Cash down & advance with commission
Transaction (selling)	Only cash down	Cash down & credit (for a week)	Cash down & credit	Cash down & credit
Selling form	Raw	Raw	Processed (Snack)	Raw
Selling time	Immediately after harvest/ within one month	Immediately after purchase/within one month	Immediately after process	Within one to four months
Grading method	None	Personal experience based & fun air dry/sun dry	None	Personal experience based & color sorter and cleaning machine
Weighing measurement	1 Basket = 15 viss	45 Viss/bag	Small snack box	19 Ton/container
Mode of transportation	Light truck/tricycle	Truck (6-wheel, 12-wheel)	Express	Truck (12-wheel), ship
Market destination	Connected buyer & open market (CF), Open market (N-CF)	Connected buyer	Connected buyer & open market	Connected buyer
	Aunglan/Pyalo	Aunglan, Mandalay, Yangon, Magway	Aunglan, Yangon, Mandalay, Nyaung U, Ayeyarwady Region	Japan, Taiwan, China

4.6 Sesame Marketing Margin, Cost and Profit of Stakeholders in Aunglan Township

The services of various agencies constituting in a marketing channel are remunerated out of the marketing "margin". This term is used to denote the difference between the price paid to the first seller and that paid by the final buyer (Kohls & Uhl, 2002). Trends in commodity prices and domestic marketing margins are important indicators of market performances. In this section, the marketing costs and margins were calculated for each supply chain stakeholders. Various marketing margins, costs and profits of market participants were presented in Table (4.22) and (4.23).

The price received by contract and non-contract households were 1,643,330 MMK/ton and 1,630,900 MMK/ton while sesame production cost was 1,154,545 MMK/ton and 1,237,373 MMK/ton respectively. Thus, average profit was 488,785 MMK/ton for contract households and 393,527 MMK/ton for non-contract households. Percentage of profit per cost price ratio for contract households was 42.34% while that for non-contract households was 31.80% respectively.

According to the result, the net profit received by wholesalers, food processors and exporters were 102,151 MMK/ton, 82,698 MMK/ton and 116,881 MMK/ton respectively. Total marketing costs of township wholesalers, food processors and exporters were 16,093 MMK/ton, 937,925 MMK/ton and 200,235 MMK/ton respectively. The marketing margins of township wholesalers, food processors and exporters were 118,244 MMK/ton, 1,020,623 MMK/ton and 317,116 MMK/ton respectively. The wholesalers, food processors and exporters got the profit per cost price about 6%, 3.09% and 5.79%, respectively.

Table 4.22 Marketing cost, margin and profit of sesame farm households in the study area

(MMK/ton)

Items	Contract farmers (N=60)	Non-contract farmers (N=42)
(1) Effective price received by farmers	1,643,330	1,630,900
(2) Production cost of sesame	1,154,545	1,237,373
(3) Average profit of farmers (1-2)	488,785	393,527
(4) Profit per cost price (3/2)	42.34%	31.80%

Table 4.23 Marketing cost, margin and profit of wholesalers, food processors and exporters

(MMK/ton)

Items	Wholesalers (N=14)	Food processors (N=2)	Exporters (N=5)
(1) Avg. buying price	1,685,095	1,735,402	1,818,884
(2) Avg. selling price	1,803,339	2,756,025	2,136,000
(3) Marketing margin (2-1)	118,244	1,020,623	317,116
(4) Total marketing cost	16,093	937,925	200,235
- Cost of packing	3,240	32,664	6,125
- Cost of transportation	0	122,490	33,872
- Cost of labor	5,390	331,744	8,125
- Cost of processing	6,725	448,905	80,051
- Cost of fee	738	2,122	72,062
(5) Cost price (1+4)	1,701,188	2,673,327	2,019,119
(6) Profit (3-4)	102,151	82,698	116,881
(7) Profit per cost price ratio (6/5)	6.00%	3.09%	5.79%

4.7 Constraints of Sesame Supply Chain Stakeholders

General constraints commonly faced by sampled sesame supply chain stakeholders were summarized in Figure (4.10).

4.7.1 General constraints for production and marketing of sampled farm households

The sampled farm households in the study area faced a number of constraints and problems that limited their productivity and marketing in monsoon sesame production during 2017 as shown in Appendix (10). All sampled farm households answered that they suffered climate change as a major constraint in the study area because erratic rainfall and unfavorable temperature during monsoon season reduced sesame yield. Moreover, the common constraints faced by sampled farm households in the study area were labor scarcity, unstable price, high input cost, lack of capital, incidence of disease and pest, lack of extension service, high transportation cost and lack of improved varieties. These major constraints limited to farmers by reducing yield and earning less income.

4.7.2 General constraints of wholesalers in sesame marketing in Aunglan

The constraints of sampled wholesalers in the study area was presented at Appendix (11). The majority of wholesalers felt price fluctuation which was major problem for wholesalers in sesame market since the price of sesame was mainly depend on not only export market demand and production amount but also availability of sesame by major producing countries such as, India, China and Africa. Wholesalers mentioned that there was difficult to get good quality of sesame and faced up to extreme weather. Both lack of capital and seed impurity were also mentioned as the important constraints. Lack of information and improved storage facilities were also limited condition for wholesalers. Moreover, wholesalers mentioned that there was high tax rate in marketing, chemical residue problem and labor scarcity as their constraints.

4.7.3 General constraints of food processors in sesame marketing in Aunglan

Constraints expressed by sampled food processors were mentioned as shown in Appendix (12). The major constraints of sampled food processors were lack of capital followed by lack of skillful labors, low quality of sesame and credit system in selling the process. Among them, lack of capital was found as the major constraint for two food processors in the study area.

4.7.4 General constraints of exporters in sesame marketing in Yangon

Myanmar is one of the major sesame export countries in the world and there are a lot of potential demands. Appendix (13) presented some constraints of exporters faced in sesame marketing. Sampled exporters faced low quality of sesame, lack of improved varieties, lack of advanced technology, problem of chemical residue, price fluctuation, extreme weather and lack of SPS (Sanitary and phytosanitary) testing laboratory. In addition, sampled exporters faced high tax rate, lack of storage facilities, lack of dryer, color sorter and cleaning machine.

4.8 Factors Influencing the Profitability of Monsoon Sesame Production by Sampled Farm Households in the Study Area

This section indicated the estimated results of factors affecting on the profit of monsoon sesame production (Sahmon Nat variety) for sampled farm households in Aunglan Township during 2017. To determine the factors affecting the sesame profit, multiple regression function was employed. The specific profit functions of sesame farmers were estimated by using 8 independent variables: yield, age of household heads, schooling year of household heads, sown area, family size, total family labor cost on the farm, total hired labor cost on the farm, total material cost on the farm. Dummy variables of availability of non-farm income (1 = Yes, 0 = No), access to credit (1 = Yes, 0 = No), access to production practices (1 = Yes, 0 = No), access to formal and informal market information (1 = Formal/Township wholesaler, 0 = Informal/ Neighboring farmer or social media), type of sesame farmers (1 = Contract famers, 0 = Non-contract farmers) were also included.

Descriptive statistics of dependent and independent variables used in sesame profit function was shown in Table (4.24). The multiple regression results on factors influencing the profitability of sesame production of sampled farm households in Aunglan Township was shown in Table (4.25). The adjusted R squared points out that the model was significant and it explained on the variation in sesame profit by 61 percent. According to the sesame profit regression estimates, sesame profit of the sampled farm households was positively and significantly influenced by effective yield at 1 percent level. If one percent was increased in effective yield of sesame, the sesame profit would be increased by 7.63%.

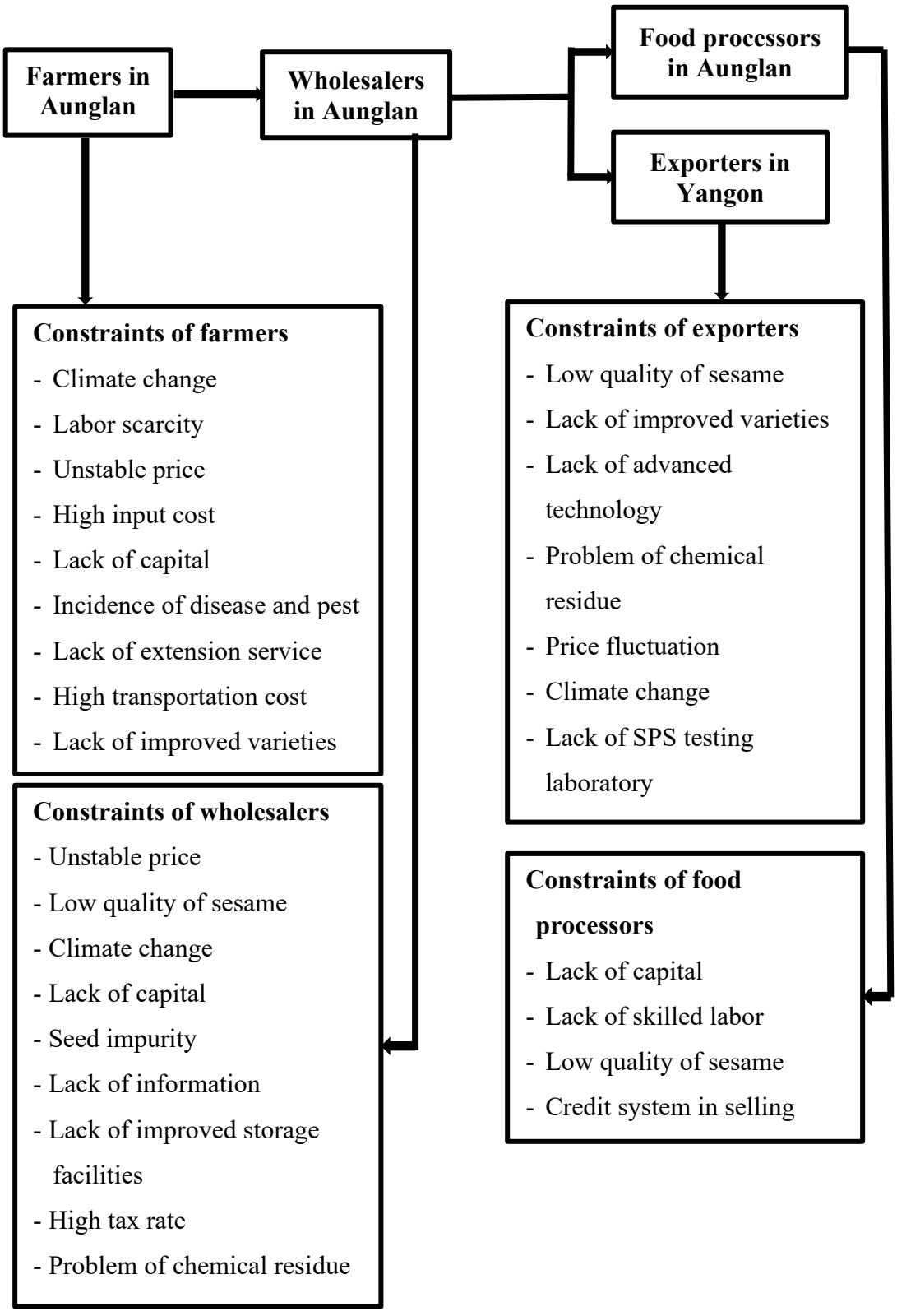

Figure 4.10 Major constraints of sampled stakeholders in sesame supply chain

The result showed that the farmers who had got the highest yield can obtain more profit due to yield greatly affected on profit. Total hired labor cost and total material cost were negatively and significantly influenced on sesame profit at 1 percent level. It meant that if one percent was increased in total hired labor cost and total material cost of monsoon sesame production by sampled farm households, the sesame profit would be decreased by 2.63% and 2.10% respectively. Thus, it can be concluded that the farmers who had paid high cost of hired labor cost and total material cost on the farm in sesame production could receive low profit.

Therefore, yield of monsoon sesame showed positive association with sesame profit and statistically significant positive relation could be seen for all sampled farm households. However, total hired labor cost and total material cost were statistically significant negative relations with sesame profit for all sampled farm households. According to regression results, sampled contract households achieved better profit comparable to that of sampled non-contract households even though there were not statistically significant difference in both types of farmers. Thus, contract farming is needed to encourage to improve livelihoods of farmers with more systematic and comprehensive practices.

Table 4.24 Description of dependent and independent variables in sesame profit function (N = 102)

Description of variables	Mean	Min.	Max.	SD
Monsoon sesame profit (MMK/ha)	126,062	-208,908	1,077,925	181,811
Effective yield of sesame (kg/ha)	251.93	30.25	883.15	119.85
Age of household heads (Year)	48.29	29	74	10.22
Schooling year of household heads (Year)	5.85	2	14	3.19
Sown area of sesame (ha)	3.27	0.20	16.19	2.36
Family size (No.)	4.32	2	10	1.49
Total family labor cost (MMK/ha)	48,371	9,880	134,615	26,026.59
Total hired labor cost (MMK/ha)	157,277	6,175	300,105	58,583.02
Total material cost (MMK/ha)	73,947	14,852	156,664	29,383.76
Availability of non-farm income (Dummy)	1 = Yes (24.51%)		0 = No (75.49%)	
Access to credit (Dummy)	1 = Yes (97.06%)		0 = No (2.94%)	
Access to production practices (Dummy)	1 = Yes (94.12%)		0 = No (5.88%)	
Access to market information (Dummy)	1 = Formal (81.37%)		0 = Informal (18.63%)	
Type of farmers (Dummy)	1 = CF (58.82%)		0 = Non-CF (41.18%)	

Table 4.25 Determinants of profitability of monsoon sesame production by sampled farm households in the study area (N = 102)

Variables	Unstandardized Coefficients		t-value	Sig.
	B	Std. Error		
Constant	32.10**	15.41	2.08	0.04
Ln effective yield	7.63***	0.69	11.02	0.00
Ln age of household heads	- 1.61ns	1.66	- 0.97	0.34
Ln schooling year of household heads	- 0.83 ns	0.71	- 1.17	0.25
Ln sown area	- 0.04 ns	0.48	- 0.08	0.94
Ln family size	0.00 ns	0.98	0.00	0.10
Ln total family labor cost	- 0.58 ns	0.55	- 1.05	0.30
Ln total hired labor cost	- 2.63***	0.87	- 3.03	0.00
Ln total material cost	- 2.10***	0.71	- 2.95	0.00
Availability of non-farm income (Dummy)	0.31 ns	0.80	0.38	0.70
Access to credit (Dummy)	2.62 ns	2.04	1.28	0.20
Access to production practices (Dummy)	1.76 ns	1.44	1.22	0.23
Access to formal and informal market information (Dummy)	0.14 ns	0.83	0.17	0.87
Type of farmers (Dummy)	0.08 ns	0.71	0.11	0.92
R^2			0.66	
Adjusted R^2			0.61	

Note: ***, ** and* are significant level at 1%, 5%, and 10% level respectively, ns is not significant differences.

CHAPTER V
SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary of Findings

5.1.1 Identifying stakeholders in the study area

There were four stakeholders along sesame supply chain in the study area: (1) farmers, (2) township wholesalers, (3) processors and (4) exporters. Majority of the sampled farm households in the study area sold raw sesame seed directly to township wholesalers. There was direct link between farmers and wholesalers in the study area. Therefore, they played an important role in the sesame marketing. Township wholesalers sold raw sesame to food processors and exporters. Processor traded their sesame brittle package to wholesalers, retailers and consumers in different regions. Exporters sold their products to Japan, Taiwan by ship and China by road transport.

5.1.2 General characteristics of sesame supply chain stakeholders (farmers)

The household heads of contract households were younger, less schooling years and less farming experience as compared to non-contract households. Majority of sampled household heads were male. The average family members of sampled households were around 4 members. In both groups, most of farm households had more working age family members and more than half of the family members worked on farm. The average farm size of the sampled households were around 7 ha and the largest share of total farm area by sampled households was upland area.

When comparing farming assets of sampled farm households, majority of farm households possessed traditional farm implements such as plough, harrow, bullock cart and cattle on the other hand only a small number of the sampled farm households possessed tractor and power tiller. This may be suggested that farm households in the study area was at very beginning stage in cultivation of farm mechanization.

Most of contract and non-contract farm households received credit from MADB alone, and contract households had more credit sources in comparison with non-contract households. Majority of sampled farm households acquired production practices mainly from both DOA and agro-input dealer through extension agents. Majority of contract households have more access of extension services from training, meeting and field demonstration as compared to non-contract households. In addition, manual being for GAP guidelines to provide farmers and other stakeholders with

necessary knowledge and skills, strengthening the productivity, improving competitiveness, supply identified market outlet with good quality product and thus enhance income of farmers. Regarding market information, contract households mostly received from township wholesalers while non-contract households got from both township wholesalers and farmers to farmers.

In the study area, annual household incomes of sampled farm households were composed of crop income, non-farm income, livestock income and remittances. It was clearly observed that share of crops income was highest contribution in household income categories in both farmer groups. Net income of crops for contract households was higher than non-contract households. The average sesame sown area of contract households was higher than that of non-contract households. Similarly, the average yield and price of sesame by contract households obtained slightly higher than non-contract households.

Majority of labors were used in harvesting, drying and threshing followed by thinning and weeding in monsoon sesame production by both groups of farmers. With respect to input used in monsoon sesame production of sampled farm households in the study area, contract households used more inputs than non-contract households because of they could receive credit from more different sources. Production cost of sesame by contract households was relatively higher than non-contract households due to their higher usage of FYM, compound fertilizers, gypsum and fungicide. Thus, contract households incurred higher total variable cost than non-contract households in sesame production. However, it did not affect their returns because contract households received higher sesame yield in comparison with non-contract households. Results of the cost and return analysis revealed that contract households received higher gross benefit than non-contract households. Therefore, the return per unit of capital invested or benefit cost ratio of contract farm households was slightly higher than that of non-contract farm households. In the study area, return from monsoon sesame production covered the total variable costs for all sampled farm households.

5.1.3 General characteristics of market participants (wholesalers, food processors and exporters)

Among the market participants, the average age of wholesalers, food processors and exporters were 45 years, 60 years and 54 years old respectively. Wholesalers had relatively more business experience than food processors and exporters. Most of the

market participants obtained higher education level as compared to sampled household heads and half of wholesalers and all exporters were graduates. Wholesalers and exporters used different types of purchasing such as cash down, advance payment system and commission fee 0.05%. The type of purchasing of food processors was only cash down payment system. Wholesalers, processors and exporters used cash down and credit (for a week) in selling. All stakeholders apart from processors sold raw sesame and there was still lack of advanced technology in quality checking, grading and using international recognized weighing scale. Some of wholesalers had capacity of using fun air dry and some used only sun dry for cleaning seed. Only exporters had the capacity to use color sorter and cleaning machine to get better quality sesame.

5.1.4 Marketing margin, cost and profit of market participants

Among the market participants, marketing margin of township wholesaler got the lowest margin. Profit per cost price for wholesalers and exporters were not different, they got the higher achievement as compared to processors in the marketing channel.

5.1.5 Constraints of sesame production for stakeholders in marketing system

In Aunglan Township, unpredictable rainfall and unfavorable temperature during 2017 monsoon sesame production season, reduced yield supply and quality of sesame seed. Climate change was the major constraint for sampled farm households followed by labor scarcity, unstable price, high input cost and lack of capital, etc. Low quality sesame, price fluctuation, extreme weather, lack of capital, lack of information, and advanced technology were common constraints or influencing factors for all stakeholders although each stakeholder earned reasonable returns or profits at each stage of sesame supply chain.

5.1.6 Regression analysis

According to the sesame profit function analysis, the significant influencing factors of sesame profit were yield, total hired labor cost and total material cost. Sesame profit was positively relationship with yield. Other things being equal, if one percent increase in yield, sesame profit will increase by 7.63%. Total hired labor cost and total material cost negatively and significantly related with sesame profit. If one percent increase in total hired labor cost and total material cost, sesame profit will decrease by 2.63% and 2.10% respectively. Contract farm households got better profit as compared to non-contract households although there were not significantly different in two types of farmers.

5.2 Conclusion

Overall, performance of contract households was better than that of non-contract households in the study area although contract scheme was not systematically arranged between stakeholders. Majority of contract farmers followed the commitment of contract system even though contract made verbally only based on mutual trust between local wholesalers and farmers. Contract farming can ensure year-round supply of sesame raw material at the required quantity and quality while ensuring sustainable market for farmers at a better price. Thus, in order to get better performances of sesame farmers in Myanmar, more effective and comprehensive contract scheme should be practiced based on learning other successful contract crops.

Generally, Myanmar has high potential for sesame production, so, production practices should be improved not only to get higher yield but also to increase income of producers and to contribute foreign exchange earnings for the country. Limited access to credit by stakeholders led inadequacy of capital investment in sesame supply chain. Therefore, financial aid and credit access should be explored for enabling long term and short-term assistance from collaborating government and institutional lending agencies in order to reduce the problem of inadequate capital among the sesame stakeholders. Investments are needed at all levels to produce quality seeds and effective use of inputs at farm level to meet food safety and to increase export. Under this condition, it is urgently needed to develop seed industry through public-private partnership to meet the growing demand for quality seed.

Encouraging capacity building program of the stakeholders especially farmers is crucial concerning the production practices. Technical advice and other services can also be provided jointly by governmental institutions and private companies or NGOs. Majority of farmers still possessed manual farming tools. Therefore, farmers should be supported for utilization of efficient farm machinery and equipment for various activities of crop production in attempts to boost the yield, high quality products and mitigating losses.

In Myanmar sesame market; there was limited information of price, traded volume, exported quality safety, etc. Provision of market information is very important for sesame market development to generate better income for stakeholders. This is because sesame is one of the international crops in which its price is linked to international market. In the study area, price information was transmitted mostly from

township wholesalers to farmers. Therefore, government should establish market information database system to help in addressing the problems associated with sesame marketing. Social media should be applied more for transmission of price information. This could possibly help farmers to sell their products at reasonable higher prices.

Sesame yield is necessary to increase which can increase farm income. As the hired labor cost and total material cost negatively influenced on profit of sesame production, enhancing of labor-saving techniques like farm mechanization and supporting to get credit for monsoon sesame production should be more appreciated for the development of farmers. Marketing infrastructure (road and transportation, storehouse, color sorter and cleaning machine, etc.) should be improved for stakeholders along the supply chain.

5.3 Recommendation

All sesame supply chain stakeholders should pay attention to improve quality of sesame in order to get market share in not only domestic but also international market by overcoming current constraints. A deliberate policy on sesame market and development should be formulated to remove market distortions and promote market efficiency in terms of quality control, stable supply of product and reduced-price fluctuation in the system. The government has to evaluate the competitive position of Myanmar's sesame in the world market and assess the opportunity for increasing market share. Quality assurance and food safety has become a serious societal issue, that should be instituted to prevent food contamination starting at field level throughout the whole production and post-harvest handling processes to end market. Finally, in order to fulfill the requirement of domestic consumption and to achieve the export earnings, intensification of sesame production should be raised with higher investment, efficient use of inputs and improved technology as well as improving contract farming along the supply chain.

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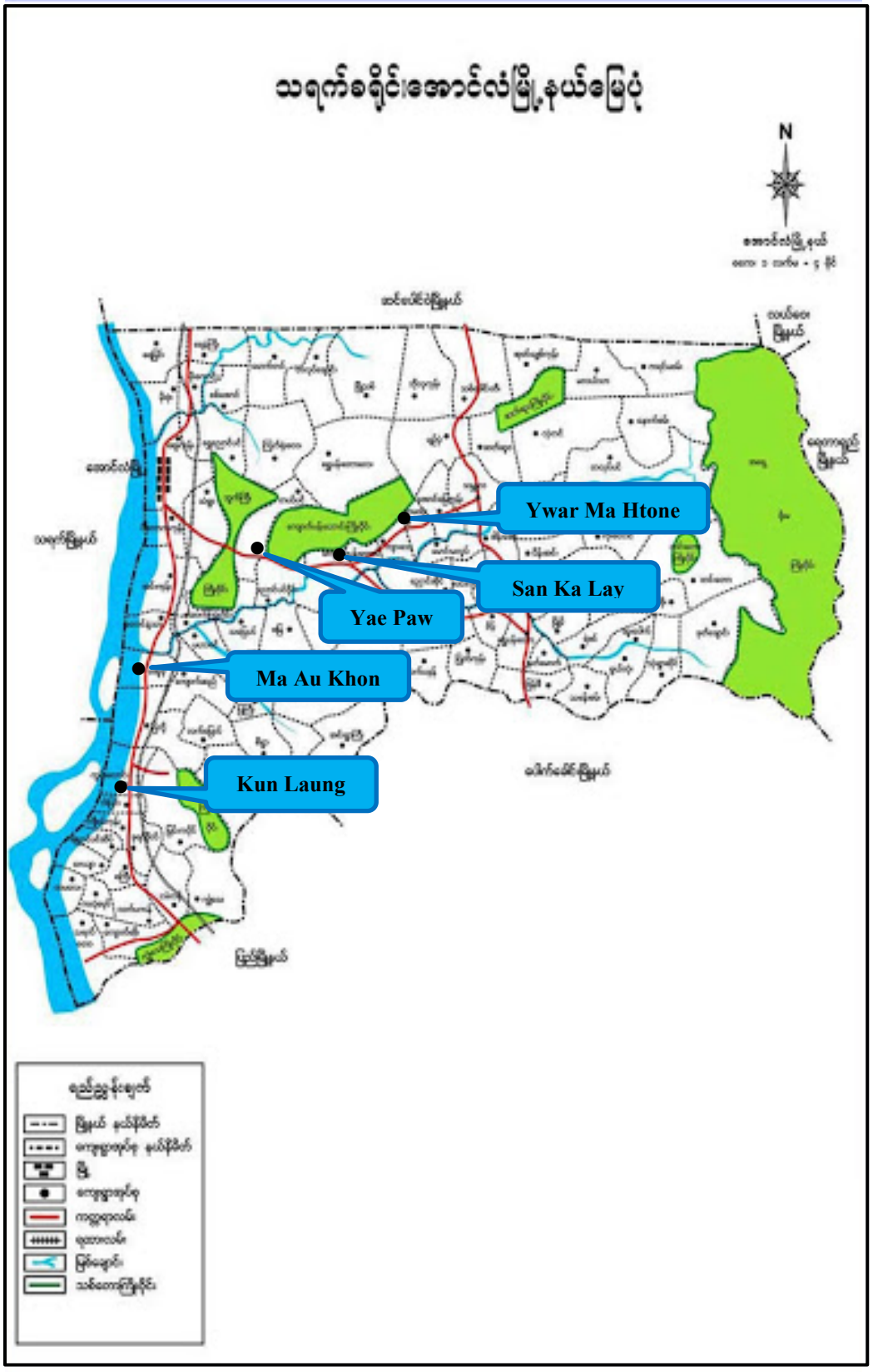
APPENDICES

Appendix 1 Characteristics of sesame varieties

Sinyadanar-3			Black theik pan			Red sesame (25/160)		
1	Mature days	- 90-95	1	Mature days	- 80-90	1	Mature days	- 90-95
2	Seed color	- Black	2	Seed color	- Black	2	Seed color	- Red
3	Plant height (cm)	- 110-130	3	Plant height (cm)	- 120-150	3	Plant height (cm)	- 91-137
4	Plant type	- Branching	4	Plant type	- Branching	4	Plant type	- Branching
5	Days to flowering	- 30	5	Days to flowering	- 30	5	Days to flowering	- 30
6	Days to 50% flowering	- 40	6	Days to 50% flowering	- 40	6	Days to 50% flowering	- 35
7	No. of capsule per node	- 1	7	No. of capsule per node	- 1	7	No. of capsule per node	- 1
8	Capsule type	- Flat	8	Capsule type	- Flat	8	Capsule type	- Flat
9	No. of seed per capsule	- 68	9	No. of seed per capsule	- 68-72	9	No. of seed per capsule	- 64
10	Seed weight -1000 seeds (gm)	- 3-3.2	10	Seed weight -1000 seeds (gm)	- 2.8-3.0	10	Seed weight -1000 seeds (gm)	- 2.4
11	Yield (basket/acre)	- 15-20	11	Yield (basket/acre)	- 15-20	11	Yield (basket/acre)	- 10-15
12	Oil content (%)	- 50	12	Oil content (%)	- 48-50	12	Oil content (%)	- 55

Note: Sahmon Nat is a local variety and varietal trial is still conducting to identify for its characters.

Appendix 2 Map of Aunglan Township



Source: GAD, 2018

Appendix 3 Average net income sources and percentage share of household income for sampled farm households in the study area

Income sources	Contract farmers (N=60)		Non-contract farmers (N=42)		Total (N=102)	
	Avg. income (MMK/ yr)	% of HH income	Avg. income (MMK/ yr)	% of HH income	Avg. income (MMK/ yr)	% of HH income
Crops	2,343,988	76.88	1,466,528	52.13	1,983,897	67.18
- MSS	127,588	4.18	93,099	3.31	114,602	3.88
- MGG	428,283	14.05	120,714	4.29	301,637	10.21
- WGG	360,500	11.82	66,690	2.37	239,520	8.11
- MGN	90,175	2.96	112,262	3.99	99,270	3.36
- WGN	87,375	2.87	214,119	7.61	139,564	4.73
- MSC	74,917	2.46	150,119	5.34	105,882	3.59
- WSC	18,000	0.59	81,548	2.90	44,167	1.50
- PP	18,533	0.61	108,429	3.83	55,549	1.88
- LLB	14,958	0.49	52,000	1.85	30,211	1.02
- CHP	0	0.00	13,214	0.47	5,441	0.18
- COP	5,917	0.19	8,143	0.29	6,833	0.23
- COT	1,117,742	36.66	446,190	15.86	841,221	28.49
- MPD	0	0.00	0	0.00	0	0.00
- SPD	0	0.00	0	0.00	0	0.00
Livestock income	115,500	3.79	345,000	12.26	210,000	7.11
- Poultry	30,000	0.98	37,857	1.35	33,235	1.13
- Pig	40,000	1.32	48,572	1.73	43,530	1.47
- Cattle	45,500	1.49	258,571	9.18	133,235	4.51
Non-farm income	442,833	14.52	844,524	30.02	608,235	20.60
Remittance income	146,667	4.81	157,143	5.59	150,980	5.10
Total HH income	**3,048,988**	100.00	**2,813,195**	100.00	**2,953,112**	100.00

MSS = Monsoon Sesame, MGG = Monsoon Green gram, MGN = Monsoon Groundnut, PP = Pigeon pea, MPD = Monsoon Paddy, MSC = Monsoon Sweet corn, WGG = Winter Green gram, WGN = Winter Groundnut, SPD = Summer Paddy, LLB = Lablab bean, CHP = Chick pea, COP = Cow pea, COT = Cotton

Appendix 4 Percentage of sampled farm households for each cropping pattern in the study area

Cropping pattern	Contract farmers (N=60)	Non-contract farmers (N=42)	Total (N=102)	t-test
MSS, MGG - WC	22 (36.67)	10 (23.81)	32 (31.37)	1.41*
MSS, MGG, MPD - WC	10 (16.67)	3 (7.14)	13 (12.75)	1.51*
MSS, MGG, MGN, MPD - WC	8 (13.33)	5 (11.90)	13 (12.75)	0.21ns
MSS, MGG, PP - WC	2 (3.33)	5 (11.90)	7 (6.86)	1.54ns
MSS, MGG, MGN - WC	4 (6.67)	3 (7.14)	7 (6.86)	0.09ns
MSS, MGG, MGN, MPD, MSC - WC	2 (3.33)	3 (7.14)	5 (4.90)	0.82ns
MSS, MGG, MPD, MSC - WC	3 (5.00)	0.00	3 (2.94)	1.76*
MSS - WC	1(1.67)	1 (2.38)	2 (1.96)	0.25ns
MSS, MGG, PP, MPD - WC	0.00	2 (4.76)	2 (1.96)	1.43ns
MSS, MGG, MGN, SC - WC	0.00	2 (4.76)	2 (1.96)	1.43ns
MSS, MGG, MGN, PP, MPD - WC	2 (3.33)	0.00	2 (1.96)	1.43*
MSS, MPD, MSC - WC	1 (1.67)	1 (2.38)	2 (1.96)	0.25ns
MSS, MGG, MPD - WC - SPD	0.00	1 (2.38)	1 (0.98)	1.00ns
MSS, MGG, MPD - F	1 (1.67)	0.00	1 (0.98)	1.00ns
MSS, MGG, MPD, MSC - WC - SPD	0.00	1 (2.38)	1 (0.98)	1.00ns
MSS, MGG, PP, MPD - F	0.00	1 (2.38)	1 (0.98)	1.00ns
MSS, MGG, MGN, PP - WC	1 (1.67)	0.00	1 (0.98)	1.00ns
MSS, MGG, MGN, PP, MPD, MSC - F	1 (1.67)	0.00	1 (0.98)	1.00ns
MSS, MGN, MPD, MSC - WC	0.00	1 (2.38)	1 (0.98)	1.00ns
MSS, MGG, PP - F	0.00	1 (2.38)	1 (0.98)	1.00ns
MSS, MGG, PP, MPD, MSC - WC	1 (1.67)	0.00	1 (0.98)	1.00ns
MSS, MGG, MGN, MPD - WC - SPD	1 (1.67)	0.00	1 (0.98)	1.00ns
MSS, MGN, MPD - WC	0.00	1 (2.38)	1 (0.98)	1.00ns
MSS, PP, MPD - F	0.00	1 (2.38)	1 (0.98)	1.00ns

Note: The values in the parentheses represent percentage.
MSS = Monsoon Sesame, MGG = Monsoon Green gram, MGN = Monsoon Groundnut, PP = Pigeon pea, MPD = Monsoon Paddy, MSC = Monsoon Sweet corn, SPD = Summer Paddy, F = Fallow, WC = Winter crops (Green gram, Groundnut, Lablab bean, Chick pea, Cotton)

Appendix 5 Labor use in sesame production by sampled farm households

Items	Units	Contract farmers (N=60)	Non-contract farmers (N=42)	Total (N=102)	t-test
(1) Average family labor					
Land preparation (cattle)	Animal day	4.20	5.12	4.58	1.46^{ns}
Land preparation (machine)	Machine day	0.21	0.03	0.13	1.60*
Land preparation (labor)	Man day	2.10	2.56	2.29	1.46^{ns}
Sowing	Man day	0.10	0.12	0.11	0.20^{ns}
Thinning & weeding	Man day	0.60	0.21	0.44	1.32*
Fertilizer application	Man day	0.66	0.65	0.65	0.06^{ns}
Pesticide application	Man day	1.05	1.18	1.10	0.45^{ns}
Harvesting	Man day	0.45	0.53	0.48	0.33^{ns}
Drying	Man day	0.04	0.18	0.10	0.75^{ns}
Threshing	Man day	0.43	0.62	0.51	0.72^{ns}
Transportation from farm to home	Man day	2.47	2.47	2.47	0.00
(2) Average hired labor					
Land preparation (cattle)	Animal day	0.21	0.59	0.36	1.38^{ns}
Land preparation (machine)	Machine day	1.24	1.24	1.24	0.00
Land preparation (labor)	Man day	0.10	0.29	0.18	1.38^{ns}
Sowing	Man day	1.13	1.12	1.13	0.20^{ns}
Thinning & weeding	Man day	9.59	10.14	9.82	0.33^{ns}
Fertilizer application	Man day	1.05	0.71	0.91	1.45^{ns}
Pesticide application	Man day	1.71	1.26	1.53	1.10^{ns}
Harvesting	Man day	8.87	9.29	9.04	0.59^{ns}
Drying	Man day	4.40	4.47	4.43	0.19^{ns}
Threshing	Man day	3.13	3.00	3.08	0.29^{ns}
Transportation from farm to home	Man day	0.00	0.00	0.00	-
(3) Total labor					
Land preparation (cattle)	Animal day	4.40	5.71	4.94	2.18*
Land preparation (machine)	Machine day	1.44	1.27	1.37	0.98^{ns}
Land preparation (labor)	Man day	2.20	2.85	2.47	2.18^{ns}
Sowing	Man day	1.24	1.24	1.24	0.00
Thinning & weeding	Man day	10.18	10.35	10.26	0.09^{ns}
Fertilizer application	Man day	1.71	1.35	1.56	1.37*
Pesticide application	Man day	2.76	2.44	2.63	0.87^{ns}
Harvesting	Man day	9.32	9.88	9.55	0.83^{ns}
Drying	Man day	4.45	4.65	4.53	0.61^{ns}
Threshing	Man day	3.56	3.62	3.58	0.14^{ns}
Transportation from farm to home	Man day	2.47	2.47	2.47	0.00

Note: *, ** and***are significant at 10%, 5% and 1% level respectively, ns is not significant differences.

Appendix 6 Allocation of family and hired labor and machinery use by sampled farm households

Type of labor	Units	Contract farmers (N=60)	Non-contract farmers (N=42)	Total (N=102)
Average family labor	Animal day	4.20 (95.24)	5.12 (89.67)	4.58 (92.71)
Average hired labor	Animal day	0.21 (4.76)	0.59 (10.33)	0.36 (7.29)
Total animal day		**4.41**	**5.71**	**4.94**
Average family labor	Machine day	0.21 (14.48)	0.03 (2.36)	0.13 (9.49)
Average hired labor	Machine day	1.24 (85.52)	1.24 (97.64)	1.24 (90.51)
Total machine day		**1.45**	**1.27**	**1.37**
Average family labor	Man day	7.90 (20.86)	8.58 (24.36)	8.18 (22.23)
Average hired labor	Man day	29.98 (79.14)	26.64 (75.64)	28.62 (77.77)
Total man day		**37.88**	**35.22**	**36.80**

Appendix 7 Enterprise budget of sesame production for all sampled farm households (N=102)

Items	Units	Level	Effective price	Total value
1. Gross benefit				
Effective yield	kg/ha	251.93	1,637	412,636
Total gross benefit	MMK/ha			**412,636**
2. Variable cost				
(a) Material cost (cash)				
Urea	kg/ha	24.99	399	9,970
Compound	kg/ha	43.67	531	23,171
Gypsum	kg/ha	18.49	199	3,676
Insecticide	Liter/ha	0.42	10,608	4,455
Fungicide	kg/ha	0.06	12,000	720
Herbicide	Liter/ha	0.17	9,629	1,637
Foliar	Liter/ha	0.50	8,400	4,200
Total material cost (cash)	MMK/ha			47,829
(b) Material cost (own)				
Seed	kg/ha	6.25	2,526	15,787
FYM	Ton/ha	2.13	4,850	10,331
Total material cost (own)	MMK/ha			26,118
Total material cost (a+b)	MMK/ha			**73,947**
(c) Family labor cost				
Land preparation with draft cattle	Amd/ha	4.58	3,696	16,928
Land preparation with machinery	Machine day/ha	0.13	17,600	2,288
Land preparation with labor	Md/ha	2.29	2,632	6,027
Sowing	Md/ha	0.11	3,444	334
Manual thinning & weeding	Md/ha	0.44	4,000	1,760
Fertilizer application	Md/ha	0.65	3,528	2,293
Pesticide application	Md/ha	1.10	3,936	4,330
Harvesting	Md/ha	0.48	4,200	2,016
Drying	Md/ha	0.10	4,500	450
Threshing	Md/ha	0.51	4,050	2,066
Transportation from farm to home	Md/ha	2.47	4,000	9,880
Total family labor cost (c)	MMK/ha			**48,371**
(d) Hired labor cost				
Land preparation with draft cattle	Amd/ha	0.36	4,125	1,485
Land preparation with machinery	Machine day/ha	1.24	18,800	23,312
Land preparation with labor	Md/ha	0.18	2,500	450
Sowing	Md/ha	1.13	3,778	4,269
Manual thinning & weeding	Md/ha	9.82	3,907	38,368

Appendix 7 (Continued) Enterprise budget of sesame production for all sampled farm households

Items	Units	Level	Effective price	Total value
Fertilizer application	Md/ha	0.91	3,487	3,173
Pesticide application	Md/ha	1.53	4,100	6,273
Harvesting	Md/ha	9.04	4,790	43,302
Drying	Md/ha	4.43	4,900	21,707
Threshing	Md/ha	3.08	4,850	14,938
Transportation from farm to home	Md/ha	0.00	0	0
Total hired labor cost (d)	MMK/ha			**157,277**
(e) Interest on cash cost				
Material cost	MMK/ha	47,829	0.09	4,305
Hired labor cost	MMK/ha	157,277	0.09	14,155
Total interest on cash cost (e)				**18,460**
Total variable cost (TVC) (a+b+c+d+e)				298,055
Total variable cash cost (TVCC) (a+d+e)				223,566
Return above variable cost (TGB - TVC)				114,581
Return above variable cash cost (TGB - TVCC)				189,070
Return per unit of cash expensed (TGB/TVCC)				**1.85**
Return per unit of capital invested (TGB/TVC)				**1.38**
Break-even yield (Total variable cost/average price per kg)				181.97
Break-even price (Total variable cost/average yield per ha)				1,183.09

Appendix 8 Enterprise budget of sesame production for contract farm households (N=60)

Items	Units	Level	Effective price	Total value
1. Gross benefit				
Effective yield	kg/ha	261.03	1,643	428,958
Total gross benefit	MMK/ha			**428,958**
2. Variable cost				
(a) Material cost (cash)				
Urea	kg/ha	21.98	390	8,572
Compound	kg/ha	48.93	540	26,422
Gypsum	kg/ha	19.90	194	3,870
Insecticide	Liter/ha	0.38	10,604	4,030
Fungicide	kg/ha	0.09	12,000	1,080
Herbicide	Liter/ha	0.18	9,600	1,728
Foliar	Liter/ha	0.44	8,500	3,740
Total material cost (cash)	MMK/ha			**49,441**
(b) Material cost (own)				
Seed	kg/ha	6.09	2,577	15,694
FYM	Ton/ha	2.27	4,670	10,601
Total material cost (own)	MMK/ha			26,295
Total material cost (a+b)	MMK/ha			**75,736**
(c) Family labor cost				
Land preparation with draft cattle	Amd/ha	4.20	3,728	15,659
Land preparation with machinery	Machine day/ha	0.21	17,000	3,570
Land preparation with labor	Md/ha	2.10	2,500	5,250
Sowing	Md/ha	0.10	3,400	340
Manual thinning & weeding	Md/ha	0.60	4,000	2,400
Fertilizer application	Md/ha	0.66	3,450	2,277
Pesticide application	Md/ha	1.05	3,928	4,124
Harvesting	Md/ha	0.45	4,300	1,935
Drying	Md/ha	0.04	5,000	200
Threshing	Md/ha	0.43	4,400	1,892
Transportation from farm to home	Md/ha	2.47	4,000	9,880
Total family labor cost (c)	MMK/ha			**47,527**
(d) Hired labor cost				
Land preparation with draft cattle	Amd/ha	0.21	4,334	910
Land preparation with machinery	Machine day/ha	1.24	19,000	23,560
Land preparation with labor	Md/ha	0.10	2,667	267
Sowing	Md/ha	1.13	3,850	4,351
Manual thinning & weeding	Md/ha	9.59	3,922	37,612

Appendix 8 (Continued) Enterprise budget of sesame production for contract farm households

Items	Units	Level	Effective price	Total value
Fertilizer application	Md/ha	1.05	3,500	3,675
Pesticide application	Md/ha	1.71	3,960	6,772
Harvesting	Md/ha	8.87	4,960	43,995
Drying	Md/ha	4.4	5,120	22,528
Threshing	Md/ha	3.13	5,000	15,650
Transportation from farm to home	Md/ha	0.00	0	0
Total hired labor cost (d)	MMK/ha			**159,319**
(e) Interest on cash cost				
Material cost	MMK/ha	49,441	0.09	4,450
Hired labor cost	MMK/ha	159,319	0.09	14,339
Total interest on cash cost (e)				**18,788**
Total variable cost (TVC) (a+b+c+d+e)				301,371
Total variable cash cost (TVCC) (a+d+e)				227,549
Return above variable cost (TGB - TVC)				127,588
Return above variable cash cost (TGB - TVCC)				201,410
Return per unit of cash expensed (TGB/TVCC)				**1.89**
Return per unit of capital invested (TGB/TVC)				**1.42**
Break-even yield (Total variable cost/average price per kg)				183.39
Break-even price (Total variable cost/average yield per ha)				1,154.54

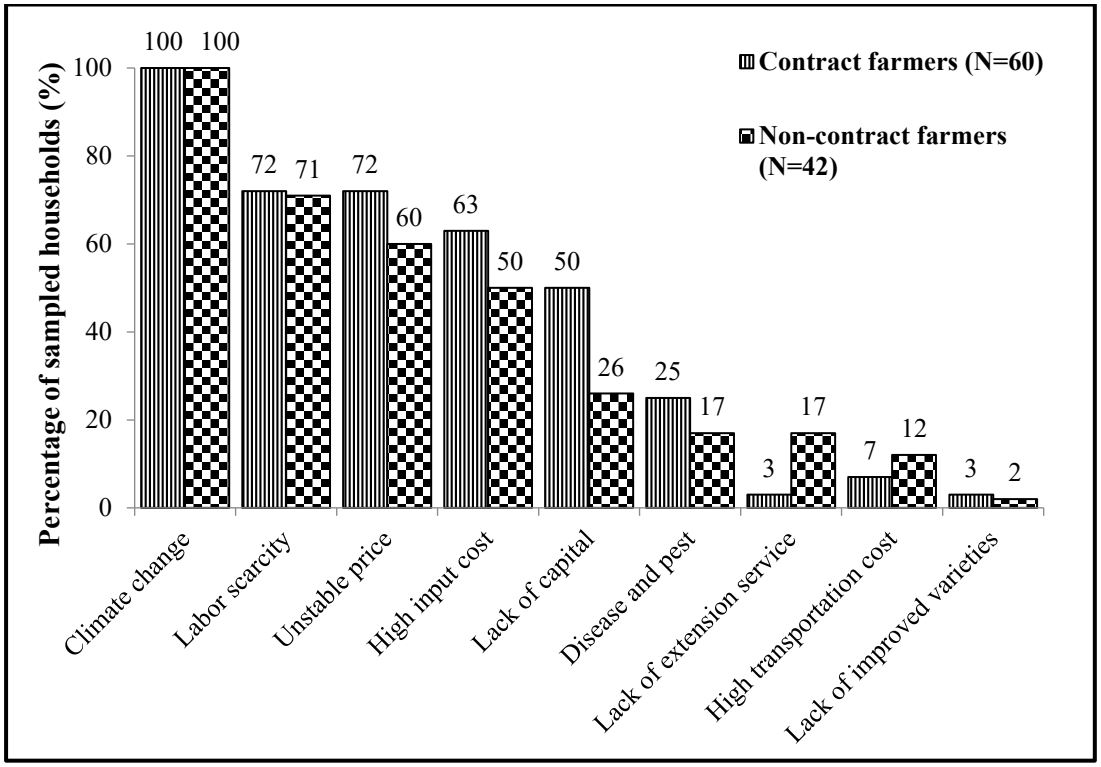
Appendix 9 Enterprise budget of sesame production for non-contract farm households (N=42)

Items	Units	Level	Effective price	Total value
1. Gross benefit				
Effective yield	kg/ha	237.04	1,630	386,589
Total gross benefit	MMK/ha			**386,589**
2. Variable cost				
(a) Material cost (cash)				
Urea	kg/ha	29.29	400	11,716
Compound	kg/ha	36.17	517	18,700
Gypsum	kg/ha	16.47	200	3,294
Insecticide	Liter/ha	0.47	10,610	4,987
Fungicide	kg/ha	0.02	12,000	240
Herbicide	Liter/ha	0.17	9,637	1,638
Foliar	Liter/ha	0.60	8,052	4,831
Total material cost (cash)				45,406
(b) Material cost (own)				
Seed	kg/ha	6.48	2,453	15,898
FYM	Ton/ha	1.94	5,200	10,088
Total material cost (own)	MMK/ha			25,986
Total material cost (a+b)	MMK/ha			**71,392**
(c) Family labor cost				
Land preparation with draft cattle	Amd/ha	5.12	3,652	18,698
Land preparation with machinery	Machine day/ha	0.03	20,000	600
Land preparation with labor	Md/ha	2.56	2,800	7,168
Sowing	Md/ha	0.12	3,500	420
Manual thinning & weeding	Md/ha	0.21	4,000	840
Fertilizer application	Md/ha	0.65	3,600	2,340
Pesticide application	Md/ha	1.18	3,900	4,602
Harvesting	Md/ha	0.53	4,000	2,120
Drying	Md/ha	0.18	4,100	738
Threshing	Md/ha	0.62	3,500	2,170
Transportation from farm to home	Md/ha	2.47	4,000	9,880
Total family labor cost (c)	MMK/ha			**49,576**
(d) Hired labor cost				
Land preparation with draft cattle	Amd/ha	0.59	4,000	2,360
Land preparation with machinery	Machine day/ha	1.24	18,580	23,039
Land preparation with labor	Md/ha	0.29	2,400	696
Sowing	Md/ha	1.12	3,654	4,092
Manual thinning & weeding	Md/ha	10.14	3,870	39,242

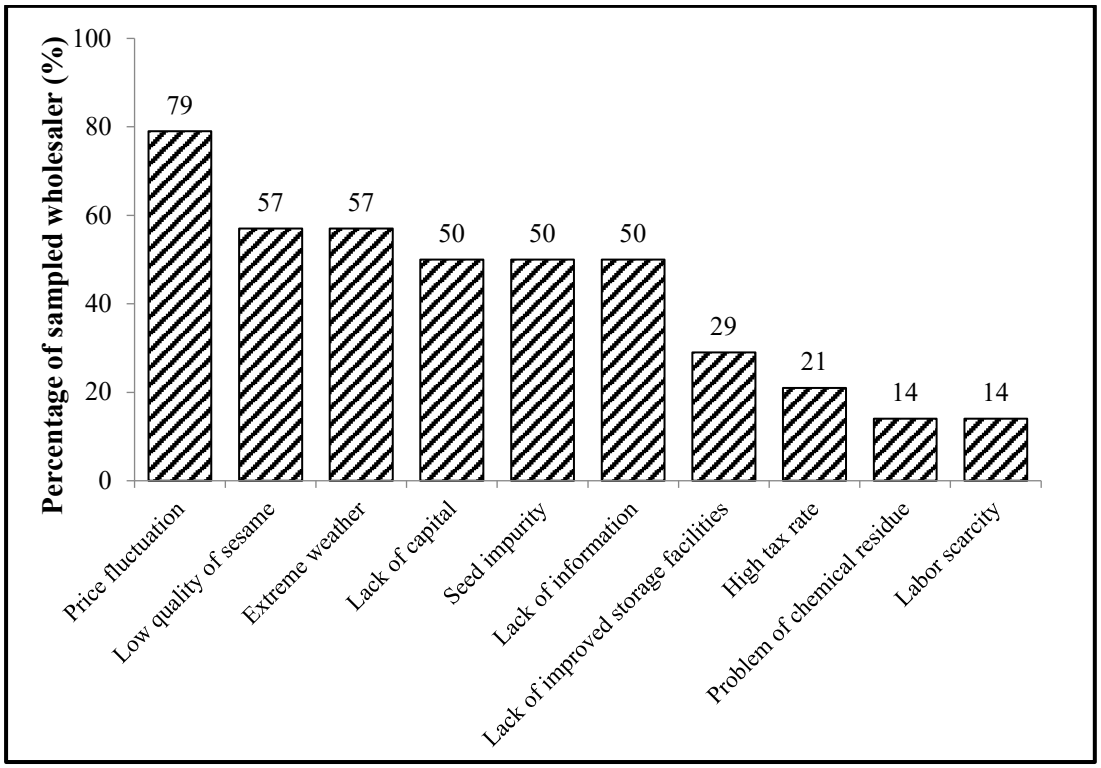
Appendix 9 (Continued) Enterprise budget of sesame production for non-contract farm households

Items	Units	Level	Effective price	Total value
Fertilizer application	Md/ha	0.71	3,460	2,457
Pesticide application	Md/ha	1.26	4,300	5,418
Harvesting	Md/ha	9.29	4,547	42,242
Drying	Md/ha	4.47	4,634	20,714
Threshing	Md/ha	3.00	4,700	14,100
Transportation from farm to home	Md/ha	0.00	0	0
Total hired labor cost (d)	MMK/ha			**154,360**
(e) Interest on cash cost				
Material cost	MMK/ha	45,406	0.09	4,087
Hired labor cost	MMK/ha	154,360	0.09	13,892
Total interest on cash cost (e)				**17,979**
Total variable cost (TVC) (a+b+c+d+e)				293,307
Total variable cash cost (TVCC) (a+d+e)				217,745
Return above variable cost (TGB - TVC)				93,282
Return above variable cash cost (TGB - TVCC)				168,844
Return per unit of cash expensed (TGB/TVCC)				**1.78**
Return per unit of capital invested (TGB/TVC)				**1.32**
Break-even yield (Total variable cost/average price per kg)				179.84
Break-even price (Total variable cost/average yield per ha)				1,237.37

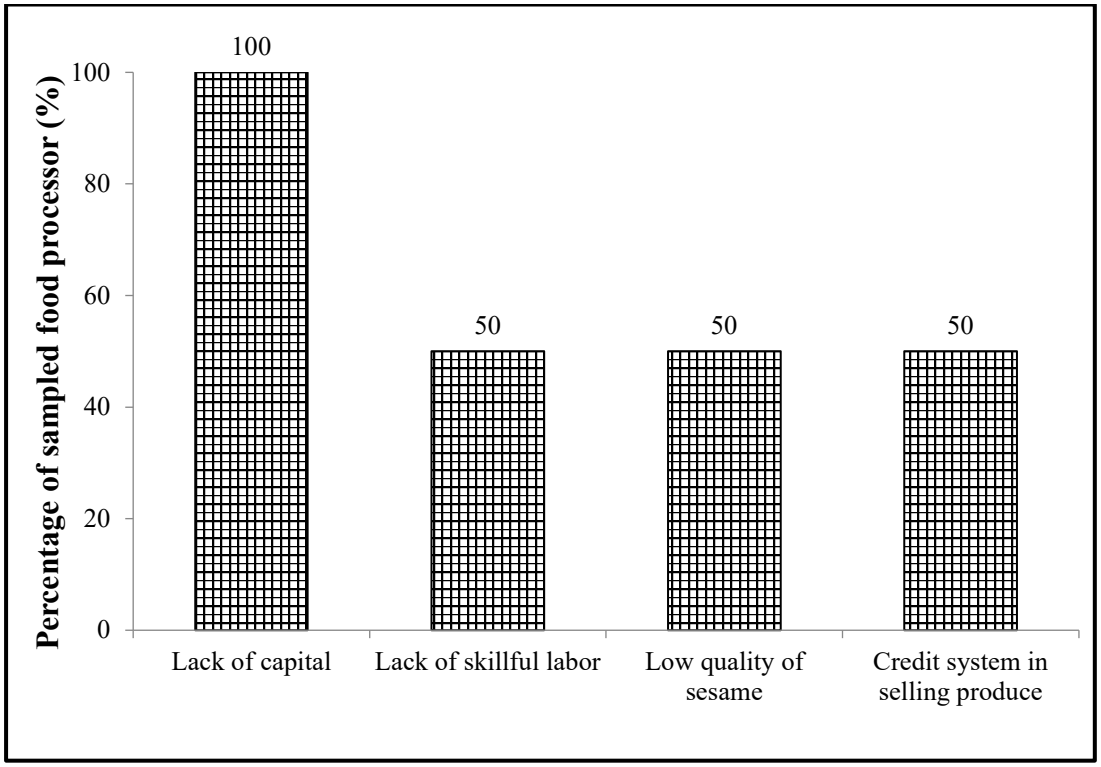
Appendix 10 Constraints in sesame production and marketing by sampled farm households in the study area



Appendix 11 Constraints of township wholesalers in sesame marketing in the study area



Appendix 12 Constraints of food processors in sesame marketing in the study area



Appendix 13 Constraints of exporters in sesame marketing in the study area