LOCAL PRODUCTION PRACTICES AND MARKETING CHANNEL OF ONION (*Allium cepa* var.cepa) IN SELECTED AREAS OF MYANMAR

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A Thesis Submitted to the Post-Graduate Committee of the Yezin Agricultural University in Partial Fulfillment of the Requirements for the Degree of Master of Agricultural Science (Horticulture)

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The thesis attached here to, entitled **"Local Production Practices and Marketing Channel of Onion (*Allium cepa* var. cepa) in Selected Areas of Myanmar"** was prepared and submitted by Ye Win Paing under the direction of the chairperson of the candidate supervisory committee and has been approved by all members of that committee and the board of examiners as a partial fulfillment of the requirements for the degree of **Master of Agricultural Science (Horticulture)**.

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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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DEDICATED TO MY BELOVED PARENTS

U TUN MAUNG AND DAW MYINT MYINT THEIN

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LOCAL PRODUCTION PRACTICES AND MARKETING CHANNEL OF ONION (*Allium cepa* var.cepa) IN SELECTED AREAS OF MYANMAR

ABSTRACT

This research was conducted to study the local production practices, to find out constraints on production and marketing of onion and to evaluate marketing margins of all the stakeholders in onion marketing channel during January to July 2013. Using simple random sampling method, the survey was done on 90 farmers from Myingyan and Taungthar townships, 25 wholesalers and 25 retailers (5 each from Yangon, Mandalay, Nay Pyi Taw, Myingyan and Taungthar).

According to the results, most of the respondents in the study areas operated small scale onion farms of less than 1.2 ha. In terms of growing system, bulb to bulb system was observed in rainy onion growing and seed to bulb system in winter onion growing. Most of the growers used their own seeds and sets, but no usage of either improved or hybrid variety was observed in study areas. Most of the respondents used too dense planting spacing which were around 156 plants/m^2. While farmers from Taungthar area commonly used cow dung manure, most of the farmers from Myingyan area apply inorganic fertilizer alone during winter season. In both growing seasons, more split application of urea fertilizer was observed in Taungthar area compared to Myingyan area. Accordingly, the average yield of onion in Taungthar area was higher than that of Myingyan.

According to economic analysis, the gross margin per unit of land received from growing winter onion in Taungthar and Myingyan were 952,575 kyat/ha and 346,393 kyat/ha respectively and that from rainy onion in Taungthar and Myingyan were 523,954 kyat/ha and 418,432 kyat/ha respectively. The benefit cost ratio (BCR) for winter onion was 1.35 in Taungthar and 1.15 in Myingyan, while BCR for rainy onion was 1.36 in Taungthar and 1.35 in Myingyan. In both seasons, profitability of growing onion in Taungthar was more positive and attractive to farmers.

Onions produced in Myingyan and Taungthar townships were marketed along the channel comprising Yangon, Mandalay, Mawlamyine and Nay Pyi Taw markets. The marketing margins and profit of local wholesalers who traded to Mandalay market were observed the highest. The marketing margin (92 kyat/kg) and cost (47 kyat/kg) in Yangon wholesale market were the highest compared to Mandalay and Nay Pyi Taw wholesale markets. The highest profit (53 kyat/kg) was observed in Mandalay wholesale market. In

Yangon and Nay Pyi Taw market channels, the highest profit share of consumer price (11.77% and 12.35% of the consumer paid price) was obtained by the farmers.

According to the responses of sample farmers, the most serious problems being faced during the onion production and marketing were price fluctuation, labor difficulties, high cost of fertilizers and pesticides. Among them, price fluctuation was determined to be the biggest problem for the farmers. Based on the results, it can be suggested that the practices such as usage of improved varieties, more split application of urea fertilizer and more usage of cow dung manure should be preformed. It also needs to improve the availability of agro-chemical inputs, the storage facilities, processing technologies and marketing efficiency in order to optimize the farmers' productivity and income.

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CHAPTER I
INTRODUCTION

Onion belongs to the family Alliaceae. Onion is one of the most popular vegetables that form of daily diet. It is either used in raw form or dehydrated form to add favor and taste to dishes. Although it is consumed in small quantity by the most, it is used daily in wide varieties of dishes (Jahan et al., 2007).

Onion is one of the major crops in many tropical countries and placed high with other vegetable crops. It is one of the oldest vegetables in continuous cultivation dating back to at least 4000 B.C. The ancient Egyptians were pronounced to cultivate onion along the Neil River (Boyhan et al., 2011). Although the origin is still remaining unknown, it is believed to be Afghanistan and the surrounding regions (Brewster, 2008).

Onion is an important vegetable crop whose distinctive flavor is appreciated by a lot of people throughout the world. One of the advantages of onion is that the bulbs can be harvested and sold either 'green' in salads (Lannoy, 2001), while the mature bulbs are cooked or eaten raw as a vegetable (Straub et al., 1992). The usage of onion is not limited to any climate or associated with any nationality. At least 175 countries grow onion. According to the United Nations Food and Agriculture Organizations, an estimated 2.7 million ha of onions is an indispensable item in every kitchen as condiment and vegetable. As onion has medicinal value, it is used in some pharmaceutical preparation also. It has many uses as folks remedies and recent reports suggest that onion plays a part in preventing heart diseases and other ailments (Barakade et al., 2011).

Onion is also one of the important commercial crops in Myanmar. It is widely grown in different parts of the country. It has been grown in all regions except Tanintharyi Division and Mon State. Among the onion production areas in Myanmar, Mandalay Division has the highest number of onion growing acres. Within Mandalay Division, Myingyan District is the leading area of onion production (DAP, 2013). The world's largest onion producer is China and India stands the second place. Myanmar stands the 7th place in term of production area (Indian Horticulture database, 2008). In Myanmar, about 72,031 ha of onion is grown annually and average yield is 16.1MT/ha which is quite lower than the world's average yield (19.1 MT/ha) (DOA, 2013). Poor management practices may be one of the reasons for lower yield.

With high yield and good post-harvest handling, the main challenge faced by onion producers is the oversupply of onion to the market. So, it is important to understand

the marketing system. The lack of market information reaching to farmer level can cause a negative impact on critical production decisions. So the relationship among farmers, wholesalers and retailers play an important role in marketing of onion.

In order to raise the income of the farmers and promote the economic development of the country, an efficient agricultural production and marketing system are needed. An efficient marketing system is the one capable of moving goods from producers to consumers at the lowest cost consistent with the provision of the consumer demand. There is little information about the systematic analysis on the production and marketing of onion in Myanmar. Thus the production practices and marketing activities along the marketing channels of onion should be analyzed and examined.

Therefore, this study was conducted with the following objectives.

1. To study the production practices of onion in the study areas
2. To find out constraints on production and marketing of onion in selected areas,
3. To evaluate marketing margins of all the stakeholders involved in onion marketing channel

CHAPTER II
LITERATURE REVIEW

2.1 Ecological Requirement for Onion Growing

Onions are very sensitive to climate and soil condition. Onions require a number of specific conditions in order to achieve optimal growth. These include bountiful sunshine; stone-free, loamy, well-irrigated soil and excellent drainage. Onion does not grow well in a clay soil or soil with a high salinity (Platt, 2003). It can be grown on soil textures ranging from sandy to clay loams. There is an advantage for onion on sandy soil because of less risk of bulb disease problem as the fields are dry quickly. The disadvantages are that they may require more frequent irrigation and nitrogen leaching may be more than other soil types. By adjusting the irrigation frequency according to crop demand and by frequent nitrogen applications, growers can usually produce optimum yields on sandy soils (Corgan et al., 2000).

The optimum pH range regardless of soil type is 6.0 to 6.8, although alkaline soils are also suitable. Onions do not thrive in soils below pH 6.0 because of trace element deficiencies or occasionally aluminum or manganese toxicity (Shanmugasundaram and Kalb, 2001).

Although onion is a cold season crop, it can be grown in a wide range of temperatures. Onion is adapted to a growing season with air temperatures of 13° to 24°C. The best growth and onion quality are obtained if the temperature is cold during the vegetative stage from germination to bulb initiation. Low temperatures at early season with higher temperatures after bulb formations are very desirable (Mamaril et al., 2013).

2.2 Plant Density

Several works have confirmed that economic returns from onion can be improved through optimizing crop density (Brewster, 1987). Closer spacing results in smaller bulbs, while wider spacing increases bulb size (Sinnadurai, 1978; Singh, 1995). Bulb yields increase with increasing plant density up to a certain limit. A spacing of 10 x 30 cm in a single row and 10 x 10 cm in multiple row system gave the highest bulb yield (Badarudin and Haque, 1977). The effects of population density are moderated by cultivar and environment. High planting density significantly can increase double-bulb and total yield while dry weight and bulbing ratio can be reduced (Farragg, 1995). In Ghana, it was stated that average bulb weight obtained from the 100 plants/m^2 (10 x 10 cm) density was

comparable to that achieved from some of the lower densities. And so this plant density seems to be the most appropriate to be used in terms of bulb size and bulb yield (Kanton et al., 2002).

2.3 Water Management

Onions are very sensitive to water stress. They respond to water stress with reduced rates of transpiration, photosynthesis, and growth. During bulb growth, onions are more sensitive to water stress than other crops. Water stress at this time reduces bulb yield and size. The water stress at the 3 to 5-leaf stage reduced the percentage of single-centered bulbs compared to non-stressed onion (Shock et al., 2000).

Moisture sensitive stage of onion starts from bulb formation to maturity. Moisture stress in this stage leads to irrevocable yield loss. This stage is known as critical period or moisture sensitive period.

Careful attention to irrigation scheduling can assure high onion yields, better bulb storability and better internal quality. Onions need frequent irrigation to maintain high soil moisture. And it may be difficult to reduce nitrate leaching with furrow irrigation. Under-irrigation leads to losses in total yield, market grade, and single centeredness. Over-irrigation leads to soil erosion, bulb disease susceptibility, water loss, extra energy costs for pumping, N leaching, and increased crop N needs (Shock et al., 2010).

Rabbani et al. (1986) reported that many factors, such as cultivars, bulb maturity, moisture content of the bulb, temperature, relative humidity, etc. are associated with spoilage of onion during storage and these storage losses could be as high as 66%. Irrigation is also one of the factors that affect storability of onion as it helps to increase moisture content of bulb (Chung, 1989). The excessively wet soil is conducive to bulb rotting pathogens. It encourages neck rot, which can reduce crop marketability at harvest or from storage. Onions that are over-irrigated are especially prone to storage decomposition, particularly if significant rainfall events occurred during the growing season (Shock et al., 1998).

In Bangladesh, it was observed that total 6 times of irrigation after the crop establishment can increase not only the bulb yield but also the percentage of storage losses. It was stated that irrigation both at 10 to 15 days interval (6 to 4 times of irrigation after crop establishment), gave the maximum yields which were identical with each other. The storage losses of onion under normal room temperature increased with increasing number of irrigation (Biswas et al., 2010).

2.4 Fertilizer Management

Nutrient requirements do not constantly exist throughout the season. It varies depending on the growth stages. The period of slow growth lasts about 50 to 70 days after planting under typical weather condition. During this phase, nutrient needs are very low. The onion plant has the highest demand for water and nutrients during bulb growth. Generally bulb growth begins at 90 days after planting and end up at 130 to 150 days after planting (Sullivan et al., 2001).

The sparse, shallow rooting of onions is less effective than most crop plants in extraction of immobile nutrients (P, K, and some micronutrients such as Zn). So onions are more susceptible than most crops to deficiencies of these nutrients. This shallow root system of onions is important in consideration for efficient management of mobile nutrients such as nitrate-N and sulphate-S. Mobile nutrients can be lost from the root zone by over-irrigation (Brewster, 1990). The excess nitrate-nitrogen which leaches below the root zone can contaminate ground water, while excess phosphorus can be carried into lakes and streams by surface water runoff.

Nitrogen is usually the greatest expense of all the fertilizer costs. Nitrogen affects not only bulb yield but bulb grade or quality, maturity and storability and disease resistance. Shortages of N reduce both total yield and bulb size or marketable yield. A nitrogen shortage also delays maturity as measured by the percentage of tops down and may increase the shrinkage in storage.

Onions use very little N (less than 5 percent of the total requirement) before bulb initiation and then use from 0.45 to 1.36 kg N per acre per day during rapid bulbing. Preplant applied N is not as effective as N side-dressed after onions are well established and the root system has begun to develop. Preplant applied N is easily moved beyond the limited root system with the first one or two furrow irrigations. A higher percentage of fertilizer N is absorbed and used by the plant if the fertilizer is applied when onion root system is well developed. Split applications of N are more effective than single preplant application (Brown, 2000).

Onions take up more than 45.36 kg per acre of nitrogen, potassium and calcium, with substantially lower amounts of sulphur, phosphorus and magnesium. The bulb yields of 32 to 50 MT per acre can be obtained with an available N supply (including nitrate + ammonium-N in soil before seeding, estimated soil N mineralization and additive N fertilizer) of approximately 113 to 136 kg N per acre. Minimizing preplant N fertilizer

application and applying most or all of the N fertilizer as side-dress application are important factors to be an efficient N fertilizer application (Sullivan et al., 2001).

Phosphorus (P) deficiency reduces bulb size and can delay maturation. It may not exhibit obvious symptoms. Small root systems of onion are less efficient in accessing soil P. Onions are normally more affected by shortages of P during early growth stages because root systems are limited and cool soil temperatures reduce P diffusion or movement to root surfaces (Brown, 2000). Crop P uptake for a bulb yield of 38.1 MT per acre was 9.07 to 11.34 kg P per acre in Columbia. Maximum P uptake rates are 0.14 to 0.23 kg per acre per day during bulb growth.

Onion takes up nearly equal amounts of N and K. The bulb yield of 32 to 50 MT removed 49.89 to 72.57 kg K per acre in Columbia, with peak uptake rates of 0.91 to 1.36 kg per acre per day. Including available soil K, applying 90.72 kg K (108.86 kg K_2O) per acre is recommended in Columbia Basin (Sullivan et al., 2001).

Continuous usage of inorganic fertilizer affects soil structure. Hence, organic manures can serve as alternative to mineral fertilizers for improving soil structure (Dauda et al., 2008). It was confirmed that organic manure increases the nutrient status of a soil which leads to increase in onion yield. The role of nutrients is one of the important factors in boosting productivity and quality of onion which is a heavy feeder of mineral elements and continuous use of inorganic fertilizers resulted in deficiency of micronutrients, imbalance in soil physicochemical properties and unsustainable crop production (Jeyathilake et al., 2006). In Srilanka, it was found that compost enhanced number of bulb per plant and half fold of recommended inorganic fertilizers (Urea 100 kg ha^{-1}, Triple Super Phosphate 100 kg ha^{-1}, and Muriate of Potash 50 kg ha^{-1}) and compost at the rate of 4 MT ha^{-1} could give profitable yield and this combination could possibly reduce the cost of production in the onion cultivation (Seran et al., 2010).

2.5 Weed Management

Weeds compete with onions for light, nutrients, water and space. In addition to reducing harvestable bulbs through competition, weeds interfere with the harvesting process by decreasing hand-harvesting and machine harvest efficiency (Corgan et al., 2000). Orkwor (1983) reported that weed infestation significantly reduced crop vigor, leaf production, bulb diameter and consequently bulb yield in onions.

Good weed control requires integration of cultural and chemical techniques. Weed control options are often limited in vegetable crops such as onion. The best methods for

an individual grower will depend on several factors such as weed species present, onion row spacing, labor costs and labor availability.

Hand weeding effectively controls most weed species. In order to reduce crop damage and to allow for the use of mechanical tools such as hoes, conduct hand weeding when both the crop and weeds are small. Removal of large weeds with extensive root systems may damage crop roots or foliage. Although hand weeding is very effective, it may also be very expensive because of time and labor requirements (Culpepper, 2011). Hassan and Malik (2002) reported that cultural control (four hand weeding) is the best for weed control because it provides maximum weed control in onion.

2.6 Harvesting and Curing

The time of onion harvest depends on market opportunities, weather and the planned storage period. As bulb growth slows, the onion neck becomes soft and the plant falls over. Maturation is commonly evaluated by the percentage of tops down and by the amount of dry leaves percent. Achieving a proper degree of maturation before harvest is a key factor in producing high quality onions for storage.

Onions are ready to harvest when the leaves collapse. For storage, onion tops should have broken over before harvest and the neck should collapse and dry. Storage bulb maturity can be accelerated by withholding irrigation water or by pruning the root system. Bulbs for storage may be harvested when 50 percent or more of the tops have broken over, but the bulbs must be cured and dried thoroughly before being placed in storage. Bulbs intended for immediate use can be undercut when 15 to 25 percent of the tops are down (Shanmugasundaram and Kalb, 2001). As the risk of sunburn is high, harvesting should not be performed once the temperature exceeds 38°C (Hickey, 2005).

An onion bulb is a series of concentric swollen leaves still attached to a short stem or base. These are surrounded by scales, which are dried leaves. Onions are cured in order to extend their shelf life. Curing of onion bulbs serves several functions. First it dries the outer two to four scales, providing mechanical protection. It dries the roots remaining attached to the bulb following undercutting and the neck left attached to the crown following topping, deterring disease infection. Lastly, curing encourages dehydration and the sealing of wounds that may have resulted during bulb growth or mechanical damage (Boyhan, 2011). Curing could be sun-drying, air-drying and mechanical drying. Sun-drying should last for 6-10 days (Mamaril, 2013).

2.7 Marketing of Agricultural Produce

Marketing is a kind of system in order to accelerate the moving of goods from the producers to the consumers. This system encompasses two major types of activities, physical handling and exchange of price setting process.

Agricultural marketing can be defined as comprising of all activities involved in supply of farm inputs to the farmers and movement of agricultural products from the farm to the consumers. Agricultural marketing system includes the assessment of demand for farm-inputs and their supply, postharvest handling of farm products, performance of various activities required in transferring farm products from farm gate to processing industries or to ultimate consumers, assessment of demand for purchase and sale of farm inputs and agricultural products.

The definition of marketing which is most applicable of agriculture is given by Kohls and Uhi (2002). Food marketing can be defined as the performance of all business activities involved in the flow of goods and services from the point of initial agricultural production until they are in the hands of consumers.

Marketing function includes the exchange function (buying and selling), physical function (storage, transportation, processing, packaging, loading or unloading, etc.) and facilitating function (establishing grades, standard, financing, risk taking and market information).

An efficient marketing system is essential for the development of the agricultural sector. If as much as it provides outlets and incentives for increased production, the marketing system contributes greatly to an orientation of subsistence farming towards commercialization. Agricultural marketing and agricultural market is efficient when it meets the following facts:

(1) It encourages increased supply to the market of a product in its different forms.

(2) It stimulates an increased demand of marketed output.

In order to achieve 1) and 2) above, it has to ensure that the market:

(1) Operate with as minimum costs and or socially allowable

(2) Delivers the right quantity, quality and form of a product to the right consumers, at the right place and at the right time (French, 1987)

Lower food price may be achieved by greater efficiency in production and in marketing. Efforts to improve marketing system often reveal that it is essential not only to raise quality of the product, and provide better packaging and speeding transport, but also to improve the facilities and organization of the actual market (FAO, 1989).

Local factors: soil, climate and cultural practices (cultivation, irrigation, pruning, spraying, etc.) also have a market effect on the storage and marketing quality of the produce grown (FAO, 1957).

2.8 Marketing Channel/Chain

According to Stern et al. (1996), marketing channels can be viewed as sets of independent organization involved in the process of making a product or service available for consumption or use. The complexity of these channels depends upon the distance between the producers and the consumers, the availability of marketing facilities, the size of farms, and the time available for the farmer to do marketing.

Kohls and Uhl (2002) define marketing channels as alternative routes of product flows from producers to consumers. They focus on the marketing of agricultural products, as does this study. Their marketing channel starts at the farm's gate and end at the consumer's front door. The marketing channel approach focuses on firm's selling strategies to satisfy consumers' preference.

A general knowledge of the commonly used marketing channel is valuable to understand the marketing system and the correlation between markets and market agencies. The performance of a marketing channel is related with the consumption of its structure and the behaviour of the intermediaries conducting in those channels. To consider the link between intermediaries and the movement of the product from producer to consumers, the concept of marketing channel or channels of distribution needs to analyze.

2.9 Marketing Costs and Margins

Marketing costs and margins are required to understand for all stakeholders' value addition who is participating in onion marketing channel. Farmers who seek to produce a crop need to be aware not only the production costs but also the cost of marketing and demand condition. Wholesalers, retailers and processors must be fully aware of their costs if they want to trade profitably.

FAO (2007) assumes that harvesting of the crop and movement of that produce to the farm gate is part of the production cost. The first marketing cost is produce preparation including cleaning, sorting and grading. The second cost usually faced by the farmers or traders is packaging. Types of packaging may be different depending on the product types and market condition. Then handling cost in all stages of marketing chain should be taken into account that will have the labour cost of packing, unpacking, loading

and unloading. Transportation cost will be different with distance between farmer or seller and market that will also depend on the quality of roads and mode of transport. The assumption behind all commercial storage is that the price will rise efficiently while the crop is in store to cover the cost of storage.

Next invincible cost is capital cost, but it is very important to count for the interest rate if traders run the business with loan money, if not the opportunity cost should be taken into account. Finally fees, taxes, commissions are faced in agricultural marketing that all these costs have to be put into the calculations. Price incentives which are with marketing costs, affect the profits of marketing participants and their decision making. The analyzing costs are useful to compare the relative efficiency of various marketing agents (Guvheya et al., 1998).

A marketing margin is the percentage of the final weighted average selling price taken by each stage of the marketing chain. The total marketing margin is the difference between what the consumer paid and what the producer/farmer received for his product. In other words, it was the difference between retail price and farm price (Cramer and Jesen, 1982)

Olukosi and Isitor (1990) stated that marketing margin was studied to measure efficiency of markets. It was an attempt to evaluate economic or price efficiency. Generally, it referred to the difference between the retail price and the producer price. The marketing margin showed the fraction of the consumer expenditure on a commodity that was received by the producer and each of marketing agents.

CHAPTER III
RESEARCH METHODOLOGY

3.1 Description of Study Areas

3.1.1 Myingyan and Taungthar

Myingyan and Taungthar Townships are located in Mandalay Division. Myingyan is situated at 21° 06’ 105” to 21° 46’ 15” N latitude and 95° 15’ 30” to 95° 37’ 30” E longitude. Taungthar is situated at N latitude 21° 0’ 20” to 21° 24’ 00’ and E longitude 95° 06’ 105” to 95° 08’ 05”. Total area of Myingyan Township is 374.29 sq.miles and Taungthar Township is 507.21 sq.miles. Myingyan Township is composed of 66 village tracts and 186 villages. Taungthar Township is composed of 86 village tracts and 243 villages. Myingyan Township has total cultivated area of about 66,704 ha and 76,360 ha in Taungthar Township respectively.

Cereal crops such as wheat and corn, oil seed crop such as groundnut, sesame, sunflower, peas and beans, culinary crops such as pepper, chilly, garlic and onions and some vegetables have been cultivated in both areas. Among these cultivated areas, onion comprises 6.06 % (4,403 ha) of total cultivated area in Myingyan Township and, 5.95% (4,545.8 ha) in Taungthar (SLRD, 2013). The criteria for selecting these study areas were on the basis of onion growing acreage.

3.1.2 Yangon wholesale market

Yangon is the focal point of internal and external trade. Most of the surplus of agricultural produces from other State and Division enter Yangon city by means of road, rail and waterway. There are two main markets: Bayintnaung and Thirimingalar market. Bayintnaung is the wholesale market for dry goods and Thirimingalar market is for fresh produce. Many of the Myingyan and Taungthar onions are distributed to Yangon retail markets and other distance markets such as Delta region, Mawlamyine, Htawel and export markets via Bayintnaung wholesale market (Personal communication).

3.1.3 Mandalay wholesale market

Mandalay market is the focal point of upper Myanmar. It is the important terminal market and also a major transit market for onion. Agricultural produce enters Mandalay city from surrounding regions by road, railway and waterways. Kaingdan market is the major wholesale market place in Mandalay. Onions are distributed to Mandalay retail

markets and other distance markets such as Southern Shan, Kachin and Sagaing areas via Kaingdan wholesale market.

3.1.4 Nay Pyi Taw wholesale market

Nay Pyi Taw is the Capital of Myanmar. Nay Pyi Taw Aharathukha market is the wholesale fresh produce market for Nay Pyi Taw region. It is located near Kinpundan Village, Pyinmana Township. Onions are distributed to Nay Pyi Taw retail markets and other nearby markets such as Taungngu, Lewe through Aharathukha wholesale market.

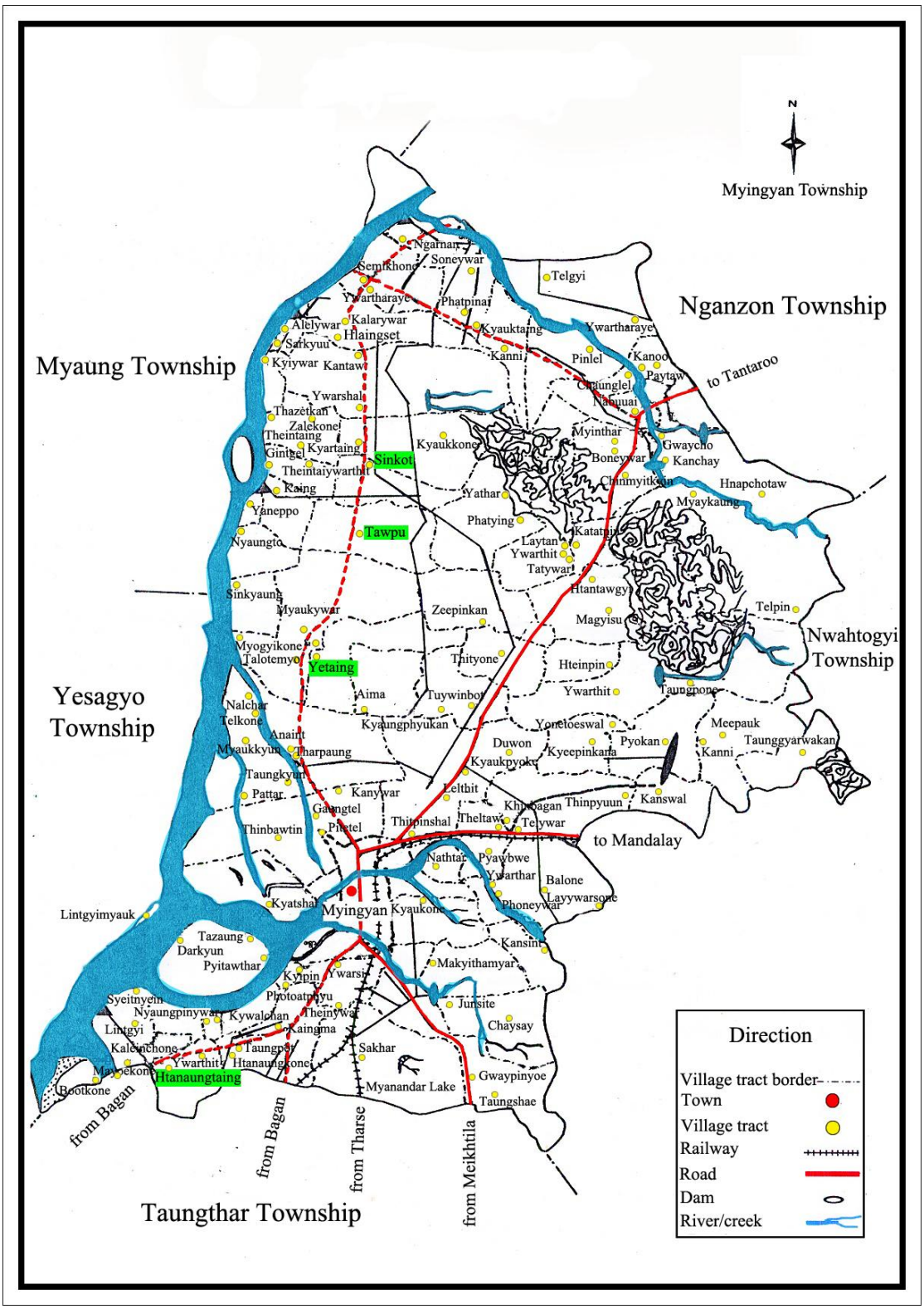

Figure 3.1 Study areas in Myingyan Township

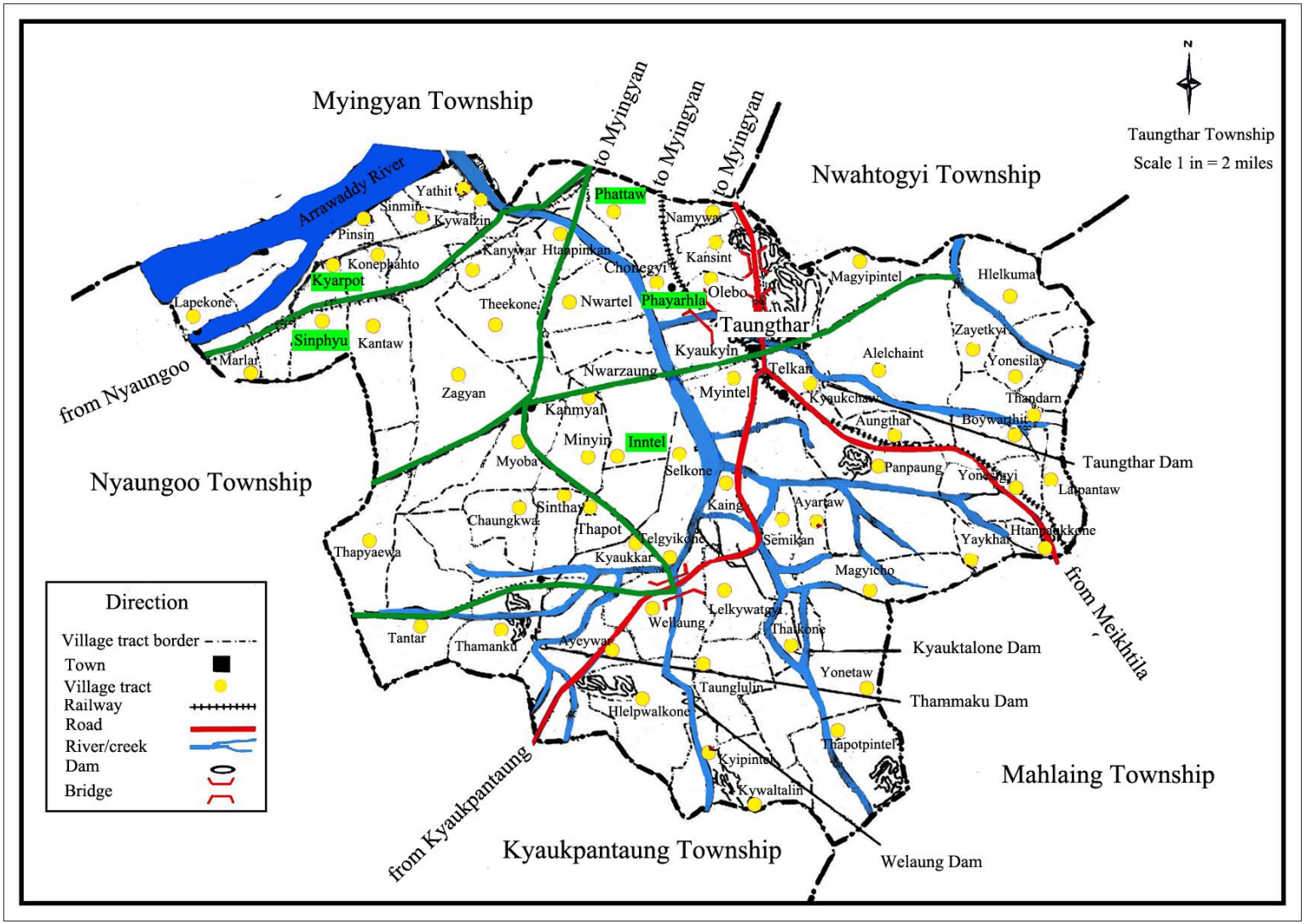

Figure 3.2 Study areas in Taungthar Township

3.2 Sampling Method and Data Collection

Simple random sampling procedure was used in collecting the data. Data for production were collected through personal interview with 90 onion growers from 9 villages in Myingyan and Taungthar areas: 40 growers from 4 villages of Myingyan and 50 growers from 5 villages of Taungthar area. Surveys in these areas were conducted twice for the production data during January (harvesting period of rainy onion) and July 2014 (storage period of winter onion) (Table 3.1). Questionnaires were prepared for studying cultivation methods, exploring constraints to the production of onion and calculating marginal revenue of onion growers in the study areas.

Each of five wholesalers from Myingyan and Taungthar were interviewed separately to overview initial stage in collection, storage and distribution of onion. Moreover, each of 5 retailers from Myingyan and Taungthar were interviewed to identify the merchandizing activities in retailing of Myingyan and Taungthar onion.

Different surveys were conducted in Yangon, Mandalay and Nay Pyi Taw markets for acquiring retailing and distribution data. These survey data attempted to overview the merchandizing activities in the marketing, wholesaling and retailing of Myingyan and Taungthar onion. Each 5 wholesalers from Bayintnaung (Yangon), Kaingdan (Mandalay) and Aharathukha (Nay Pyi Taw) wholesale markets and each 5 retailers from Tamwe (Yangon), Manmyo (Mandalay) and Myoma (Nay Pyi Taw) retail markets were interviewed to attain above data (Table 3.2).

The secondary data were obtained from Department of Agriculture (DoA), Settlement and Land Record Department (SLRD), Department of Agricultural Planning (DAP) and Ministry of Commerce (MOC).

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Table 3.1 Sample villages and number of respondents from Myingyan and Taungthar onion growing areas

No.	Township	Village	No. of respondents
1	Myingyan	Htanaungtaing	10
		Yetaing	10
		Tawpu	10
		Sinkot	10
2	Taungthar	Phattaw	10
		Phayarhla	10
		Kyarpot	10
		Sinphyu	10
		Inntel	10
	Total		90

Table 3.2 Selected market areas and number of respondents

No.	Market	No. of respondents		
		Wholesalers	Retailers	Total
1	Myingyan	5	5	10
2	Taungthar	5	5	10
3	Bayintnaung wholesale market (Yangon)	5	-	5
4	Tamwe retail market (Yangon)	-	5	5
5	Kaingdan wholesale market (Mandalay)	5	-	5
6	Manmyo retail market (Mandalay)	-	5	5
7	Aharathukha wholesale market (Nay Pyi Taw)	5	-	5
8	Myoma retail market (Nay Pyi Taw)	-	5	5
	Total	25	25	50

3.3 Data Analysis

The Statistical Package for Social Science (SPSS) version 21.0 computer software was used for descriptive analysis of farm actual data and other economic data for marketing, distribution and retailing. Pearson's correlation coefficient was used to analysis the relationship between adoptions of cultural practices and yield.

3.3.1 Cost and return analysis

Enterprise budgeting is used in the economic analysis. The cost and return analysis was used to determine the profitability of the crop in the study areas. Both cash and non-cash items were included in the estimation of material cost and labor cost. Non-cash items for material cost were owned seed, owned working animals, owned FYM and so on. Cash payment for labor included hired labor and payment for land preparation (hired tractor or working animals).

Profitable measures were estimated by using the following formulae:

1. Return Above Variable Cost = Total Gross Return – Total Variable Cost

   RAVC = TGR – TVC

2. Return Above Variable Cash Cost = Total Gross Return – Total Variable Cash Cost

   RAVCC = TGR – TVCC

3. Benefit Cost Ratio = Total Gross Return/ Total Variable Cost

   BCR = TGR/TVC

4. Gross Margin per unit of land = Total Gross Return – Total Variable Cost

Other measurements used in economic analysis are as follows;

Total Variable Cash Cost = Total material costs + Total hired labor cost

Total Variable Cost = Total variable cash cost + Total family labor cost

3.3.2 Marketing costs and margins

Marketing costs are the total costs for bringing produce from the farm to the consumer. Margins are the costs that are added by transporters and traders to cover their expenses and to provide a profit for their services. They are added to the basis of farm gate price of a product.

In this study, marketing margin is calculated using the concurrent method (Market Research and Planning Cell 1985) whereby prices at consecutive levels of the marketing channel are compared at the same point in time. Hence, a marketing margin is specified as:

$$M_t^L = P_t^L - P_t^{L-1}$$

M_t^L = Margin between market level (L) and its proceeding level (L-1) at time t

P_t^L = Price at market level (L) at time t

P_t^{L-1} = Price at market level (L-1) at time t

When marketing margins at different levels of the marketing chain are to be compared, it is common to use the consumer price as to common denominator for all margins. The following are some commonly used indicators in the analysis**.**

(a) Total Gross Marketing Margin (TGMM)

TGMM = (Consumer Price–Farmer's Price)/Consumer Price x 100

Margin of Wholesaler = (Consumer Price–Wholesaler's Price)/Consumer Price x 100

Margin of Retailers = (Consumer Price–Retailer's Price)/Consumer Price x 100

(b) Farmer's portion of Producer's Gross Marketing Margin (PGMM)

PGMM = (Consumer Price – Marketing Gross Margin)/Consumer Price x 100

(c) Gross Marketing Margin = Average Selling Price – Average Buying Price

(d) Profit = Gross Marketing margin – Total Marketing Cost

The magnitude of margins is considered as improving efficiency in the marketing channel which could go a long way in increasing income and/or ensuring affordable prices to the urban consumers.

CHAPTER IV
RESULTS AND DISCUSSION

4.1 Characteristics of Sample Farmers

The demographic and social characteristic of sample farmers in the study areas is shown in Table 4.1. The age of respondents ranged from 20 to 75 years. Most of the respondents (72% in Taungthar and 76.9% in Myingyan) had 40-60 years of ages. The working experience of respondents ranged from 3 to 50 years. In this study, 48% of respondents from Taungthar and 69.2% of respondents from Myingyan had 16-30 years of working experience.

The education of the respondents ranged from monastery to graduated level. Most growers (68% in Taungthar and 53.8% in Myingyan) had the primary and monastery level of education.

Most of respondents from Taungthar (62.0%) were small scale farmers (< 3.3 ha of total cultivated area), while about half of the respondents from Myingyan (48.7%) were medium scale farmers (3.3 to 6.5 ha of total cultivated area). Average farm size was 3.80 ha ranging from 0.21 to 9.31 ha. Respondents from Myingyan area possess more cultivated area than those from Taungthar area. Most of the respondents (70.0% of the growers from Thaungthar and 76.9% of the growers from Myingyan) operated less than 1.3 ha of onion growing area.

4.2 Growing Systems Adopted by Sample Farmers

There were two different types of onion growing systems in the study areas. This difference was depending upon the season- rainy and winter. For rainy onion, all farmers from both areas used bulb to bulb growing system because of its short growing period which depends upon weather condition. Irrigation practice was mainly dependent on the rainfall. In this growing system, small and unmarketable bulbs from the previous season were used as seed onions (sets). That kind of growing system was locally called as “Zaw-Site” or “Rainy onion growing”. For winter season, seed to bulb system was adopted by all farmers in the study areas. Most of the farmers used their own seeds produced during previous season. In this system, the transplanting of seedlings was used by all farmers in the study areas.

Table 4.1 Demographic characteristics of sample farmers in the study areas

Characteristics	Percent of respondents	
	Taungthar (n = 50)	Myingyan (n = 40)
Age (year)		
< 41	24.0	12.8
41 – 60	72.0	76.9
> 60	4.0	10.3
Education level		
Monastery and primary	58.0	53.8
Middle school	28.0	30.8
High school and above	14.0	15.4
Work experiences (year)		
< 16	32.0	12.8
16 – 30	48.0	69.2
> 30	20.0	18.0
Total cultivated area(ha)		
< 3.3	62.0	33.3
3.3 – 6.5	28.0	48.7
> 6.5	10.0	17.9
Onion growing area(ha)		
< 1.3	70.0	76.9
1.3 – 2.4	22.0	17.9
> 2.4	8.0	5.2

For winter onion growing, the farmers raise the seedlings during September-October, transplant the seedlings in December-January and harvest the bulb in April. Rainy onion growing is begun in September-October and ended up in December-January. Rainy onion cannot be stored due to its highly perishable nature mainly because of the presence of high moisture content. According to the respondents, the winter onion can be stored up to 6 months without sprouting.

4.3 Growing Practices

In this section, the information on cultivation practices, source of seed, seed rate, rate of fertilizer and control measure of pests and diseases are presented. These informations will aid to understand the cultural practices for onion production in the study area and to estimate the cost and return of production.

4.3.1 Varieties used

Table 4.2 presents the varieties, sources of seeds and land preparation practices followed by the sample growers. Two major local cultivars were observed in the study areas. In both growing seasons, about 75% of the respondents from Myingyan and 40 % respondents from Taungthar used the variety which is locally known as “Sint Aoe” or “Kyaw Min”. The rest of the respondents (25% from Myingyan and 60% from Taungthar) in both season used “Shwe-Phalar Hteik Mauk” variety which is locally called “U Phay Gyi” variety. In Taungthar, “Shwe-Phalar Hteik Mauk” variety was more commonly used whereas “Kyaw Min” variety was more popular in Myingyan.

All these varieties are local cultivars and believed to be cultivated in these areas more than 20 years ago. According to some experienced growers, these varieties were shifted from Myaung Township which is located in Sagaing Division. No hybrid varieties were used by sample farmers in the study areas.

4.3.2 Sources of seeds

Most of the farmers used their own seeds produced during the previous season. About 89.74% of respondents from Taungthar and 79.31% from Myingyan used their own seeds for winter onion growing. During rainy season, most of the respondents (88.24% respondents from Taungthar and 67.65% from Myingyan area) used their own sets. The rest of the respondents bought the required seeds and sets from neighboring villages.

4.3.3 Land preparation

Land preparation for rainy onion begins as soon as the rain starts to fall. Normally during June and July, most of the farmers begin land preparation. Plowing and harrowing was done by using animal drawn ploughs or tractors. There was no exact number of the frequency of plowing and harrowing. Usually the farmer practice 9 to 10 times of plowing and harrowing for land preparation. Most of the respondents assumed that onion thrives best on well-drained soil.

Seed bed preparation for winter onion begins almost the same time as rainy onion growing. Ploughing and harrowing were performed two to three times for seedbeds preparation. Usually, the width of a seedbed was about 1.10 m and the length was varied dependent on the farm size. Land preparation for planting was practiced during July and August. There are two types of growing bed systems in the study areas: raised bed and sunken bed system. Seventy-six percent of the respondents from Taungthar area adopted raised bed system while almost all of the respondents from Myingyan study areas practiced sunken bed system during winter season. The planting beds were about 0.15 m high and about 1.52 m wide. The lengths of the seed beds were vary depending on the farm size. Sunken beds of 1.83 x 1.83 m, 1.21x 1.21 m and 1.21 x 1.83 m was used in study areas for the purpose of maintaining more irrigated water during the hot weather. Raised beds were prepared the same way as done in rainy onion growing. Between each plot, about 0.30 m wide walkways were made.

Table 4.2 Varieties used, sources of seeds and planting bed systems adopted by the sample farmers

Practices	Percent of respondents			
	Winter onion		Rainy onion	
	Taungthar n = 37	Myingyan n = 24	Taungthar n=32	Myingyan n=33
Onion varieties				
Shwe-Phalar Hteik Mauk	60.00	25.00	60.00	25.00
SintAoe	40.00	75.00	40.00	75.00
Seed sources				
Own seeds	89.74	79.31	88.24	67.65
Buy seeds	10.26	20.69	11.76	33.35
Planting bed system				
Raised bed system	76.00	-	100.00	100.00
Sunken bed system	24.00	100.00	-	-

(a)

(b)

Plate 1 Varieties used by the sample farmers in the study areas

(a) Shwe-Phalar Hteik Mauk (or) U Phay Gyi variety (local Name)
length ≈ 2 to 7 cm, height ≈ 2 to 5 cm

(b) SintAoe (or) Kyaw Min variety (local name)
length ≈ 2 to 6 cm, height ≈ 2.5 to 5 cm

(a)

(b)

Plate 2 Planting bed systems observed in the study areas

(a) Sunken bed system onion growing

(b) Raised bed system onion growing

Plate 3 Young seedlings which were ready for transplanting

Plate 4 Sets for rainy onion growing

4.3.4 Raising of onion seedlings

Table 4.3 presents the percent of sample farmers practicing some of the preharvest cultural practices. All the farmers practiced transplanting system in winter onion growing. Direct seeding was not adopted by the growers in the study areas. Most of the respondents from both study areas (68% in Taungthar and 59% in Myingyan) used 14 to 19 kg/ha of seed rate in winter onion growing. An average seed rate is about 15.37 kg onion seeds for one hectare growing. Although about 7.69 kg is required for one hectare, most farmers used to grow more seeds to compensate the unnecessary damages (personal communication). Small, under sized or unmarketable dry bulbs produced from previous winter season were selected to be used as the seeds (sets) for rainy onion production. Most farmers carefully selected the bulbs to be free from any damages and diseases. After the selection, they stored the selected bulbs separately from other onions which are subject to be sold.

In winter onion production, about 43.24% of respondents from Taungthar mulched their seed beds with rice straw while 16.67% of respondents from Myingyan adopted mulching after seed sowing. About 7 to 10 days after seed sowing those farmers removed the rice straw cover from the seed beds. It was then irrigated at least once a day. It was found that 21.62% of the respondents from Taungthar area adopted the seeds pretreatment with pesticides in order to protect the seeds from soil borne pathogens. Very few percent of the respondents (4.17%) from Myingyan area adopted seed pretreatment.

During sowing seeds, all the farmers broadcasted the seeds by hands. No seeders or in line sowing techniques were observed. About 91.18% of the respondents from Taungthar and 79.17% in Myingyan used foliar sprays during seedling raising. Urea application was usually started 15 days after sowing. Most respondents performed 2 to 3 times of urea application to seedbeds before transplanting.

Hand weeding in seed bed was usually done twice before transplanting. But applications of herbicides to seedbeds were not found in this study. As the bulb to bulb growing system was used for rainy onion, it did not need to raise seedlings for rainy onion production.

4.3.5 Plant density

For the rainy onion growing, most farmers used two row planting systems. Two parallel rows of onion plants were put together on the small raised beds. The plants were usually grown 0.08 m apart within rows and 0.15 to 0.3 m apart between rows. Most of the growers (50% in Taungthar and 69.7% in Myingyan) from both study areas, adopted

the two row planting system, 0.15m x 0.08m. For winter onion production, whether it was raised bed system or sunken bed system, plant spacing was nearly the same in all fields. Usually most of the respondents (91.9% from Taungthar study area and 95.8% from Myingyan study areas) used 0.08 x 0.08 m of plant spacing. Total population density was around 156 plants per m^2, which is too dense.

As stated before, the bulb yield may increase with plant density to a certain limit. Since the closer spacing resulted in smaller bulbs while wider spacing increases bulb size (Sinnadurai, 1978 and Singh, 1995), too much plant density could pose some problems in nutrient competition which may lead to difficulties in handling the practices such as weeding and harvesting.

Table 4.3 Adoption of some preharvest cultural practices by the sample farmers in study area

Practices	Percent of respondents			
	Winter onion		Rainy onion	
	Taungthar n = 37	Myingyan n = 24	Taungthar n=32	Myingyan n=33
Growing systems				
Seed to bulb	100.00	100.00	-	-
Bulb to bulb	-	-	100.00	100.00
Seed rate (kg/ha)				
< 14	28.00	37.04	-	-
14 – 19	68.00	59.26	-	-
> 19	4.00	3.70	-	-
Bulb rate (kg/ha)				
< 1,211	-	-	31.25	47.06
1,211 – 1,614	-	-	40.63	44.12
> 1,614	-	-	28.12	8.82
Foliar spray to seed beds				
Adopter	91.18	79.17	-	-
Non adopter	8.82	20.83	-	-
Seeds pretreatment				
Adopter	21.62	4.17	-	-
Non adopter	88.38	95.83	100.00	100.00
Mulching (rice straw)				
Adopter	43.24	16.67	-	-
Non adopter	56.76	83.33	100.00	100.00
Spacing				
Multiple row (0.08 x0.08)	91.90	95.80	3.10	3.00
Multiple row (0.10 x0.10)	8.10	4.20	-	-
Two row (0.15 x 0.08)	-	-	50.00	69.70
Two row (0.20 x 0.08)	-	-	9.40	15.10
Two row (0.30 x 0.08)	-	-	37.50	12.20

4.4 Chemical Fertilizers and Organic Manure Application

4.4.1 Fertilizer application in winter onion

Table 4.4 presents the fertilizer application and irrigation practices of sample growers. Only cow dung manure was used as source of organic manure in the study areas. About 95 % of respondents from Taungthar area and 29.17% from Myingyan area used cow dung manure. This may be because most of the respondents from Myingyan areas used cow dung manure more on other crop growing than in winter onion production. Basal application of urea was practiced by 48.65% of respondents from Taungthar and 79.17% from Myingyan area. More respondents from Myingyan area used urea in basal application before transplanting.

About 304.12 kg/ha of urea was used by the farmers in Taungthar. It was found that more usage of urea (395.77 kg/ha) in Myingyan area compared to Taungthar during winter onion growing. Although more amount of urea was used, respondents from Myingyan area practiced less number of split application. About 45.95% of respondents from Taungthar area performed more than 5 times of urea split application while about half fold of the respondents (45.83%) from Myingyan study area performed 3 to 4 times of urea split application. Less split application of urea can cause more losses of nitrogen in various means.

Application of compound fertilizers was practiced by 31.43% of respondents from Taungthar and 45.83% of respondents from Myingyan study areas. Average rate of compound fertilizers used was 34.46 kg/ha in Taungthar and 86.86 kg/ha in Myingyan area. During winter onion growing, more usage of cow dung manure, more split applications of urea fertilizer and less usage of inorganic fertilizers were observed in Taungthar compared to Myingyan study area.

4.4.2 Fertilizer application in rainy onion

During rainy season, most of the farmers from both study areas (81.25% in Taungthar and 81.82% in Myingyan) used cow dung manure. Almost all of the farmers put cow dung manure during land preparation. Over half (59.38%) of respondents from Taungthar and 69.70% from Myingyan used urea in basal application during bulb planting. Most of the respondents (60.00% of respondents from Taungthar and 88.89% from Myingyan respectively) practice split application less than 3 times and less split application was more common in Myingyan.

Average rate of urea usage was 314.08 kg/ha in Taungthar area and 204.29 kg/ha in Myingyan. The use of urea fertilizers was more common in Taungthar. Average rate of compound fertilizer was 78.77 kg/ha in Taungthar and 69.93 kg/ha in Myingyan. More usage of urea fertilizer, more split application of urea fertilizer were noted in Taungthar area. Basal urea application and compound usages were nearly the same in both study areas.

4.5 Irrigation

All of the respondents used furrow irrigation system. Most of the farmers used underground water for irrigation. But the frequency of irrigation in winter and rainy season are different.

4.5.1 Irrigation in winter season

During the cold season, most of the respondents in the study areas (67.57% in Taungthar and 58.33% in Myingyan) irrigated more than 5 times. About one-third of the respondents from Myingyan area irrigated less than 5 times. Less irrigation frequency was more common in Myingyan area. The respondents from Taungthar area irrigated their fields more frequently than respondents from Myingyan.

4.5.2 Irrigation in rainy season

During rainy season, main irrigated water is mostly dependent on the amount rainfall. So the frequency of irrigation in rainy season was less than that in winter season. Most of the respondents (60.61%) from Myingyan study area irrigated their farms less than 3 times during this season, while two-third of the respondents from Taungthar study area (65.63%) irrigate 3 – 4 times during this season.

Table 4.4 Fertilizer application and irrigation practices of sample growers in the study areas

Inputs	Percent of respondents			
	Winter onion		Rainy onion	
	Taungthar n = 37	Myingyan n = 24	Taungthar n=32	Myingyan n=33
Cow dung input	94.59	29.17	81.25	81.82
Basal input of urea	48.65	79.17	59.38	69.70
Frequency of urea split application				
< 3	24.32	37.50	60.00	88.89
3 – 4	29.73	45.83	40.00	11.11
> 4	45.95	16.67	-	-
Foliar spraying				
Adopter	100.00	87.50	90.63	81.82
Non adopter	-	12.50	9.37	18.18
Compound fertilizer aplication				
Adopter	32.43	45.83	50.00	45.45
Non adopter	67.57	54.17	50.00	54.55
Frequency of irrigation				
< 3	-	-	28.13	60.61
3 – 4	8.11	33.33	65.63	39.39
5 – 6	67.57	58.33	6.25	-
> 6	24.32	8.33	-	-

Table 4.5 Amount of inorganic fertilizers used by the respondents in the study areas

Item		Minimum kg/ha	Maximum kg/ha	Average kg/ha
Urea fertilizer				
Winter onion	Taungthar	70.60	494.22	304.12
	Myingyan	185.33	741.33	395.77
Rainy Onion	Taungthar	98.84	741.33	314.08
	Myingyan	61.78	494.22	204.29
Compound fertilizer				
Winter onion	Taungthar	0.00	185.33	34.46
	Myingyan	0.00	494.22	86.86
Rainy Onion	Taungthar	0.00	411.86	78.77
	Myingyan	0.00	247.11	69.93

Plate 5 Harrowing and distribution of cow dung manure

Plate 6 Cow dung manure application during land preparation

4.6 Protection Practices

4.6.1 Weed control

All the respondents from Taungthar area and 83.33% from Myingyan area practiced hand weeding and herbicide spraying together for weed control in winter season. Very few percent of respondents (about 12.5%) from Myingyan study area practiced hand weeding only. During rainy onion growing, most farmers from Taungthar (83.87%) and around half fold of the respondent from Myingyan (54.55%) performed hand weeding and herbicide spraying for weed control. Nearly 10% of growers from Taungthar study area and about one third of the growers from Myingyan study area (39.39%) practiced hand weeding only during rainy onion growing. Application of herbicides was lower in Myingyan study area compared to Taungthar. In both study areas, the use of herbicide was lower in rainy onion growing (Table 4.6).

Generally, most of the respondents practiced 1 to 3 times of hand weeding during each growing season. The number of hand weeding was found to vary depending on the weed condition.

4.6.2 Insects and disease control

The frequencies of application of pesticides are presented in Table 4.6. It was found that all the respondents in study areas used insecticides for insect control. The most commonly infested insects in study areas were hispa, thrips and aphids. About half of the respondents from Taungthar and Myingyan study areas (48.60 % and 50 % respectively) applied insecticides more than six times during winter season. Average number of insecticides application followed by the respondents during winter season was around seven times in both study area: 7.22 in Taungthar and 6.54 in Myingyan and ranging from 2 to 15 times in winter season. Comparing to winter season, the number of insecticide application in rainy season is lower in both study areas. Average application frequencies were about 4 times in Taungthar and about 3 times of application in Myingyan. Half of the respondents from Taungthar (46.90%) and most of the respondent from Myingyan (84.80%) practiced less than three times of insecticide applications during rainy season (Table 4.7).

About 94.59% of respondents from Taungthar and 70.83% from Myingyan used fungicides during winter onion growing. Seventy-five percent of respondents from Taungthar and 57.58% from Myingyan used fungicides during rainy onion growing. The adoption of fungicides application was more common in Taungthar. Average frequencies

of fungicide application were about 4 times in Taungthar and about 3 times of application in Myingyan study area during winter season. During the rainy season, average application frequencies were lower in both study areas. More frequency of fungicides application was observed during the winter onion growing comparing to rainy onion growing in both study areas. The most severe onion diseases found in the study areas were downy mildews, powdery mildew, purple blotch and neck rot. No conventional ways of control measures for pest and diseases were observed in both study areas.

4.6.3 Most common pesticides and fungicides used by the onion farmers in the study areas

The most common insecticides used in the study areas were Fosteen, Shwe siper, Shaolin and Cyan (Pyrithroid groups). These pesticides were used to control Hispa (young and adult). Following were Tenchent and Pilot (Pyrithroid and Organo phosphate groups), which were also targeted to control the Hispa at larva stage. Profenofos and Acephate (Organo phosphate chemical groups) stood in the third place in the study areas. These chemicals are aids to control the Thrips and Aphids. Among all the pests in the study areas, Hispa seemed to be the most threatening pest for the respondents in the study areas (Table 4.8).

The most common fungicides in the study areas were Kumulus, Sulphur and Armo crown (Inorganic compound groups: Sulphur and Copper oxychloride), which were used to control the Powdery and Downy Mildew. The uses of Sulphur fungicides have another purpose. It can provide the Sulphur compounds which are needed to strengthening the cell walls of the plants. Dithane, Agrithane, Mep zeta and Mancozeb (Dithio-carbarmate) were the second most common fungicides used by the farmers to control Downy mildew disease. The third most common fungicides in the study areas were Armo venus, Skat and Shwe zopin (Trirazole groups). These chemicals are aimed to control the Anthranose, Purple blotch and neck rot diseases (Table 4.9).

Table 4.6 Crop protection practices adopted by the respondents

Practices	Percent of respondents			
	Winter onion		Rainy onion	
	Taungthar n = 37	Myingyan n = 24	Taungthar n=32	Myingyan n=33
Weed control				
Hand weeding only	-	12.50	9.68	39.39
Herbicides only	-	4.17	6.45	6.06
Both hand weeding and herbicide	100.00	83.33	83.87	54.55
Insecticide application				
Adopter	100.00	100.00	100.00	100.00
Non adopter	-	-	-	-
No. of insecticide application				
< 4	5.40	12.50	46.90	84.80
4 – 6	46.00	37.50	50.00	12.6
> 6	48.6	50.00	3.10	3.00
Fungicide application				
Adopter	94.59	70.83	75.00	57.58
Non adopter	5.41	29.17	25.00	42.42
No. of fungicide application				
< 4	29.70	83.30	100.00	97.00
4 – 6	64.90	-	-	3.00
> 6	5.40	16.70	-	-

Table 4.7 Frequency of pesticides spraying adopted by the respondents in the study areas

Pesticide spraying		Minimum (Number)	Maximum (Number)	Average (Number)
Insecticide application				
Winter onion	Taungthar	2.00	7.22	15.00
	Myingyan	3.00	6.54	14.00
Rainy onion	Taungthar	1.00	4.00	10.00
	Myingyan	1.00	2.88	8.00
Fungicide application				
Winter onion	Taungthar	0.00	4.19	7.00
	Myingyan	0.00	2.87	14.00
Rainy onion	Taungthar	0.00	1.53	3.00
	Myingyan	0.00	1.27	4.00

Table 4.8 Usage of common pesticides and their targeted pests in the study areas

Chemical groups	Common name	Trade name	% usage	Targeted pests
Pyrithroid	Cypermethrin	Fosteen	44.9	Hispa (young)
		Shwe siper		Hispa (adult)
	Cyhalothrin	Shaolin		
	Chlopyrifos	Cyan		
Pyrithroid + Organo phosphate	Chlopyrifos + Cypermethrin	Tenchent	26.55	Hispa (larva)
		Pilot		
Organo phosphate	Profenofos	Map nofos	17.00	Thrip, Aphid
	Acephate	Viter shield		
		Acephate		
	Dimethoate	Map fin		
		Diamond		
Carbamate	Carbofuran	Furadan	10.20	Soil born pests
Neonikothroid	Imidacloprid	Armo mida	1.36	Thrip, Aphid
			100	

Table 4.9 Usage of common fungicides and their targeted diseases in the study areas

Chemical group	Common name	Trade name	% usage	Targeted diseases
Inorganic compound	Sulphur	Kumulus	34.23	Powdery mildew, Support sulphur compound
		Sulphur		
	Copper oxychloride	Armo crown	17.81	Downy mildew
Dithio-carbarmate	Mancozeb	Dithane	23.29	Protection and Downy mildew
		Agrithane		
		Mep zeta		
		Mancozeb		
	Propineb	Antracol	1.37	Protection
Trirazole	Propiconazole	Armo venus	16.44	Anthranose, Purple blotch, Neck rot
		Skat		
	Azoxystroben	Shwe zopin	1.37	Neck rot
Benzylmedazole	Carberdazin	Armo ranger	4.11	Neck rot, Anthranose
		Carberdazin		
		Cubromide	1.37	
			100	

4.7 Harvesting and Post-harvest Practices

4.7.1 Harvesting

The decision making to harvest and yield data are presented in Table 4.10. No mechanical harvesting was observed in the study areas. All the farmers practiced hand harvesting. Small crowbars were used on hard-surfaced soils. Very little amount of harvest damages were found in the study areas. Farmers carefully removed these damaged bulbs and used for their home consumption.

During the winter onion growing, most of the respondents in the study areas (98% from Taungthar and 96.3% from Myingyan) decided the harvesting time by looking up the collapse of leaves. But in the rainy onion growing, most of the respondents (about 72% from Taungthar and nearly half of the respondents from Myingyan) decided the harvesting times based on the market price.

Most of the respondents from Taungthar (78%) obtained the bulb yield between 12,105 to 16,140 kg/ha, while about 41% of respondents from Myingyan study area received 8,070 to 12,105 kg/ha of bulb yield in winter onion growing. The bulb yield of rainy onion is lower than that of winter onion in both study areas. Most of the respondents from the study areas (84.38% from Taungthar and 72.73% from Myingyan) obtained 4,035 to 8,070 kg/ha of onion bulb yield in rainy onion growing. The average yield of winter onion was 15208.99 kg/ha in Taungthar and 11654.60 kg/ha in Myingyan. For the rainy onions, it was observed that average bulb yield in Taungthar was 6746.14 kg/ha and Myingyan was 5914.87 kg/ha. The average yield in Taungthar study areas was higher than that in Myingyan study area in both growing seasons (Table 4.11).

4.7.2 Post-harvest operation

Table 4.12 presents adoption of some post-harvest practices by the participants throughout the market channel. All the farmers from the study areas performed neck cutting and cleaning processes (removing the mud from bulb and winnowing). Curing and sorting of decayed bulb after harvesting was practiced by all the farmers for the purpose of storage. It was assumed that all the farmers in the study areas understood the importance of curing and removing the decayed bulbs. If the cleaning and sorting were not performed carefully, the postharvest losses will be high. About 86 % of farmers from Taungthar and 83% from Myingyan area practiced removing the loose outer shells before storing the produce. About 62% of sample growers from Taungthar area and 75 % from Myingyan practiced grading. Mainly two sizes of grading were practiced in both areas.

All the grading processes were performed by visual mean. The rest of the sample growers did not perform grading. Instead, they sold their produces after cleaning. No graded onions (all sizes) were put together in the mesh bags and transported to nearby towns by the vehicles like tractors and light trucks. That kind of mixed sizes were locally called "Jon".

Nearly every respondent stored winter onion during summer (97% growers from Taungthar and 100% from Myingyan). For rainy onion, storing was not observed in both areas because of the presence of high water content and the nature of highly perishable. All the growers sold the produces as soon as after harvested.

All the wholesalers from Myingyan and Taungthar areas practiced sorting of decay bulbs, removing outer loose shells and grading process. They also tended to store for longer period than other market participants from Yangon, Mandalay and Nay Pyi Taw wholesale markets. Most of the wholesalers from Taungthar and Myingyan study areas sold their produces only when the price was high. Selling onion was largely depended on the price situation. Sometime, they stored their produces up to 5 or 6 months while waiting for reasonable higher price.

Storing the bulbs was practiced at each market level. Storage period was different depending upon the market price. Mostly, longer storage was observed at the wholesalers from Taungthar and Myingyan comparing to other wholesalers from different markets. In Mandalay and Nay Pyi Taw wholesale market, cleaning, sorting and grading processes were employed. But, wholesalers from Yangon area did not perform the cleaning process. The wholesalers from Yangon sold the commodities as soon as they are arrived. Longer storage of onion was not observed at Yangon, Mandalay, and Nay Pyi Taw wholesale markets. Mostly, they stored the produces for about 7 to 10 days long.

Table 4.10 Decision to harvest and yield of sample farmers in study areas

Items	Winter onion		Rainy onion	
	Taungthar	Myingyan	Taungthar	Myingyan
Decision to harvesting				
Leaves soften	-	-	28.10	44.80
Collapse of leaves	98.00	96.30	-	-
Price basis	-	-	71.90	48.30
Plant age	2.00	3.70		6.90
Yield (kg/ha)				
< 4,035	-	4.17	3.13	24.24
4,035 – 8,070	-	16.67	84.38	72.73
8,070 – 12,105	5.41	41.67	12.50	3.03
12,105 – 16,140	78.38	29.87	-	-
> 16,140	16.22	8.33	-	-

Table 4.11 Average bulb yield observed in the study areas

Item		Average kg/ha	Minimum kg/ha	Maximum kg/ha
Winter onion	Taungthar	15208.99	10760.16	27092.54
	Myingyan	11654.60	3228.05	18157.77
Rainy onion	Taungthar	6746.14	4035.06	12105.18
	Myingyan	5914.87	1210.52	18157.77

Table 4.12 Adoption of respondents to post-harvest operations

No.	Processes	Percent of respondents				
		Farmers		Wholesalers		Retailers
		Taungthar (n= 50)	Myingyan (n= 40)	Taungthar, Myingyan (n=10)	YGN, MDY, NPW (n=15)	All markets (n=25)
1	Neck cutting	100	100	-	-	-
2	Curing	100	100	-	-	-
3	Sorting of decayed bulb	100	100	100	77	100
4	Removing outer loose shell	86	83	100	77	100
5	Grading	62	75	100	77	100
6	Storing	97	100	100	100	100

YGN = Yangon, MDY = Mandalay, NPW = Nay Pyi Taw

Plate 7 Tools used in weeding locally called "Gaout"

Plate 8 Small crowbars used for harvesting on hard surfaces

Plate 9 Cutting neck and roots

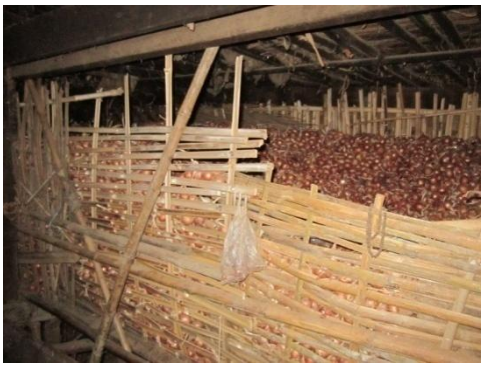
Plate 10 Decayed and shrunken bulbs removed by the farmers

Plate 11 Cleaning and grading practices performed by wholesalers

Plate 12 Decayed, shrunken and unmarketable bulbs removed by the wholesalers

Plate 13 Open field curing of rainy onion before cleaning

Plate 14 Open shed curing of winter onion



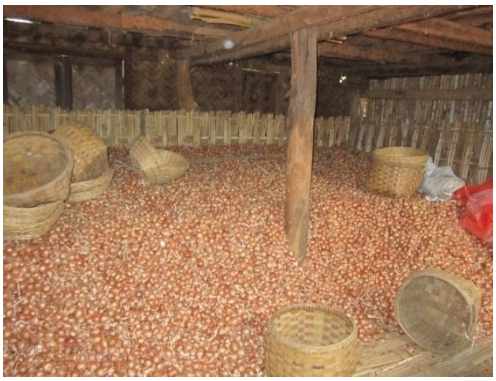


Plate 15 Small scale storage conditions practiced by onion farmers

(a)

(b)

Plate 16 Large scale storage conditions practiced by wholesalers in

(a) Myingyan and Taungthar areas

(b) Yangon, Mandalay and Nay Pyi Taw areas

Plate 17 Transportation to local wholesale markets by tricycle and tractor

(a) (b)

Plate 18 Transportation to wholesale markets by big trucks

(a) Loading practices found in Mandalay wholesale market

(b) Transporting to distant markets by big truck

4.8 Correlation Coefficient between Adoption of Cultural Practices, Yield and Production Cost

4.8.1 Correlation coefficient between adoption of cultural practices and yield for winter onion

Table 4.13 and 4.14 present the correlation coefficients between adoption of cultural practices and yield for winter onion production in Taungthar and Myingyan. During the winter onion growing, yield was positively and significantly related to the frequency of urea split application in Taungthar study area. This finding implied that more frequent application of urea fertilizer was a factor for achieving more yields in Taungthar. Although it was not significant, there was a positive correlation between the yield and the frequency of urea split application in Myingyan.

The number of irrigation was significantly correlated with yield in Myingyan study area. This result meant that more frequency of irrigation can enhance the yield. It was stated that although the storage loss was high, increase in number of irrigation can give higher yield than less number of irrigation (Biswas et al., 2010). The number of irrigation was also positively correlated with the yield in Taungthar study area, although not significant. Moreover, the number of urea split application was positively and significantly correlated with the frequency of irrigation in both study areas. This was because most of the growers in study areas performed the application of urea fertilizers and the irrigation practices altogether.

However, there was a negative correlation between the yield and the amount of urea basal application, which was significant in Myingyan study area. This result implied that if the more amount of urea fertilizer was used in basal application, the lower bulb yield would be resulted. Interestingly, there was a negative correlation between the amount of urea in basal application and the urea split application times in Taungthar. Although it was not significant, the negative correlation between the amount of basal urea and the number of split application was also observed in Myingyan area. According to this result, it can be assumed that the sample growers who use more amount of urea fertilizer in basal application performed less number of urea split application.

The production cost was positively correlated with the practices such as number of urea split application and irrigation times in both of Taungthar and Myingyan areas. It was significant in Taungthar area. These results indicated that the frequency of urea split application and the irrigation times were some of the contributing factors for high production cost.

Table 4.13 Correlation coefficient (R) between adoption of production practices and yield of winter onion growing in Taungthar

	Yield	Seed rate	Amount of cow dung used	Amount of Compound fertilizer	Amount urea (basal)	Amount of urea (total)	No. of urea split application	No. of irrigation
Yield	1							
Seed rate	0.028	1						
Amount of cow dung used	0.168	-0.301	1					
Amount of compound fertilizer	-0.185	-0.109	-0.115	1				
Amount of urea (basal)	-0.250	0.144	-0.202	-.0075	1			
Amount of urea (total)	0.191	-0.063	-0.024	-0.228	0.136	1		
No. of urea split application	0.384*	-0.405*	0.161	-0.184	-0.486**	0.293	1	
No. of irrigation	0.206	-0.256	0.001	-0.235	-0.354*	0.318	0.662**	1
Production cost	0.282	-0.128	0.152	-0.320	-0.349*	0.292	0.598**	0.505**

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.14 Correlation coefficient (R) between adoption of production practices and yield of winter onion growing in Myingyan

	Yield	Seed rate	Amount of cow dung used	Amount of Compound fertilizer	Amount urea (basal)	Amount of urea (total)	No. of urea split application	No. of irrigation
Yield	1							
Seed rate	-0.024	1						
Amount of cow dung used	0.161	-0.059	1					
Amount of compound fertilizer	-0.170	0.256	-0.204	1				
Amount of urea (basal)	-0.402*	0.393	-0.324	0.279	1			
Amount of urea (total)	0.018	0.425*	0.109	-0.034	0.274	1		
No. of urea split application	0.305	-0.404	-0.074	-0.230	-0.251	-0.338	1	
No. of irrigation	0.429*	-0.221	0.318	-0.072	-0.593**	-0.149	0.412*	1
Production cost	0.222	0.417*	-0.382	0.062	-0.062	0.091	0.115	0.072

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

4.8.2 Correlation coefficient between adoption of cultural practices and yield for rainy onion

The correlation coefficient of adoption of cultural practices, yield and production costs of rainy onion in Taungthar and Myingyan study areas are presented in Table 4.15 and 4.16. The amount of sets rate used was positively and significantly correlated with the yield in Taungthar study area. In Myingyan study area it was still positively correlated but not significant. These results implied that the amount of sets used for onion production was one of the contributing factors for high yield through increasing the number of plant population. The higher in plant population can increase the bulb yield up to a certain limit (Badarudin and Haque, 1977). In Myingyan study area, the amount of total urea usage was significantly correlated with the yield. But it was not significantly correlated with the yield in Taungthar. This implied that the more usage of urea fertilizer can increase the yield in Myingyan study area. And also the split application of urea fertilizer was significantly and positively correlated with the yield in Myingyan study area. The results revealed that the more split application of urea, the higher the yield. There was a positive relationship between the amount of total urea fertilizer and the yield. This result implied that the respondents who used more amount of urea fertilizer obtained higher yield.

The production cost was significantly correlated with the urea fertilizer in Taungthar study area. Although it was not significant, the positive correlation was observed in Myingyan study area. These results indicated that the amount of urea fertilizer was one of the reasons for higher production cost. And also there was a significant correlation between production cost and the sets rate in Myingyan study area. Positive correlation was also observed between production cost and the sets rate in Taungthar. These results implied that the amount of sets rate was also a reason for increasing production cost.

4.8.3 Comparison of the correlation coefficients for winter and rainy onion growing

In both seasons, the number of urea split application was positively correlated with the yield in both study areas. Urea split application seemed to be the influencing factors for higher yield in both growing seasons. The frequency of irrigation was positively correlated with the yield in winter onion production. Also the frequency of irrigation was found to be one of the influencing factors for higher yield in winter onion production. It was observed that there was a positive correlation between the amount of urea fertilizer and the yield in rainy onion. The results showed that the higher amount of urea fertilizer was one of the effective ways for increasing yield in rainy onion production.

Table 4.15 Correlation coefficient (R) between adoption of production practices and yield of rainy onion growing in Taungthar

	Yield	Seed rate (sets)	Amount of cow dung used	Amount of Compound fertilizer	Amount of urea (basal)	Amount of urea (total)	No. of urea split application	No. of irrigation
Yield	1							
seed rate (sets)	0.593**	1						
Amount of cow dung used	0.051	0.135	1					
Amount of compound fertilizer	0.020	-0.069	-0.100	1				
Amount of urea (basal)	0.141	0.152	-0.225	0.040	1			
Amount of urea (total)	0.313	0.068	-0.017	0.270	0.199	1		
No. of urea split application	0.051	-0.247	0.138	0.368*	-0.464**	0.446*	1	
No. of irrigation	-0.077	0.031	0.223	0.121	0.219	-0.028	0.037	1
Production cost	0.138	0.280	-0.103	0.204	0.019	0.644**	0.346	0.006

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 4.16 Correlation coefficient (R) between adoption of production practices and yield of rainy onion growing in Myingyan

	Yield	Seed rate (sets)	Amount of cow dung used	Amount of Compound fertilizer	Amount of urea (basal)	Amount of urea (total)	No. of urea split application	No. of irrigation
Yield	1							
seed rate (sets)	0.289	1						
Amount of cow dung used	0.081	0.195	1					
Amount of compound fertilizer	0.224	0.242	-0.094	1				
Amount of urea (basal)	0.005	0.023	-0.225	-0.224	1			
Amount of urea (total)	0.379*	0.230	-0.094	-0.284	0.457**	1		
No. of urea split application	0.585**	-0.141	-0.050	0.033	-0.164	0.221	1	
No. of irrigation	0.235	0.007	-0.037	-0.276	0.185	0.342	0.396*	1
Production cost	0.316	0.371*	0.225	0.231	-0.194	0.287	0.270	0.236

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

4.9 Marketing Analysis

4.9.1 Attributes for cost and return analysis

The data of the enterprise budget for winter onion in Taungthar and Myingyan study areas are presented in Table 4.17 and for rainy onion, the data are presented Table 4.20. Enterprise budget was used to analyze cost and returns of onion farmers. Variable costs of production were material input costs, hired labor costs, family labor opportunity costs and marketing costs. Return of onion production included return from sale with average current price of onion during the study period.

4.9.2 Cost and return analysis for winter onion

Total material cost in Taungthar area was 1,022,111 kyat/ha and Myingyan area was 931,575 kyat/ha. Total opportunity cost for Taungthar and Myingyan areas were 461,531 kyat/ha and 433,621 kyat/ha respectively. It was expensed for hired labor cost 1,107,587 kyat/ha in Taungthar and 911,765 kyat/ha in Myingyan. Total interest cost on cash cost, was 106,485 kyat/ha in Taungthar and 92,167 kyat/ha in Myingyan (Table 4.18 and 4.19).

It was found that total gross return was 3,650,290 kyat/ha in Taungthar and 2,715,522 kyat/ha in Myingyan. Total variable cash cost was 2,236,183 kyat/ha in Taungthar and 1,935,507 kyat/ha in Myingyan. Total variable cost was 2,697,715 kyat/ha in Taungthar and 2,369,129 kyat/ha in Myingyan. Return above variable cash cost and variable cost or return per unit of cash cost and return per unit of capital invested were used as measurements of cost return analysis. The return per unit of cash cost was 1.63 in Taungthar and 1.40 in Myingyan, which meant that if one kyat was invested on variable cash cost, net returns will be 1.63 kyats in Taungthar and 1.40 kyats in Myingyan. Return per unit of capital was 1.35 in Taungthar and 1.15 in Myingyan. It meant that if one kyat was invested on variable cost, net return will be 1.35 kyats in Taungthar and 1.15 kyats in Myingyan (Table 4.17).

It was found that net returns of the respondents from Taungthar were higher than respondents from Myingyan study area. According to this cost and return analysis, profitability of growing onion in Taungthar was found to be more positive and attractive to farmers.

Table 4.17 Enterprise budget for winter onion production in the study areas

Item	Unit	Taungthar Value	Myingyan Value
Gross return	kyat/ha	3,650,290	2,715,522
Total variable cash cost (a + c + d)	kyat/ha	2,236,183	1,935,507
Total variable cost (a + b + c + d)	kyat/ha	2,697,715	2,369,129
Gross margin	kyat/ha	952,575	346,393
Return above variable cash cost (RAVCC)	kyat/ha	1,414,106	780,014
Return per unit of cash cost		1.63	1.40
Return per unit capital (BCR)		1.35	1.15
Break even yield	kg/ha	11,247	10,167
Break even price	kyat/kg	177	203

Table 4.18 Gross benefit and cost of production for winter onion in Taungthar study area

Items	Unit	level	Effective price (kyat)	Total value (kyat)
Gross benefit	kyat/ha	15,209.54	240	**3,650,290**
Seed cost	kg/ha	16.28	21,703	353,325
Cow dung manure	cart/ha	26.35	4,768	125,637
Fertilizer (Urea)	kg/ha	6.33	19,919	126,087
Fertilizer (Compound)	kg/ha	2.68	31,923	85,554
Fuels	gal/ha	37.92	3,665	138,977
Other liquid chemicals		2.47	77,948	192,532
Total material cost (a)	kyat/ha			**1,022,111**
Seed bed preparation	amd/ha	7.27	3,375	24,536
Planting	md/ha	3.81	1,954	7,445
Seed bed irrigation	md/ha	73.87	1,575	116,345
Seed bed weeding	md/ha	4.64	1,585	7,354
Seed bed fertilizing	md/ha	5.80	1,254	7,273
Plough and harrowing	amd/ha	11.80	4,500	53,100
Transplanting	md/ha	4.65	2,132	9,914
Irrigation	md/ha	23.86	2,970	70,864
Weeding	md/ha	4.70	2,161	10,157
Fertilizer application	md/ha	9.04	1,186	10,721
Pesticide application	md/ha	14.65	1,172	17,170
Harvesting	md/ha	4.45	2,164	9,630
Cleaning	md/ha	2.47	1,466	3,621
Transportation	carts/ha	39.54	2,868	113,401
Total family labor cost (b)	kyat/ha			**461,531**
Seed bed preparation	amd/ha	7.89	3,375	26,629
Planting	md/ha	10.49	1,954	20,497
Seed bed irrigation	md/ha	57.47	1,575	90,515
Seed bed weeding	md/ha	21.66	1,585	34,331
Plough and harrowing	amd/ha	9.28	4,500	41,760
Furnishing planting bed	md/ha	17.05	2,746	46,819
Transplanting	md/ha	95.56	2,132	203,734
Irrigation	md/ha	22.45	2,970	66,677
Weeding	md/ha	53.93	2,161	116,543
Fertilizer application	md/ha	9.20	1,186	10,911
Pesticide application	md/ha	19.15	1,172	22,444
Harvesting	md/ha	98.12	2,164	212,332
Cleaning	md/ha	76.58	1,466	112,266
Transportation	carts/ha	35.61	2,868	102,129
Total hired labor cost (c)	kyat/ha			**1,107,587**
Material cost	%	1,022,111	5	51,106
Variable cash cost	%	1,107,587	5	55,379
Total interest on cash cost (d)	kyat/ha			**106,485**

Table 4.19 Gross benefit and cost of production for winter onion in Myingyan study area

Items	Unit	level	Effective price (kyat)	Total value (kyat)
Gross benefit	kyat/ha	11,654.60	233	**2,715,522**
Seed cost	kg/ha	14.93	23,958	357,693
Cow dung manure	cart/ha	5.52	4,800	26,496
Fertilizer (Urea)	kg/ha	8.01	19,500	156,195
Fertilizer (Compound)	kg/ha	3.06	33,286	101,855
Fuels	gal/ha	34.99	3,850	134,712
Other liquid chemicals		2.47	62,601	154,624
Total material cost (a)	kyat/ha			**931,575**
Seed bed preparation	amd/ha	6.76	3,727	25,195
Planting	md/ha	5.12	2,135	10,931
Seed bed irrigation	md/ha	71.43	1,596	114,002
Seed bed weeding	md/ha	5.55	1,777	9,862
Seed bed fertilizing	md/ha	5.52	1,091	6,022
Plough and harrowing	amd/ha	9.41	3,805	35,805
Transplanting	md/ha	4.99	2,138	10,669
Irrigation	md/ha	23.54	2,692	63,370
Weeding	md/ha	4.86	2,073	10,075
Fertilizer application	md/ha	8.40	1,258	10,567
Pesticide application	md/ha	12.78	1,261	16,116
Harvesting	md/ha	7.74	2,188	16,935
Cleaning	md/ha	4.94	1,470	6,600
Transportation	carts/ha	32.83	2,969	97,472
Total family labor cost (b)	kyat/ha			**433,621**
Seed bed preparation	amd/ha	5.03	3,727	18,747
Planting	md/ha	6.18	2,135	13,194
Seed bed irrigation	md/ha	53.13	1,596	84,795
Seed bed weeding	md/ha	14.25	1,777	25,322
Plough and harrowing	amd/ha	11.49	3,805	43,719
Furnishing raised bed	md/ha	18.57	2,195	40,761
Transplanting	md/ha	64.12	2,138	137,089
Irrigation	md/ha	31.45	2,692	84,663
Weeding	md/ha	50.23	2,073	104,127
Fertilizer application	md/ha	5.19	1,258	6,529
Pesticide application	md/ha	9.88	1,261	12,459
Harvesting	md/ha	73.23	2,188	160,227
Cleaning	md/ha	47.91	1,470	70,428
Transportation	carts/ha	36.95	2,969	109,705
Total hired labor cost (c)	kyat/ha			**911,765**
Material cost	%	931,575	5	46,579
Variable cash cost	%	911,765	5	45,588
Total interest on cash cost (d)	kyat/ha			**92,167**

4.9.3 Cost and return analysis for rainy onion

Total material cost in Taungthar area was 741,245 kyat/ha and Myingyan area was 565,021 kyat/ha. Total opportunity cost was 281,184 kyat/ha in Taungthar and 235,472 kyat/ha in Myingyan area. It was expensed for hired labor cost 387,300 kyat/ha in Taungthar and 338,813 kyat/ha in Myingyan. Total interest cost on cash cost, was 56,427 kyat/ha in Taungthar and 45,192 kyat/ha in Myingyan (Table 4.21 and 4.22).

The gross margin analysis for rainy onion in study areas were shown in Table 4.20. It was found that respondents from Taungthar expensed total variable cost 1,466,157 kyat/ha and respondents from Myingyan expensed total variable cost 1,184,498 kyat/ha. The average yield in Taungthar study area (6,746.14 kg/ha) was higher than that of Myingyan average yield (5,914.87 kg/ha). Therefore, total gross benefit for Taungthar study area was 1,990,111 kyat/ha and Myingyan area was 1,602,930 kyat/ha. Return above variable cash cost were 805,138 kyat/ha in Taungthar and 653,904 kyat/ha in Myingyan. Gross margin per unit of investment was 523,954 kyat/ha in Taungthar and 418,432 kyat/ha in Myingyan. Therefore the benefit cost ratio of Taungthar and Myingyan area were 1.36 and 1.35 respectively. By comparing the two growing seasons, the benefit cost ratio for the rainy onion is more attractive to growers in both study areas.

Table 4.20 Enterprise budget for rainy onion production in the study areas

Items	Unit	Taungthar Value	Myingyan Value
Gross return	kyat/ha	1,990,111	1,602,930
Total variable cash cost (a + c + d)	kyat/ha	1,184,973	949,026
Total variable cost (a + b + c + d)	kyat/ha	1,466,157	1,184,498
Gross margin	kyat/ha	523,954	418,432
Return above variable cash cost (RAVCC)	kyat/ha	805,138	653,904
Return per unit of cash cost		1.68	1.69
Return per unit capital (BCR)		1.36	1.35
Break even yield	kg/ha	4,970	4,371
Break even price	kyat/kg	217	200

Table 4.21 Gross benefit and cost of production for rainy onion in Taungthar study area

	Unit	Level	Effective price (kyat)	Total value (kyat)
Gross benefit	kyat/ha	6,746.14	295	**1,990,111**
Seed bulb cost	kg/ha	1,554.58	291	452,383
Cow dung manure	carts/ha	17.17	5288	90,795
Fertilizer (Urea)	kg/ha	2.42	20323	49,182
Fertilizer (Compound)	kg/ha	1.64	33067	54,230
Fuels	gal/ha	10.36	3830	39,679
Others		1.00	54977	54,977
Total material cost (a)				**741,245**
Plough and harrowing	amd/ha	17.69	4484	79,322
Planting	md/ha	8.58	1943	16,671
Irrigation	md/ha	11.87	2737	32,488
Weeding	md/ha	8.79	2142	18,828
Uprooting	md/ha	4.74	2246	10,646
Fertilizer application	md/ha	7.81	1319	10,301
Pesticide application	md/ha	11.00	1350	14,850
Cutting seed stalks	md/ha	15.16	1837	27,849
Harvesting	md/ha	11.46	2098	24,043
Transportation	amd/ha	15.72	2938	46,185
Total family labor cost (b)				**281,184**
Plough and harrowing	amd/ha	3.26	4484	14,618
Planting	md/ha	34.52	1943	67,072
Irrigation	md/ha	10.42	2737	28,520
Weeding	md/ha	31.56	2142	67,602
Uprooting	md/ha	23.17	2246	52,040
Cutting seed stalks	md/ha	16.64	2098	34,911
Harvesting	md/ha	40.01	2098	83,941
Cleaning	md/ha	20.24	1907	38,598
Total hired labor cost (c)				**387,300**
Material cost	%	741,245	5	37,062
Variable cash cost	%	387,300	5	19,365
Total interest on cash cost (d)	kyat/ha			**56,427**

Table 4.22 Gross benefit and cost of production for rainy onion in Myingyan study area

Items	Unit	Level	Effective price (kyat)	Total value (kyat)
Gross benefit	kyat/ha	5,914.87	271	**1,602,930**
Seed bulb cost	kg/ha	1,371.44	241	330,517
Cow dung manure	carts/ha	14.90	4352	64,845
Fertilizer (Urea)	kg/ha	2.08	20118	41,845
Fertilizer (Compound)	kg/ha	1.60	32188	51,501
Fuels	gal/ha	9.85	3813	37,558
Others		1.00	38755	38,755
Total material cost (a)				**565,021**
Plough and harrowing	amd/ha	20.26	3979	80,615
Planting	md/ha	6.74	1639	11,047
Irrigation	md/ha	9.15	2530	23,150
Weeding	md/ha	6.32	1766	11,161
Uprooting	md/ha	5.49	2125	11,666
Fertilizer application	md/ha	5.33	1200	6,396
Pesticide application	md/ha	8.11	1490	12,084
Cutting seed stalks	md/ha	12.78	1813	23,170
Harvesting	md/ha	8.26	1768	14,604
Transportation	amd/ha	13.86	3000	41,580
Total family labor cost (b)				**235,472**
Plough and harrowing	amd/ha	2.67	3979	10,624
Planting	md/ha	33.91	1639	55,578
Irrigation	md/ha	9.90	2530	25,047
Weeding	md/ha	36.13	1766	63,806
Uprooting	md/ha	18.63	2125	39,589
Cutting seed stalks	md/ha	23.66	1768	41,831
Harvesting	md/ha	38.01	1768	67,202
Cleaning	md/ha	21.53	1632	35,137
Total hired labor cost (c)				**338,813**
Material cost	%	565,021	5	28,251
Variable cash cost	%	338,813	5	16,941
Total interest on cash cost (d)	kyat/ha			**45,192**

4.10 General Characteristics of Market Participants

The stakeholders in the marketing channel of onion included farmers, local wholesalers, cities' wholesalers and retailers.

4.10.1 General characteristics and marketing activities of wholesalers

Table 4.23 presents the demographic characteristics of wholesalers in the study areas. Wholesalers had been leading the onion marketing sector. They tended to be specialized in onion trading than other participants and operated on much larger scale of business.

In general, the age of the wholesalers were ranging from 30 to 80 years. Most of the wholesalers from the study areas were at the middle age group of 40 to 60 years of age. The educational levels of wholesalers were high and most of wholesalers had the high school and graduated level of education.

Except the wholesalers from Myingyan and Taungthar areas, most of wholesalers had working experiences of less than 15 years. About seventy percent of wholesalers from Taungthar and Myingyan had more than 15 years of working experience.

Purchasing types of wholesalers were different. Both cash down and credit systems were performed by wholesalers depending on the situation. But exact data were not obtained in this study. Selling types of wholesalers were found as cash down system and credit system and most of the wholesalers usually used both types of selling.

Table 4.23 Demographic characteristic of wholesalers in the study areas

Attributes	Percent of respondents			
	Taungthar, Myingyan n = 10	**Mandalay n = 5**	**Yangon n = 5**	**Nay Pyi Taw n = 5**
Age (year)				
< 40	10.00	20.00	40.00	-
40 – 60	80.00	80.00	60.00	100.00
> 60	10.00	-	-	-
Education				
Primary and monastery	30.00	-	-	-
Secondary	-	40.00	-	20.00
High school and above	70.00	60.00	100.00	80.00
Work experience (year)				
< 15	30.00	60.00	60.00	100.00
15 – 30	70.00	20.00	40.00	-
> 30	-	20.00	-	-

4.10.2 General characteristics and marketing activities of retailers

Retailers were the market participants who closed to consumers in general. Onion retailers can be found in every market, every quarter of the town and cities. Retailers were very familiar with consumers who spent their income regularly for onion.

Table 4.24 presents the general characteristic of sample retailers. Ages of retailers were found within the range of 21 to 57 years. Most of the retailers from study areas were falling in the middle age group. Most of the respondents, 50% of retailers from Myingyan, Taungthar areas and 60% of retailers from Mandalay study area were at the middle school educational level. But it was found that most of the retailers from Yangon and Nay Pyi Taw had high school and graduated level of education.

Almost all of the retailers had the working experience of less than 15 years in all study areas. Retailers purchased onion cash down or using credit system. It was also found that all the retailers used only cash down system when they sold. With regard to transportation, retailers generally used tricycle, bus and light truck or man power depending on the distance from buying places.

Table 4.24 Demographic characteristics of retailers in the study areas

Attributes	Percent of respondents			
	Taungthar, Myingyan n = 10	**Mandalay n = 5**	**Yangon n = 5**	**Nay Pyi Taw n = 5**
Age (year)				
< 40	20.00	20.00	20.00	40.00
40 – 60	80.00	80.00	80.00	60.00
> 60	-	-	-	-
Education				
Primary and monastery	50.00	20.00	-	-
Secondary	50.00	60.00	40.00	40.00
High school and above	-	20.00	60.00	60.00
Work experience (year)				
< 15	100.00	100.00	80.00	100.00
15 – 30	-	-	20.00	-
> 30	-	-	-	-

4.11 Marketing Channel, Cost and Margins

4.11.1 Onion marketing channels in study area

The analysis of marketing channel was intended to demonstrate the onion flow from farmers to ultimate onion consumers in study areas. The marketing channel of onion is shown in Figure 4.1. Most of the farmers sold their onion directly to Myingyan and Taungthar wholesalers. Myingyan and Taungthar wholesalers performed the critical function along the channel by linking local production to interested markets. Myingyan and Taungthar wholesalers also received the daily price information from Bayintnaung wholesale market from Yangon and Kaingdan wholesale market from Mandalay. According to this daily price information they determined buying price.

According to the results, the highest amount of onions produced from Myingyan and Taungthar areas (47.22%) were transported to Yangon wholesale market. Following Yangon market, Mandalay and Mawlamyine markets stood together in the second places. Nearly equal quantity of commodities was traded to those market places (13.89% each of local production). Some wholesalers from Myingyan transported onion (11.11%) to other market places: Kyaukse, Myitta, Nwahtogyi, Shwenyaung and Taungngu etc. About 8.33% of total production in Myingyan and Taungthar areas was moved to local retail markets. The lowest volume (5.56% of local production) was traded to Nay Pyi Taw wholesale market.

At Bayintnaung (Yangon) wholesale markets, most of the commodities were shifted to Yangon retail markets (66.04% of total volume). This was because of high local consumption in Yangon region. About 22.39% of total volume was traded to Delta region. Small amount of onion from Bayintnaung wholesale market (9.33%) are moved to Htawel region. A commodity flow to export channel was observed but the amount of traded volume was very low (2.24%).

In Kaingdan (Mandalay) wholesale market, most of the onions (59.66% of total volume) were transported to Myitkyina, Northern Shan State and Sagaing regions. About one-fourth of the commodities at Kaingdan market were sold to Mandalay retail markets. Some of the onion (about 12.61%) had been transported to border areas (China).

As described before, very small amount of onion from Myingyan and Taungthar areas were transported to Nay Pyi Taw wholesale market. Almost all of the onions from Aharathukha (Nay Pyi Taw) wholesale markets were traded to (Nay Pyi Taw) surrounding regions (mainly Pyinmana and Taungngu).

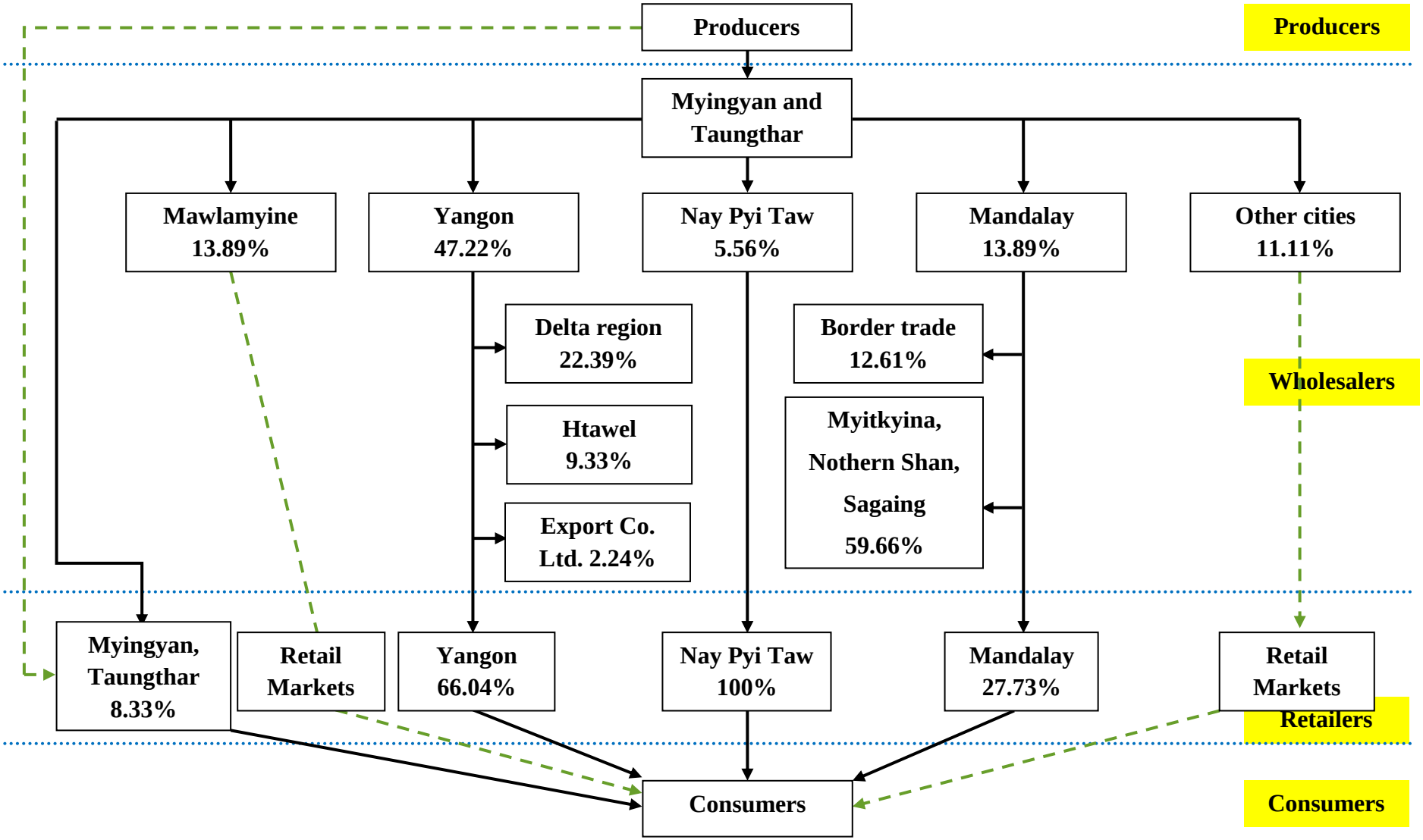


Figure 4.1 Marketing channel of onion crop in the study areas

4.11.2 Marketing cost and margin of wholesalers

Average marketing costs by activities of wholesalers were calculated in this study. Table 4.25 presents the marketing costs, margins and profits of Myingyan and Taungthar wholesalers and Table 4.26 presents costs, margin and profits of Yangon, Mandalay and Nay Pyi Taw wholesalers. These marketing costs were categorized into two types: local wholesalers and cities' wholesalers. Local wholesalers (Myingyan, Taungthar) had the highest marketing costs compared to other market places.

The wholesalers who traded the onion to Mandalay obtained the highest marketing margin (126 kyat/kg) and the wholesalers who sold in local market obtained minimum marketing margin and marketing cost (45 and 23 kyat/kg). Wholesalers who traded to Yangon market had the highest marketing cost 62 kyat/kg. The profit of wholesalers who traded to Mandalay market received the highest profit (68 kyat/kg) followed by the Nay Pyi Taw Markets (62 kyat/kg). Wholesalers who traded to Yangon market obtained the profit of about 46 kyat/kg. The profit of the wholesalers who sold in local market was the lowest (22 kyat/kg).

Table 4.25 Marketing cost, margin and profit of Myingyan and Taungthar wholesalers

Items	Unit	Targeted markets			
		Mandalay	Yangon	Nay Pyi Taw	Myingyan and Taungthar
(1) Average buying price of onion	kyat/kg	255	255	255	255
(2) Average selling price of onion	kyat/kg	381	363	377	300
(3) Marketing margin (2-1)	kyat/kg	126	108	122	45
(4) Total marketing cost	kyat/kg	58	62	60	23
- Cost of packing materials	kyat/kg	4	4	4	4
- Cost of transportation	kyat/kg	26	30	28	-
- Cost of cleaning	kyat/kg	9	9	9	-
- Cost of estimated loss	kyat/kg	18	18	18	18
- Tax for warehouse	kyat/kg	1	1	1	1
(3) Profit (3-4)	kyat/kg	68	46	62	22

Table 4.26 Marketing cost, margin and profit of wholesalers at Yangon, Mandalay and Nay Pyi Taw study areas

Items	Unit	Wholesale markets		
		Mandalay	Yangon	Nay Pyi Taw
(1) Average buying price of onion	kyat/kg	381	363	377
(2) Average selling price of onion	kyat/kg	459	454	442
(3) Marketing margin (2-1)	kyat/kg	78	92	66
(4) Total marketing cost	kyat/kg	25	47	42
- Cost of transportation	kyat/kg	0	28	12
- Loading and unloading	kyat/kg	3	4	5
- Cost of cleaning	kyat/kg	2	0	8
- Cost of estimated loss	kyat/kg	20	15	16
- Tax for shop	kyat/kg	0.3	0.3	1.0
(5) Profit (3-4)	kyat/kg	53	45	24

4.11.3 Marketing cost and margin of retailers

Average marketing margin, cost and profit of retailers from different markets along the marketing channel of onion are shown in Table 4.27. Costs of marketing function were transportation cost, tax, labor and weight lost cost.

Highest marketing margin and profit were observed in Myingyan, Taungthar retail markets (102 and 74 kyat/kg). The lowest marketing margin and highest marketing cost were observed in Nay Pyi Taw retail market (78 and 41 kyat/kg). The lowest profit of retailers was observed in Nay Pyi Taw retail market (37 kyat/kg). Yangon and Mandalay retailers had nearly the same marketing cost (32 and 31 kyat/kg). The retailers from Yangon and Mandalay got the higher profits (59 and 67 kyat/kg) than Nay Pyi Taw retailers. The profit of Taungthar and Myingyan retailers obtained the highest profit comparing to the retailers from Yangon, Mandalay and Nay Pyi Taw markets.

Table 4.27 Marketing cost, margin and profit of retailers in the study areas

Items	Unit	Retail markets			
		Mandalay	Yangon	Nay Pyi Taw	Myingyan and Taungthar
(1) Buying price of onion	kyat/kg	459	454	442	300
(2) selling price of onion	kyat/kg	557	545	521	402
(3) Marketing margin (2-1)	kyat/kg	98	91	78	102
(4) Total marketing cost	kyat/kg	31	32	41	28
- Cost of transportation	kyat/kg	6	6	14	4
- Cost of estimated loss	kyat/kg	21	22	21	18
- Cost of cleaning	kyat/kg	3	3	4	4
- Tax for shop	kyat/kg	1	1	2	2
(5) Profit (3-4)	kyat/kg	67	59	37	74

4.11.4 Composition of consumer price in study areas

Table 4.28 presents the composition of consumer price and Table 4.29 presents the percent composition of consumer price as well as the percentage share of consumer price at different stages of marketing channel. The farmers' profit over the unit variable cost of onion production was interesting to compare the profit of other market participants along the channel. There were several types of marketing margins, based on the market level. First consideration of the unit profit of the farmers was the difference between unit cost and farm gate price of onion. Then, wholesaler margin was the deduction of the onion price paid by wholesalers from obtained value of onion by wholesaler. This margin included the profit of wholesaler and costs of the marketing functions made by wholesaler. At this stage of marketing function, the value of packaging, cleaning and transportation for onion has to be added. The retail margin was the difference between the retailer paid price and the consumer paid price.

The percent share of farm gate price was varied depending on the market places. Percent share of farm gate price was 45.69 % in trading to Mandalay, 46.71 % for Yangon market, 48.94 % for Nay Pyi Taw market and 63.32 % for local market (Myingyan and Taungthar). When profits of market participants along the channel were compared, the highest profit percentage was obtained by farmer in Yangon and Nay Pyi Taw market channels. The profit share of farmers was 11.51% for Mandalay market channel, 11.77% for Yangon market, 12.35% for Nay Pyi Taw market and 15.98% for local market channel. The lowest profit share was observed in cities' wholesalers for all channels. For Mandalay and local market channels the highest profit share was received by the retailers 11.98% in Mandalay and 18.43% in local markets.

Table 4.28 Composition of consumer paid prices in the study areas

	Mandalay	Yangon	Nay Pyi Taw	Myingyan and Taungthar
share of onion's unit cost	190	190	190	190
profit of farmer	64	64	64	64
share of farm gate price	255	255	255	255
Marketing cost of L.W.S	58	62	60	23
profit of L.W.S	68	46	62	22
Marketing margin of L.W.S	126	108	122	45
Share of price to W.S	381	363	377	-
Marketing cost of W.S	25	47	42	-
profit of W.S	53	45	24	-
Marketing margin of W.S	78	92	66	-
Share of price to retailers	459	454	442	300
Marketing cost of retailers	32	32	41	28
Profit of retailers	67	59	37	74
Marketing margin of retailers	98	91	78	102
Consumer paid price	557	545	520	402

L.W.S = Local wholesalers, W.S = Wholesalers at cities' market places

Table 4.29 Percent composition of consumer paid prices in the study areas

	Mandalay	Yangon	Nay Pyi Taw	Myingyan and Taungthar
Share of onion's unit cost	34.18	34.94	36.59	47.34
Profit of farmer	11.51	11.77	12.35	15.98
share of farm gate price	45.69	46.71	48.94	63.32
Marketing cost of L.W.S	10.55	11.46	11.53	5.72
Profit of L.W.S	12.11	8.34	11.88	5.47
Marketing margin of L.W.S	22.66	19.80	23.41	11.19
Share of price to W.S	68.35	66.52	72.35	-
Marketing cost of W.S	4.51	8.54	8.00	-
Profit of W.S	9.56	8.31	4.59	-
Marketing margin of W.S	14.07	16.85	12.59	-
Share of price to retailers	82.42	83.37	84.94	74.51
Marketing cost of retailers	5.66	5.93	7.88	7.06
Profit of retailers	11.98	10.70	7.18	18.43
Average margin of retailers	17.58	16.63	15.06	25.49
Consumer paid price	100.00	100.00	100.00	100.00

L.W.S = Local wholesalers, W.S = Wholesalers at cities' market places

4.12 Farmers' Perception on Constraints of Onion Production and Marketing

The general constraints of production and marketing encountered by sample farmers are shown in Table 4.30.

(1) Price fluctuation

A lot of respondents in study areas faced up to the problem of price fluctuation. Almost all of the respondents from Taungthar and Myingyan study areas (98% and 95%) stated this problem. Price fluctuation seemed to be the biggest constraint threatening to every grower. Sometimes, this problem can cause unjustified returns for the growers.

(2) Labor difficulties

Labor difficulty seemed to be an important constraint for the respondents during transplanting, weeding and harvesting processes. Onion growing was a labor consuming process and some growers could not perform these processes in a timely manner because of labor scarcity. As the onion plant was a poor competitor with weeds, the process of hand weeding should not be delayed. If weeding cannot be performed in time, nutrient losses will be high resulting in lower yield. Most of the respondents (84%) from Taungthar and about half of the respondents from Myingyan (55%) complained about this problem.

(3) High cost of fertilizers

High fertilizer price was one of the major problems faced by the respondents. About 62% of respondents from Taungthar and 60% from Myingyan study areas had to encounter this problem. Sometimes, they could not apply adequate amount of fertilizer due to higher price. The delay in fertilizing process may result in low yield. So this problem can possibly be an important issue for addressing the lower yield of onion.

(4) High cost of pesticides

High cost of pesticides was found to be an important constraint in the study areas. Most of the respondents faced up to this problem. About half of the respondents (54%) from Taungthar and 45% from Myingyan encountered to this problem. This may affect the quality and yield of onions.

(5) Difficulty to identify pests

Difficulty to identify pests was also a constraint for the respondents. Sometimes, this may lead to misuse of pesticides and ineffective application of pesticides. About 30% of respondents from Taungthar and Myingyan study areas faced up to this problem. This may have negative impact on quality and yield of onion.

(6) High weeding cost

As weeding was a labor consuming process, most farmers encountered the high cost problem for weeding operation. About 22% respondents from Taungthar and 30% from Myingyan faced up to that problem. This problem may lead to lower yield of onion through the poor competitive nature of onion plant.

(7) Getting unsuitable price

Twenty-two percent of respondents from Taungthar and 15% from Myingyan complained about receiving lower price from local wholesalers for their produces.

(8) Poor quality herbicides

About 2% from Taungthar and 12% from Myingyan responded about the poor quality herbicides. This may have negative effect to yield.

Table 4.30 General constraints of onion production and marketing encountered by the respondents in the study areas

No.	Descriptions	Taungthar	Myingyan
		No. of respondents (respondents %) (n = 50)	No. of respondents (respondents %) (n =40)
1	Price fluctuation	49 (98.00)	38 (95.00)
2	Labor difficulties	42 (84.00)	22 (55.00)
3	High cost of fertilizer	31 (62.00)	24 (60.00)
4	High cost of pesticides	27 (54.00)	18 (45.00)
5	Difficult to identify pests	15 (30.00)	12 (30.00)
6	High weeding cost	11 (22.00)	12 (30.00)
7	Getting unsuitable price	11 (22.00)	6 (15.00)
8	Poor quality herbicides	1 (2.00)	5 (12.50)

CHAPTER V
CONCLUSION

5.1 Summary of Findings

5.1.1 Production practices of sample farmers

According to the results, age of the respondents ranged from 20 to 75 years. Although the age ranges was wide, most of the respondents had middle age group (41-60 years). About half of the respondents from Taungthar and two-third of the respondents from Myingyan had enough working experiences (16-30 years). However, most of the growers had lower educational level (monastery and primary school). In both study areas, most of the respondents were small holders who possessed from 0.12 to 1.21 ha of onion farms.

There were two types of growing systems varying depending on the growing season: bulb to bulb and seed to bulb growing system. Bulb to bulb systems was used in rainy season and seed to bulb system in winter season. Two onion varieties were observed in the study areas which have been cultivated over 20 years. Most of the respondents in the study areas produced their own seeds by open-pollination. The use of improved varieties or hybrid varieties was not found in the study areas.

During the winter onion growing, the use of cow dung manure was more common in Taungthar area. More usage of inorganic fertilizers (urea and compound fertilizers) had been observed in Myingyan area. Application of inorganic fertilizer alone was inefficient way in terms of sustainability. The use of inorganic and organic fertilizers together can contribute to higher yield. Although more amount of urea was used, respondents from Myingyan area practiced less split application of urea. More usage of urea fertilizer in top dressing and less split application of urea fertilizer were observed in Myingyan area in both seasons. This can cause higher N losses and seems to be ineffective ways of application. The frequency of urea split application can contribute to higher yield.

As irrigation in rainy onion mainly depended on the rainfall, less irrigation frequency was observed in rainy season as compared to winter season. For the winter onion, most of the respondents practiced 5-6 times of irrigation. Average irrigation frequency was higher in Taungthar area compared to Myingyan. The frequency of irrigation was also one of the contributing factors for increasing yield.

No mechanical harvesting was observed in the study areas. Only hand harvesting was practiced by the growers. Curing and cleaning processes such as neck cutting, sorting

of decayed bulbs were practiced by all growers. The farmers understand the importance of curing and sorting of decayed bulbs. Almost all of the respondents stored their produces during the winter season. Storage of rainy onion was not observed in the study areas.

5.1.4 Marketing of onion in the study areas

Comparing to rainy onion, the production cost and gross benefit for winter onion was higher in both study areas. In both seasons, average yield of onion was higher in Taungthar compared to Myingyan. The highest benefit cost ratio was observed in Taungthar area in both growing seasons. Comparing to both seasons, higher BCR ratio observed in rainy onion was more attractive to farmers from both study areas.

Most of the wholesalers and retailers were in the middle age group ranging from 40-60 years. Most of the wholesalers had the highest education level (high school and above) among all market participants. Almost all of the retailers in the study areas had less than 15 years of working experiences. Comparing to other wholesalers, most of the wholesalers from Myingyan and Taungthar areas had more working experiences. Wholesalers from Nay Pyi Taw areas had the lowest working experiences.

Nearly the entire producers sold their produces to local wholesalers. Most commodities from Myingyan and Taungthar areas were mainly transported to Yangon (Bayintnaung) wholesale market (47.22 %). The lowest volume of produces (5.56%) from Myingyan and Taunthar were traded to Nay Pyi Taw region. From Yangon (Bayintnaung) wholesale market, the highest amount of onion (66.04%) was going to Yangon retail markets. In Mandalay (Kaingdan) wholesale market, major traded areas were Myitkyina, Northern Shan State and Sagaing regions. About one-fourth of the commodities (27.73 %) were going to Mandalay retail markets. About one-tenth (12.61%) of the onions in Kaingdan wholesale market were transported to border areas (mainly China).

In Myingyan and Taungthar areas, marketing margin and cost of wholesalers who sold onion locally was narrow but for wholesalers who sold onion to other markets was large possibly because of higher transportation cost. The highest profit for Myingyan and Taungthar wholesalers was obtained by selling to Mandalay region. At cities' wholesale markets (i.e., Yangon, Mandalay and Nay Pyi Taw), the highest marketing margin was observed in Yangon wholesalers because of its higher transportation cost to retail markets. The highest profit was obtained by the wholesalers from Mandalay region. The lowest profit was found in Nay Pyi Taw wholesale market.

The composition of consumer price and margin in different market, the market participants along the channel, the lowest profit percentage of consumer paid price was obtained by wholesalers from Yangon, Mandalay and Nay Pyi Taw areas. The highest profit percentage of consumer paid price (11.77 and 12.35) was received by farmers in Yangon and Nay Pyi Taw market channels. The highest profit share (18.43%) was obtained by the retailers from local market places.

Constraints of onion production and marketing with different growers can be classified into eight groups. The serious constraints faced by the respondents were price fluctuation, labor difficulties, high cost of fertilizer and pesticides, difficulties in identifying pests, high weeding cost, receiving unsuitable return and poor quality herbicides. As the price fluctuation was high in onion marketing, all the farmers had to face the uncertainty of justified return from their produces.

5.2 Recommendation and Policy Implications

5.2.1 Provision of high yield varieties and technology for farmers

According to the research findings, most of the farmers obtained the highest profit comparing to other market participants. But almost entire sample farmers were growing local varieties. Onion varieties observed in the study areas were only local varieties which had been cultivated over 20 years. The respondents from both study areas produced their own seeds by means of open-pollination. If the selection of mother plants were not carefully practiced, the open-pollinated crops are difficult to maintain the variety integrity. And also it is important for the farmers to ensure that cross pollination from other varieties within the same species does not occur in producing seeds of open-pollinated crops. Otherwise, the true-to-type varieties will not be obtained in producing seeds (Cramer, 1998). So it is important for the growers to understand these factors when they produce their own seeds. Moreover, further study for the yield and variety trial of onion landraces should be done for the purpose of optimizing yield and quality.

Negative correlation between urea basal application and yield as observed in rainy onion production means that the application of urea fertilizer in basal is not an efficient way. So it should be suggested to minimize the basal application of urea. The use of cow dung manure was common in Taungthar area comparing to Myingyan. The farmers from Myingyan areas practiced less split application of urea fertilizers to their field. As less split application of urea fertilizers can pose the risk of high leaching loss of N, it needs to be avoided applying a lot of urea fertilizer in single side dressing. Generally, most of the

farmers' practices were based on their own experiences. To overcome the constraints of low technology, appropriate way should be sought to provide effective extension services and promote farmers' adoption to appropriate technology including the usage of improve/hybrid varieties in line with Good Agricultural Practices, which can thereby raise farmers' income through increased productivity of onion.

Although the information on frequency and amount of money spent on the pesticides applications were obtained, no data on actual dosage of pesticides application was accessible in this study. Accordingly, the question of how extent farmers' practices were safe could not be answered by this research. Thus, in the further study, it should be considered to include the criteria for systematic assessment on the pesticides usages for the control of pests in onion cultivation.

5.2.2 Provision of marketing services

Based on the research findings, marketing margin of the wholesalers who sold onion in local market was narrow but marketing margin of local wholesalers for selling onion to other markets was large mainly due to high transportation cost. Therefore, the local wholesalers received the higher profit by selling onions to Yangon, Mandalay and Nay Pyi Taw wholesale markets. The infrastructures such as roads and bridges should be upgraded in order to reduce high transportation costs or for reduction of marketing margin.

5.2.3 Promotion of marketing efficiency and agro-chemical industries

Most of the farmers received the highest profit shares in onion marketing channel. The farmers themselves should be involved substantially along the marketing activities. This will only then increase their respective shares in consumer price. Responsible persons from agricultural extension should encourage and promote farmers for direct marketing. If the state provides more formal credit to practically cover the cost of production, onion production and marketing activities of the farmer level will be much efficient for long standing prospect of farmer profit share of consumer price.

In order to reduce the major constraints faced by the growers in the study areas such as price fluctuation and labor difficulties during onion production and marketing, the government should improve the mechanized farming. And it also needs to develop post-harvest storage facilities and processing technologies. Also it should develop more export opportunities in which a lot of farmers can contribute. By these means, the price fluctuation problems and labor difficulties faced by the growers can be reduced.

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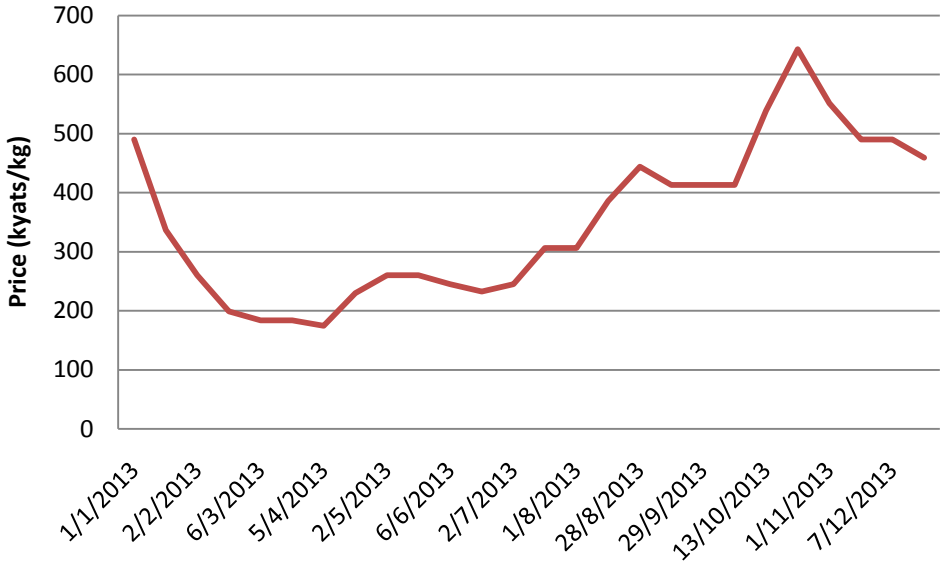
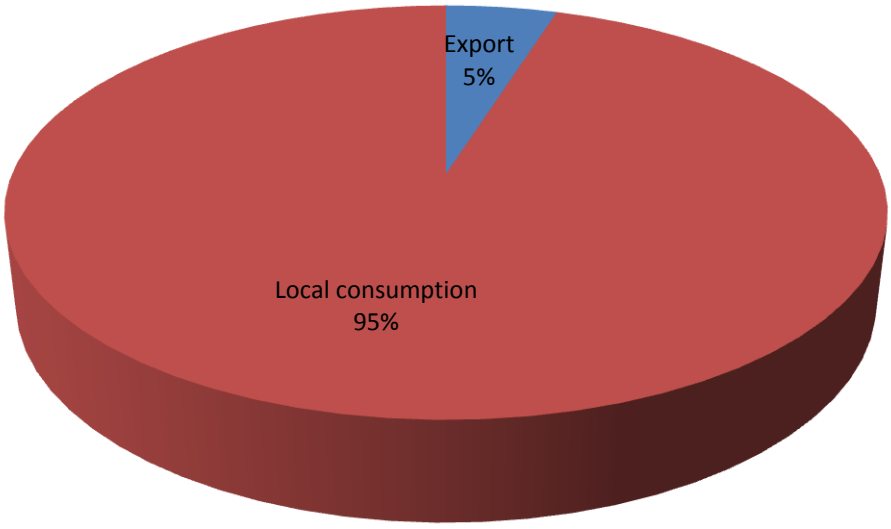
APPENDICES



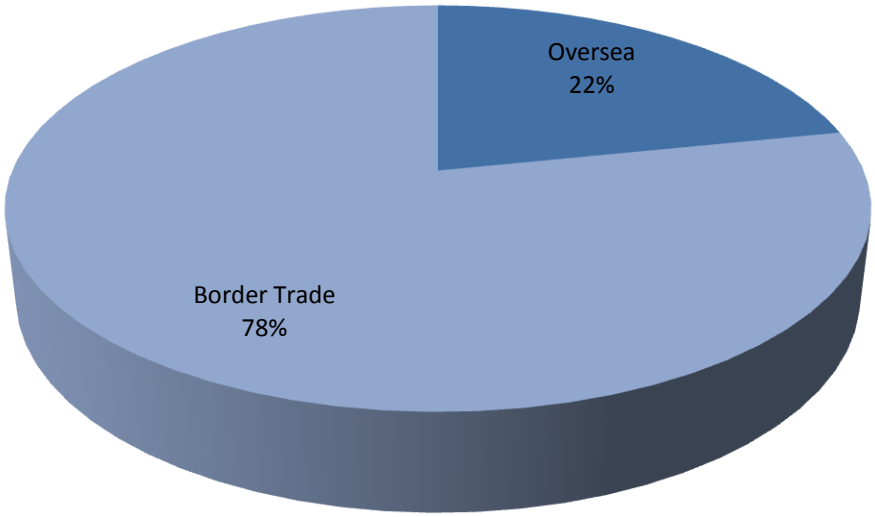
Appendix 1Changes in wholesale price of onion in Myingyan during 2013



Appendix 2 Local consumption and exported volume of onion during 2013-14

Local Consumption – 1,104,127 MT (Source, DAP)

Export volume – 56,512 MT (Source, MOC)



Appendix 3 Exported volume of onion during 2013-14

Oversea countries : Malaysia, Singapore, Mexico, UAE, Vietnam

Border trade : China, Thailand, India (Source – MOC)