# Livelihood Diversification Strategies in Post-monsoon Cotton Production Systems in Rainfed Upland of Central Myanmar

# กลยุทธในการดำรงชีพที่กระจายความเสี่ยงในระบบการผลิตฝ้ายหลังฤดูมรสุมบนพื้นที่ดอนอาศัยน้ำฝนของภาคกลางประเทศเมียนมาร์

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**บทคัดย่อ**: การศึกษานี้ได้วิเคราะห์ผลของสินทรัพย์ในการดำรงชีพต่อการผลิตฝ้ายหลังฤดูมรสุม และศึกษาปัจจัยข้อจำกัดในการผลิตฝ้ายในเมือง เจ้าเซ เมียต่า และวันวิน ซึ่งตั้งอยู่ในเขตภาคกลางของประเทศเมียนมาร์ ในปี 2553 โดยทำการสัมภาษณ์เกษตรกร 150 ครัวเรือน ที่อาศัยในพื้นที่ โดยใช้กรอบวิถีชีวิตที่ยั่งยืน (Sustainable Livelihoods Framework) พบว่าสาเหตุที่ผลผลิตฝ้ายต่ำเนื่องจากปัจจัยหลายประการ เช่น ปัญหาโรค การจัดการปุ๋ยที่ไม่เหมาะสม ขาดแคลนแรงงานช่วงเก็บเกี่ยว มีปัจจัยการเงินจำกัด และการได้รับการส่งเสริมที่ไม่เพียงพอ นอกจากนี้การเปลี่ยนแปลงภูมิอากาศยังทำให้ผลผลิตฝ้ายลดลง เกษตรกรที่ผลิตฝ้ายได้นำวิธีการจัดการที่หลากหลายเพื่อการผลิตฝ้ายอย่างยั่งยืน รวมถึงการใช้พันธุ์ปรับปรุง เมล็ดพันธุ์ที่มีคุณภาพดี การป้องกันศัตรูพืชและวิธีการจัดการปุ๋ยที่เหมาะสม และการปลูกพืชหมุนเวียน เกษตรกรได้ปฏิบัติตามคำแนะนำของเจ้าหน้าที่ส่งเสริม และใช้แรงงานอย่างมีประสิทธิภาพ เพื่อให้ได้รายได้สูงขึ้น เกษตรกรได้ประยุกต์ใช้ยุทธศาสตร์ในการดำรงชีวิตที่หลากหลายที่มีการผสมผสานระหว่างการผลิตทางเกษตรร่วมกับกิจกรรมนอกภาคเกษตร และกิจกรรมที่ไม่ได้มาจากการเกษตร การเกษตรภายใต้ระบบการผลิตพืชที่หลากหลายยังคงให้รายได้แก่ครัวเรือนสูงสุด

**คำสำคัญ**: ยุทธศาสตร์ในการดำรงชีพ ระบบการผลิตฝ้ายหลังฤดูมรสุม กรอบวิถีชีวิตที่ยั่งยืน ที่ดอนอาศัยน้ำฝน ภาคกลางประเทศเมียนมาร์

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**Abstract:** This study investigates the contribution of livelihood assets to post-monsoon cotton production, and examines the production constraining factors in three townships of Central Myanmar in 2010. A total of 150 farming households from Kyaukse, Myittha, and Wundwin townships were interviewed using sustainable livelihood framework. The low cotton yield was due to several factors such as pest problem, inappropriate fertilizer management, labor shortage during harvest, limited financial asset, and insufficient extension contact. Climatic variation also reduced crop yield. The cotton farmers adopted various management practices to sustain crop production including improved variety, good quality seed, appropriate pest and fertilizer management, as well as crop rotation. Farmers followed extension's recommendation, and effective labor use. To achieve high income, farmers adapted diversification livelihood strategies involving combination of farming, off-farm, and non-farm activities. Agriculture, through diversified cropping systems, still contributed the highest household income.

**Keywords:** Livelihood strategies, post-monsoon cotton production systems, sustainable livelihoods framework, rainfed upland, Central Myanmar

## INTRODUCTION

Agriculture supports the livelihoods of the majority of the population in Myanmar. The agricultural sector directly accounted for Gross Domestic Product (GDP) of 34 percent (2008-09), 15.4 percent of the country's exports, and contributed to the total labor force of about 61.2 percent (MOAI, 2010). The total cultivated area under various crops cultivation was about 11.87 million hectares in 2008-2009 cropping season (i.e. 17.5 percent of the total area) (MOAI, 2009).

Cotton popularly known as white gold is grown mainly for fiber and is an important field crop. Cotton has been justified as an economically viable crop that has possessed a significant and positive impact on exports, economic growth and rural development (Badiane *et al*., 2002). In both industrial and developing countries worldwide, cotton has also been used as an engine of economic growth and gives income to millions of farmers (Wang and Chidmi, 2009). In Myanmar, cotton production forms an important source of fiscal revenues and export earnings and serves as a development strategy for governments. Most of the cotton production is concentrated in the central part of the country which receives unreliable rainfall during the growing season. According to their geographical situation and farming systems, the rainfed areas are quite complex with a wide range of crops and cropping system and livestock production. There are about 359,409 hectares under rainfed and irrigated modes of production as pre-monsoon, monsoon and post-monsoon growing seasons (CSD, 2010) contributing to 3.03 percent of total cultivated area of the country.

Cotton is considered to be a difficult crop to grow because it is sensitive to drought, low temperatures and vulnerable to various insects. In Myanmar, average farm yield is about 2,400 kg $ha^{-1}$. Although average cotton yield has increased gradually from year to year, it is still below the national target yield and is only around 30 percent of the world average yield (Tin, 2006).

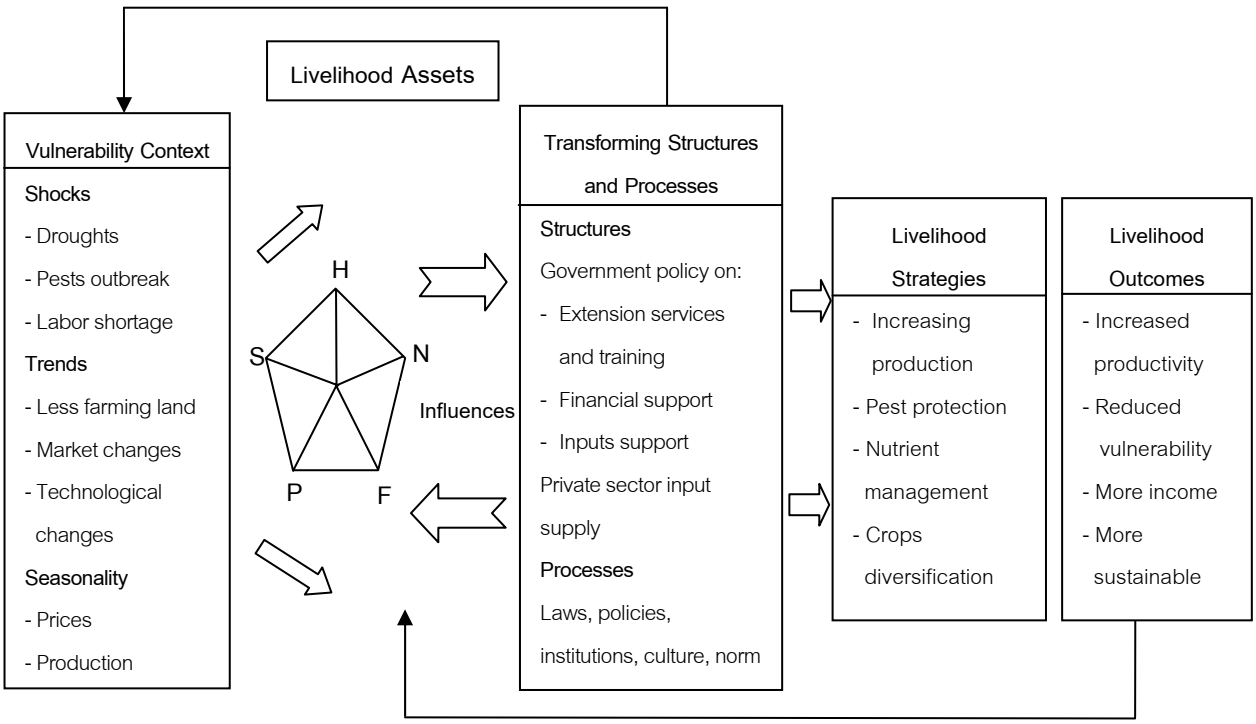
The upland cotton farmers have faced with several yield constraining factors which lead to lower household incomes. To sustain their livelihoods, the

cotton farmers adapt different strategies to improve their livelihoods. The objectives of this study are to investigate production constraints of post-monsoon cotton production and to determine the farmers' livelihood strategies in post-monsoon cotton based cropping systems.

### Sustainable livelihoods framework

The sustainable livelihoods approach is a method of thinking about the objectives, scope, and priorities for development activities. It makes the link between people and the overall enabling environment that affects the outcomes of livelihood strategies. The sustainable livelihoods framework guides what are the main facts that affect livelihoods of local people and how they relate to one another. The relationships between them are important to mirror that people modify assets to activities and the effect of the policies, institution and process to the fundamental components (DFID, 1999).

Livelihoods compose of resources or assets or capital (human, natural, social, physical and financial capital and access to use these) that allow strategies to be employed in order to survive and fulfill desirable livelihood outcomes (DFID, 2001). Thus, livelihoods framework is an appropriate way to investigate about the livelihood constraints, assets and strategies of post-monsoon cotton farmers. The framework for their interaction is illustrated in Figure 1.




**Key assets**

**H** = Human Capital, **N** = Natural Capital, **P** = Physical Capital, **S** = Social Capital, **F** = Financial Capital

Figure 1 Sustainable Livelihoods Framework showing production of cotton-based farming systems
Source: Modified from Department for International Development (DFID) (1999)

## METHODOLOGY

### Description of study area, data source and analysis

Mandalay Division is the largest cotton growing area of the Central Myanmar and it has the potential to produce large amounts of high quality cotton. The cultivated area in Mandalay Division under cotton is about 141,964 ha that is 39.48 percent of total cotton planted area of the country. This study was conducted in Kyaukse, Myittha and Wundwin townships under Mandalay Division with the cotton cultivation of 23 percent, 20 percent and 8 percent of the total cultivated area respectively.

A total of 150 farmers, with 50 from each village under each township was selected using multistage random sampling method and interviewed individually through the structured questionnaire. Data were collected on production constraints, five capital assets received by farmers and livelihood strategies on post-monsoon cotton production and farming systems. Different types of descriptive statistical method were applied to formulate percentage, frequency and average value in this study.

## RESULTS AND DISCUSSIONS

### Households' perceptions of production constraints in post-monsoon cotton production

Rainfed cotton farming is a risky enterprise and it has always been a challenge to sustain cotton productivity. The average farm yield was 947 kg $ha^{-1}$ in Kyaukse, 770 kg $ha^{-1}$ in Myittha and 891 kg $ha^{-1}$ in Wundwin, respectively. These yields were substantially below the potential yield of 1,647 kg $ha^{-1}$. Common production problems perceived by farmers are identified in Table 1.

Majority of the farmers faced with pest problems and they used seed treatment method and pesticides to control pest infestation. Pest occurrence depended on the weather factors such as temperature, relative humidity and precipitation. The farm survey showed that 84 percent, 48 percent and 94 percent of respondents in Kyaukse, Myittha and Wundwin faced with pest problems. Lack of seed treatment (72 percent of respondents) to prevent sucking pests was one of the constraints in Kyaukse. Therefore, seed treatment is essential for pest protection. The spraying frequency of five and more than five times per season was observed in 64 percent, 24 percent and 82 percent of respondents in Kyaukse, Myittha and Wundwin, respectively. The rest of the respondents in all areas used less than five spraying times.

The application of inorganic and organic fertilizer is an important practice to increase cotton yield. Lack of fertilizers or insufficient use of fertilizers is one of the constraining factors. Although farmers possessed relatively fertile soil condition, it was necessary to use fertilizer for continuously growing of cotton. About 92 percent and 78 percent of respondents in Kyaukse did not apply inorganic fertilizer and farm yard manure (FYM). Lack of application of chemical fertilizer was the second most important constraint facing by 62 percent of farmers in Myittha and 68 percent of the respondents in Wundwin did not apply FYM.

Myittha experienced the most unreliable rainfall, and received the lowest precipitation in October at the time of the peak flowering. There was labor shortage during picking time across all study areas. Other constraining factors included limited financial asset and insufficient extension contact. Low product price was particularly found in Kyauke and Myittha.

Table 1 The most common constraints perceived by respondents on post-monsoon cotton

| Constraints | Kyaukse | | Myittha | | Wundwin | |
|---|---|---|---|---|---|---|
| | Frequency | % | Frequency | % | Frequency | % |
| Poor land preparation | 5 | 10 | 8 | 16 | 7 | 14 |
| No optimum sowing time | 9 | 18 | 12 | 24 | 1 | 2 |
| No recommended spacing | 0 | 0 | 13 | 26 | 15 | 30 |
| Poor seed quality | 7 | 14 | 1 | 2 | 7 | 14 |
| No seed treatment | 36 | 72 | 23 | 46 | 16 | 32 |
| Lack of application of FYM | 39 | 78 | 20 | 40 | 34 | 68 |
| Lack of application of chemical fertilizer | 46 | 92 | 31 | 62 | 11 | 22 |
| Pest problem | 42 | 84 | 24 | 48 | 47 | 94 |
| Unreliable rainfall | 21 | 42 | 37 | 74 | 5 | 10 |
| Labor shortage | 28 | 56 | 20 | 40 | 18 | 36 |
| Limited financial asset | 14 | 28 | 12 | 24 | 6 | 12 |
| Low product price and quality | 24 | 48 | 19 | 38 | 4 | 8 |
| Insufficient extension contact | 15 | 30 | 18 | 36 | 17 | 34 |

Source: Survey, 2010

**Farmers' access to livelihood assets in post-monsoon cotton production systems**

Farmers in Kyaukse had the longest experience in cotton cultivation because of suitable soil conditions and also their interests in cotton cultivation. The total labor used ranged from 104 to 131 mandays/ha averaging 121 mandays/ha/season (Table 2).

Farmer in Kyaukse had the smallest farm size (3.57 ha), and yet their invested 58 percent of their land in cotton cultivation. While farmers in Myittha owned largest farm size (5.38 ha), they only used 28 percent of their land for cotton production.

Farmers in Kyaukse practiced higher seeding rate to overcome climatic variability, but used lowest rate of chemical fertilizer since the soil was relatively fertile. In Myittha, farmers used the highest amount of farm yard manure because they mainly depended on cotton cultivation for income and they cannot spend their capital for chemical fertilizers. However, in Wundwin, application of large amount of chemical fertilizer was found because soil condition was necessary to put chemical fertilizer. The average maximum number of contacts with extension agents (3.24) was observed in Wundwin to solve the pest problems as the area faced serious pest problems, and to promote cotton production though contract farming as means to increase cotton productivity.

Table 2 Comparison of main five assets of post-monsoon cotton production

| Capitals | Kyaukse (N=50) | Myittha (N=50) | Wundwin (N=50) | Total (N=150) |
|---|---|---|---|---|
| **Human asset** | | | | |
| Age of household head (years) | 52.02 | 49.54 | 56.14 | 52.57 |
| Household size | 4.92 | 4.82 | 5.70 | 5.15 |
| Education (years) | 5.10 | 4.40 | 4.70 | 4.73 |
| Experience in farming (years) | 27.06 | 26.32 | 32.32 | 28.57 |
| Experience in cotton cultivation (years) | 20.52 | 10.28 | 10.58 | 13.79 |
| Total labor (man days/season/ha) | 127.85 | 103.94 | 130.55 | 120.78 |
| **Natural asset** | | | | |
| Total land holding (ha) | 3.57 | 5.38 | 4.93 | 4.62 |
| Cotton cultivated land (ha) | 2.07 | 1.55 | 0.83 | 1.48 |
| **Physical asset** | | | | |
| Transportation system (%) | 60 | 36 | 60 | 52 |
| Seed rate (kg $ha^{-1}$) | 20.29 | 18.26 | 15.41 | 17.99 |
| Chemical fertilizer (kg $ha^{-1}$) | 7.82 | 22.09 | 91.62 | 40.51 |
| Farm yard manure (kg $ha^{-1}$) | 845.98 | 2192 | 1367 | 1468 |
| Pesticide cost (kyats $ha^{-1}$) | 38,329 | 35,943 | 42,321 | 38,864 |
| Land preparation cost (kyats $ha^{-1}$) | 88,316 | 80,275 | 91,958 | 86,850 |
| Farm equipment value (kyats) | 419,100 | 518,020 | 644,360 | 527,160 |
| **Social asset** | | | | |
| Labor network (%) | 34 | 42 | 52 | 43 |
| Extension contacts (no./season) | 2.98 | 2.66 | 3.24 | 2.96 |
| **Financial asset** | | | | |
| Total income (kyats $year^{-1}$) | 1,931,960 | 1,770,645 | 3,052,851 | 2,254,485 |
| Credit amount (kyats $year^{-1}$) | 78,880 | 137,000 | 218,640 | 144,840 |

Source: Survey, 2010

With regard to financial asset, the average yearly income per household was 3,052,851 kyats (US$ 3,053) in Wundwin which was significantly higher than that of Kyaukse and Myittha. This is because in Wundwin, the mainly based on rice and chili and these crops gave the higher revenue than the other crops. Also, accessibility of credit amount was the highest in Wundwin because the Cotton and Sericulture Department (CSD) supported capital for inputs in order to increase cotton planted area.

**Livelihood strategies**

Livelihood strategies are the combination of all the different activities that people are performing in the context of their livelihoods (Chambers and Conway, 1991). The aim of livelihood strategies is to achieve better livelihood outcomes.

**Farmers' production strategies on post-monsoon cotton production**

According to the sustainable livelihoods framework, farmers' expected outcome in cotton production was increased yield by sustainable production. Farmers' strategies in post-monsoon cotton production systems mainly depended on their inputs investment and management practices. Table 3 shows farmers' production strategies on post-monsoon cotton production systems in three townships.

To decrease chemical pest control and provide more natural control, farmers normally used improved variety that is relatively resistant to bollworm and hence reducing spraying frequency. Seed treatment method was applied to prevent early season sucking pests. By the utilization of this method, additional pesticide spraying for sucking pests was avoided until 45 days after planting. In protection of bollworm and late season sucking pests, number of right time application of pesticide by selecting correct insecticide and correct dosage was recommended to specific pests.

Majority of farmers used good quality seed to provide the highest germination rate and strong seedlings under certain moisture at growing time. All of the respondents followed the recommended growing practices in Kyaukse. With regard to the effective use of labor, cotton farmers avoided on the waste of labor use during the growing season especially in weeding and harvesting time. They also gave attention on the recommended growing practices and extension officers' instruction to obtain advanced technologies.

Higher proportion of farmers in Wundwin used urea and compound fertilizers in post monsoon cotton production, while farmers in Myittha applied highest amount of farm yard manure (FYM) at an average of 2,192 kg/ha. Majority of farmers in both areas also practiced crop rotation, with less farmers practiced in Kyaukse (Table 3). Farmers' sown rotation crops with cotton were mainly leguminous crops such as chickpea and mung bean but sometimes they used sorghum with cotton. They also claimed that chickpea and mung bean contributed to soil fertility and improved soil tilth.

**Farmers' livelihood strategies on cotton-based cropping system and their incomes**

In cotton-based cropping system, the majority of farmers' expected outcome was to get more income for sustainable livelihoods and to achieve more sustainable use of natural resource especially maintaining soil fertility and reducing of pest incidence. There were four main types of livelihood strategies adopted by the respondents such as only agriculture, agriculture and off-farm activity, agriculture and non-farm activity and agriculture, off-farm and non-farm activity (Table 4). Off-farm activities carried by respondents were farm wage labor, servicing draught power and machinery power. Under the non-farm activities were government staff, selling commodities, carpentry, sewing, cow dealer and driver, respectively.

In Kyaukse, the average income by the combination of agriculture and off-farm activity was about 1,582 thousand kyats (US$ 1,582) that was significantly lower than the other incomes. The combined activity of agriculture and non-farm

Table 3 Farmers' production strategies on post-monsoon cotton production system in three townships

| No. | Strategies | Kyaukse | Myittha | Wundwin |
|---|---|---|---|---|
| 1. | Good quality seed | 43 (86%) | 49 (98%) | 43 (86%) |
| 2. | Recommended growing practices | 50 (100%) | 37 (74%) | 35 (70%) |
| 3. | Plant protection | | | |
| | - Resistant variety | 50 (100%) | 50 (100%) | 50 (100%) |
| | - Seed treatment | 14 (28%) | 27 (54%) | 34 (68%) |
| | - Spraying frequency (no. per season) | 5.12 | 3.86 | 5.66 |
| 4. | Effective labor used (no. per season) | 127.84 | 103.94 | 130.55 |
| 5. | Fertility management | | | |
| | Chemical fertilizer amount (kg $ha^{-1}$) | 7.82 | 22.09 | 91.62 |
| | - Urea – side dressing | 1 (2%) | 19 (38%) | 38 (72%) |
| | - T-super – basal | 1 (2%) | - | 1 (2%) |
| | - Compound – basal | 3 (6%) | - | 9 (18%) |
| | - Compound – side dressing | - | - | 12 (24%) |
| | FYM amount – basal (kg $ha^{-1}$) | 845.98 | 2192.04 | 1366.73 |
| 6. | Crop rotation | 18(36%) | 44 (88%) | 40 (80%) |

Source: Survey, 2010

gave the highest income with the average amount of about 3,230 thousand kyats (US$ 3,230). According to survey results, 72 percent of respondents in Myittha performed only agriculture followed by 14 percent used the combination of agriculture and non-farm activity and 12 percent used agriculture and off-farm activity. The highest income was obtained by the combined use of agriculture and non-farm with the average amount of 2,451 thousand kyats (US$ 2,451) and followed by agriculture only with the average amount of 1,766 thousand kyats (US$ 1,766). In Wundwin, there was about 4,320 thousand kyats (US$ 4,320) of the highest annual income from the strategy of the combined activities of agriculture, off-farm and non-farm. The second most important strategy was cultivation of agricultural crops followed by the combined use of agriculture and non-farm activity.

In comparison of the strategies across townships, the highest incomes were obtained from most of the strategies in Wundwin except yearly income from agriculture and non-farm activity that was highest income source in Kyaukse. Agriculture alone gave nearly the equivalent amount of income in Kyaukse and Myittha. The lowest income was produced by the strategy of agriculture and off-farm activities by 14 percent of respondents in Myittha.

Table 4 Main types of livelihood strategies used by the respondents and annual income (thousand kyats)

| Main strategies | Kyaukse | | Myittha | | Wundwin | |
|---|---|---|---|---|---|---|
| | % | Income | % | Income | % | Income |
| Agriculture | 20 | 1,701 | 72 | 1,766 | 48 | 3,258 |
| Agriculture - off farm | 56 | 1,582 | 14 | 1,115 | 34 | 2,512 |
| Agriculture - non farm | 16 | 3,230 | 14 | 2,451 | 12 | 3,128 |
| Agriculture - off farm - non farm | 8 | 2,366 | - | - | 6 | 4,320 |

Source: Survey, 2010 (1 US$ = 1,000 kyats)

Agriculture is the dominant activity for livelihood outcome and farmers' used strategies to obtain more income were mainly focused on cultivation of diversified crops under different cropping systems and patterns. The most commonly used of cropping systems were cotton–sorghum-oilseeds in Kyaukse, cotton-rice-sorghum-chickpea-oilseeds, cotton-sorghum-chickpea-oilseeds and cotton-rice-sorghum-chickpea in Myittha and cotton-rice-chili-pulses-oilseeds, cotton-rice-pulses-oilseeds and cotton-rice-chili-oilseeds in Wundwin. Agricultural income was about 1,701 thousand kyats (US$ 1,701) in Kyaukse, 1,766 thousand kyats (US$ 1,766) in Myittha and 3,258 thousand kyats (US$ 3,258) in Wundwin, respectively.

In Kyaukse, agricultural income share constituted about 86 percent of total income and the majority of the crops grown were cotton, sorghum, oilseed crops, pulses and chili. Cotton income was accounted for 51.42 percent of agriculture income, while sorghum was accounted for 17.83 percent. The average amount of income from cotton was 825 thousand kyats (US$ 825). Crop production also remained the principal source of income in Myittha and there was about 95.71 percent on average and the average amount was 1,695 thousand kyats (US$ 1,695) per year. Among crop productions, cotton income was also the highest and the average amount was 583 thousand kyats (US$ 583) per year with the income share of about 34.97 percent of total farm income followed by chickpea with the amount of 534 thousand kyats (US$ 534) with the share of 31.54 percent. In Wundwin, cotton, rice, chili, chickpea, oil seed crops and pulses were staple crops. Among field crops, rice was the most important income crop with the average magnitude of 1,077 thousand kyats (US$ 1,077) and accounted for 37.71 percent of total agriculture income followed by chili (21.57 percent). Within the agriculture income, cotton income was in the third position and the average annual income was 399 thousand kyats (US$ 399), which was substantially lower than the income from rice and chili and accounted for only 13.89 percent of total crop income.

Under the off-farm income, it was found that the average amounts of 130 thousand kyats (US$ 130) with the income share of 6.74 percent of total off-farm income in Kyaukse, 20 thousand kyats (US$ 20) with the income share of only 12 percent in Myittha and 73,910 kyats (US$ 74) with the income share of 2.42 percent of total off-farm income in Wundwin. About 10.25 percent of total income with the amount of 198 thousand kyats (US$ 198) under non-farm income was observed and income from government servants was the highest with the average percentage of 44.49 percent of non-farm

income in Kyaukse. The lowest amount of non-farm income was observed in Myittha with the average amount of 56 thousand kyats (US$ 56). In Wundwin, there was about 122 thousand kyats (US$ 122) under non-farm income with the income share of 3.99 percent of total non-farm income.

## CONCLUSION

The post-monsoon cotton farmers in three selected townships possessed diverse range of livelihood assets and livelihood strategies. The sustainable cotton production practice was evolved through application of integrated approach such as usage of resistant variety, seed treatment, pesticide spraying, appropriate fertilizer management practices such as basal and crop rotation method. Farmers also gave attention to the recommended growing practices and extension officers' instruction to improve productivity. In order to obtain more income, farmers used the combination of agriculture, off-farm and non-farm activities. Agriculture was the main livelihood strategy and diversified farming systems were adopted to minimize risk and improve farm income. The combination of agriculture and non-farm gave the highest income in Kyaukse and Myittha and the highest income was received by that of agriculture, off-farm and non-farm activities in Wundwin. Cotton income was accounted for the highest share of agriculture income in Kyaukse and Myittha but rice income was highest in Wundwin.

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