Technical Cooperation Project for Agricultural Productivity and Quality Improvement in Myanmar

Project Report 2018

JAICAF ジェイカフ

March 2019

Japan Association for International Collaboration of Agriculture and Forestry

JAICAF

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of Agriculture and Forestry

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Foreword

Japan Association for International Collaboration of Agriculture and Forestry, JAICAF, implemented the survey and technical cooperation project in Myanmar aiming to contribute to produce sesame that meet a market need in fiscal year 2017 and 2018 receiving funding from the Ministry of Agriculture, Forestry and Fisheries of Japan (MAFF).

Sesame is one of the major oil crops in Myanmar and important cash crop for the farmers. The Government of Myanmar strives to expand the production and improve the quality of the oil crops including sesame. At the same time, there is a demand to support the production sites of the high quality sesame from the trade companies, food manufacturers and consumers of Japan, who rely on imports from other countries for most of edible sesame. In particular, the imports of black sesame from Myanmar account for about eighty percent of total black sesame consumption in Japan. However, there are many issues to stably ensure the qualified ones which fit to the Japanese market.

For these backgrounds, we conducted the survey and technical cooperation for the production site focusing on the central dry zone, main production area of black sesame. We targeted soil management and agricultural chemicals as farming technologies during cultivation in FY 2017 and drying method as post-harvest technology in FY 2018. We implemented the verification test on drying methods and their effects on productivity and quality of sesame in cooperation with farmers and extension workers, and conducted workshops in Magway region and Aung Lan Town Ship (T/S) to share the result of the test.

This report summarizes the activities and outcomes for the FY 2018.

Many supports and supervisions were given by the dispatched experts and the Organization of sesame manufacturers in Japan for the implementation and operation of this project. Also, many cooperation were provided, such as important information provision, arrangement with the visiting destinations and accompaniment to the dispatched experts from Ministry of Agriculture, Livestock and Irrigation of Myanmar, especially from headquarter of Department of Agriculture (DOA), Magway regional office and Aung Lan T/S office, Embassy of Japan in Myanmar and Japan International Cooperation Agency (JICA) - Rural Development Department, Myanmar office, Agriculture and Rural advisors and "Project for Profitable Irrigated Agriculture in Western Bago Region", and private companies. We are deeply grateful for all of your support.

We would like to note that this report does not represent the opinion of MAFF or Japanese government but was prepared under the responsibility of JAICAF.

March 2019

Dr. Eiji Matsubara, President
Japan Association for International Collaboration of Agriculture and Forestry

Fig. 1. Interview at a farming village

Fig. 2. Sesame field at a candidate farm

Fig. 3. Sesame floor and pod

Fig. 4. DOA extension workers inspecting sesame growth

Fig. 5. Sesame harvest

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Fig. 7. Drying test. "Piled-up-drying plot"
Immediately after starting testing

Fig. 8. "Stand-drying plot"
Immediately after starting testing

Fig. 9. "Indoor drying plot"
Immediately after starting testing

Fig. 10. Drying test. " Piled-up-drying plot "
After 15 days

Fig. 11. " Stand-drying plot "
After 15 days

Fig. 12. " Indoor drying plot "
After 15 days

Fig. 13. Mold visible after five days of piling sesame

Fig. 14. After 15 days of piling
Huge amounts of mold inside

Fig. 15. After 15 days of standing
Sesame dry and pods cracking open

Fig. 16. Using an AV checker to assess the acid value of the sesame
(Simple test after 7 days)

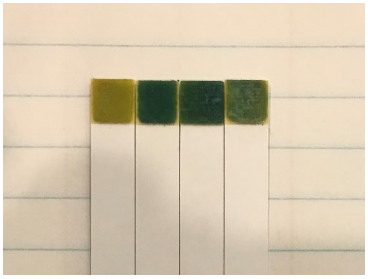


Fig. 17. (From the left) Piled-up-drying, Stand-drying, indoor drying, general practice. The more yellow the higher the acid value.

Fig. 18. Pest survey using yellow sticky traps.

Fig. 19. Pest survey using an insect net.

Fig. 20. Plant affected with Phyllody.

Fig. 21. Healthy plants have pods up to their tips.

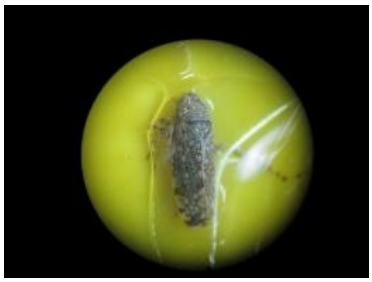


Fig. 22. Phyllody carrying pest
Sesame jassid

Fig. 23. Workshop at Magway (1)

Fig. 24. Workshop at Magway (2)

Contents

Abbreviation

DAR	Department of Agriculture Research
DOA	Department of Agriculture
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization Statistical Database
FFA	Free Fatty Acid
GAP	Good Agricultural Practice
IPM	Integrated Pest Management
ITC	International Trade Centre
JICA	Japan International Cooperation Agency
MOALI	Ministry of Agriculture, Livestock and Irrigation
T/S	Township

Chapter 1 Project Outline

1. Purpose of the Project

A large part of the population in Myanmar is living in the rural area engaging in agriculture. The country has a great potential in developing the food industry as it is expected to sustain economic growth with the substantial size of population. Agricultural technologies are useful to increase the income of the farmers. Improving the farmers' productivity and supplying agricultural products with adequate quality and quantity to the global market will contribute to the growth of the country and improvement of farmer's livelihood.

In this project, we aim to improve the productivity and earning capacity of the farmers in Myanmar and to encourage Japanese companies to create stronger relationship with Myanmar in the food related industries through training and extension of agricultural technology, such as soil improvement, proper use of the pesticides and fertilizers and appropriate postharvest management.

1) Project Background

(1) Main agricultural products in Myanmar

It is important for Myanmar to improve the agricultural productivity and income level of the farmers as the contribution of this sector to GDP is about 30% and below 20% to export income although it is an agricultural country where more than 60% of the labor population is engaging in the agriculture.[1] The agricultural sector is positioned as the most important one in the national growth strategy and the keystone of economic growth. The Ministry of Agriculture, Livestock and Irrigation (MOALI) aims to improve the productivity and quality designating 10 crops; rice, maize, groundnut, sesame, sunflower, black gram, green gram, pigeon pea, sugarcane and cotton as the most important crops for the country.

Among them, sesame is the essential crop for the Myanmar's food culture as it is used for seasonings, sweets and snacks. One of the most important use of sesame is for cooking oil and its strained lees after squeezing oil are used as the livestock feed. Myanmar is one of the world major producers of sesame (Table 1-1, Fig. 1-1). Sesame is also important as export crop (Fig. 1-2). It is exported to the world and especially to East Asian countries, China, Japan or Korea which account for the important part of export income of Myanmar. International Trade Centre (ITC) ranked sesame as one of the top 20 items that have the high export potential in Myanmar in its report to evidence the further possibility of export increase. In recent years, as China who is the major sesame producer country turned to the sesame importer, it is considered that the sesame from Myanmar will continue to increase its presence in the international market.

[1] Department of Planning, Ministry of Agriculture, Livestock and Irrigation: Myanmar Agriculture in Brief 2015, September 2015

Table 1-1　World top ten producer of sesame (2013-2017)

	2013	2014	2015	2016	2017
1	Tanzania	Tanzania	Tanzania	Tanzania	Tanzania
2	Myanmar	India	India	Myanmar	Myanmar
3	India	Myanmar	Myanmar	India	India
4	China, mainland	Sudan	China, mainland	Sudan	Nigeria
5	Nigeria	China, mainland	Sudan	Nigeria	Sudan
6	Sudan	Burkina Faso	Ethiopia	China, mainland	China, mainland
7	South Sudan	Ethiopia	Burkina Faso	Ethiopia	Ethiopia
8	Ethiopia	Chad	South Sudan	South Sudan	South Sudan
9	Burkina Faso	South Sudan	Nigeria	Burkina Faso	Burkina Faso
10	Chad	Nigeria	Chad	Chad	Chad

Source：FAO STAT (January 2019)

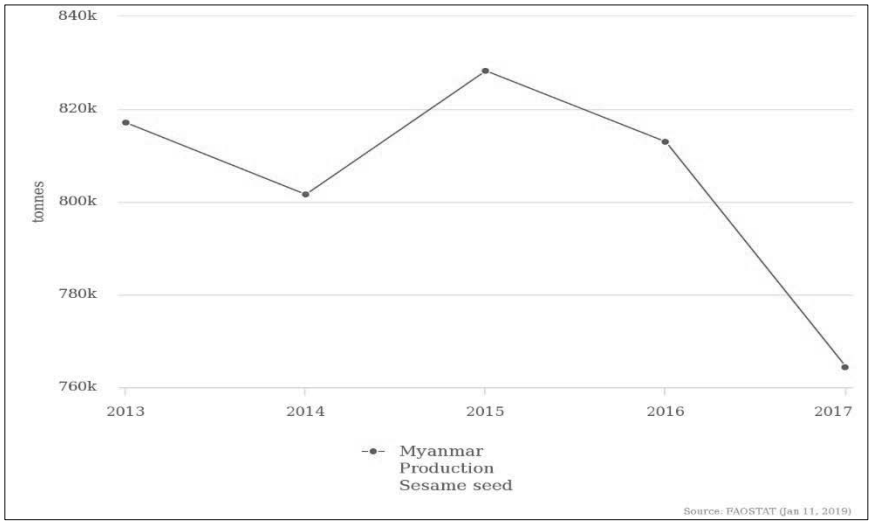


Fig. 1-1　Production amount of sesame in Myanmar (2013-2017)

Source：FAO STAT (January 2019)

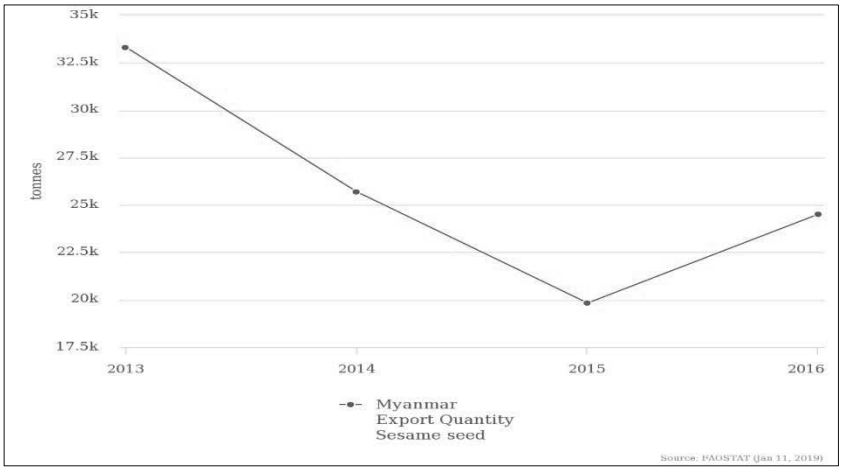


Fig. 1-2　Export amount of sesame from Myanmar (2013-2017)

Source：FAO STAT (January 2019)

(2) Market needs and potential for improvement in Myanmar's sesame production

Various sesame, such as white, black and gold sesame are produced in Myanmar. Japanese market imports black sesame among them. Exporters of black sesame to Japan are Myanmar, Paraguay and India and Myanmar is one of most major exporter of black sesame for Japanese market. Stable production of high quality black sesame in Myanmar is Japanese concern.

In FY2017, JAICAF implemented “Technical Cooperation Project for Agricultural Productivity and Quality Improvement in Myanmar” and conducted the survey and technical cooperation in Magway region, central dry zone. We tackled the problem related to cultivation period and gave advice on soil diagnostics, fertilizations, chemical residues and pest management to farmers and extension workers to improve productivity and quality.

During these activities, we found the problems related to post-harvest treatment, especially rise of acid value during drying period. High acid value is serious problem that possibly affects on stable supply of black sesame to Japanese market, because high acid value raises ship back problem as well as deterioration of flavor.

For drying, many sesame farmers piles sesame on the ground surface from 3 – 7 days (Photo 1), at first. After that, farmers stand sesame as 2nd drying. It is said that the piling process makes acid value increase because of the high humidity and high temperature.

In FY 2018, we conducted verification test to confirm correlation between piling and high acid value in cooperation with farmers and extension workers.

Photo 1　Piling

Photo 2　Standing

Additionally, it is necessary to keep paying attention on appropriate usage of agricultural chemicals to prevent violation of chemical residue standard. Appropriate usage of chemicals must be based on the actual occurrence of pests and diseases. We therefore conducted the survey on pest occurrence during drying period in parallel with the verification test on acid value and gave advice extension workers on the methods of pest survey.

[Target of the Project]

The project focused on the sesame as the target crop and clarified the status and issues of the sesame cultivation by dispatching the experts of insects, sesame market and quality control to conduct the technical guidance on acid value management, insect pest control following the targets stated below.

- To conduct drying test in cooperation with farmers and extension workers to clarify appropriate drying method to prevent increasing acid value in the target area
- To conduct survey on actual situation of pest occurrence during drying period and give guidance on methodologies of the survey in the target region

The expected achievements of the project are as follows.

- Farmers and extension workers understand the correlation between drying method and acid value and introduce appropriate drying method
- Farmers and extension workers understand the pest occurrence situation during drying period and study the effective insect pest control method fitting to the actual situation

In this project, we also provided the information on Japanese market situation and its needs for black sesame to collectors of sesame and distributers of agricultural chemicals as well as farmers and extension workers to motivate them to meet the market needs. It is necessary to keep quality of products in all the process of the value chain, from farm to table, via distribution and manufacturing.

We developed the manuals and mailed them to Myanmar.

2. Target Area

Myanmar can be divided into four climatic zones, hilly mountainous zone, central dry zone, delta zone and neritic zone, and the sesame is mainly cultivated in the central dry zone. The central dry zone consists of three areas, Mandalay Region, Magway Region and Sagaing Region, as shown in the figure 1-3. The sesame production volume of these regions account for about 90% of the country. We selected Aung Lan T/S (Township) in Magway Region as the target area considering sesame cultivation situation for Japanese market.

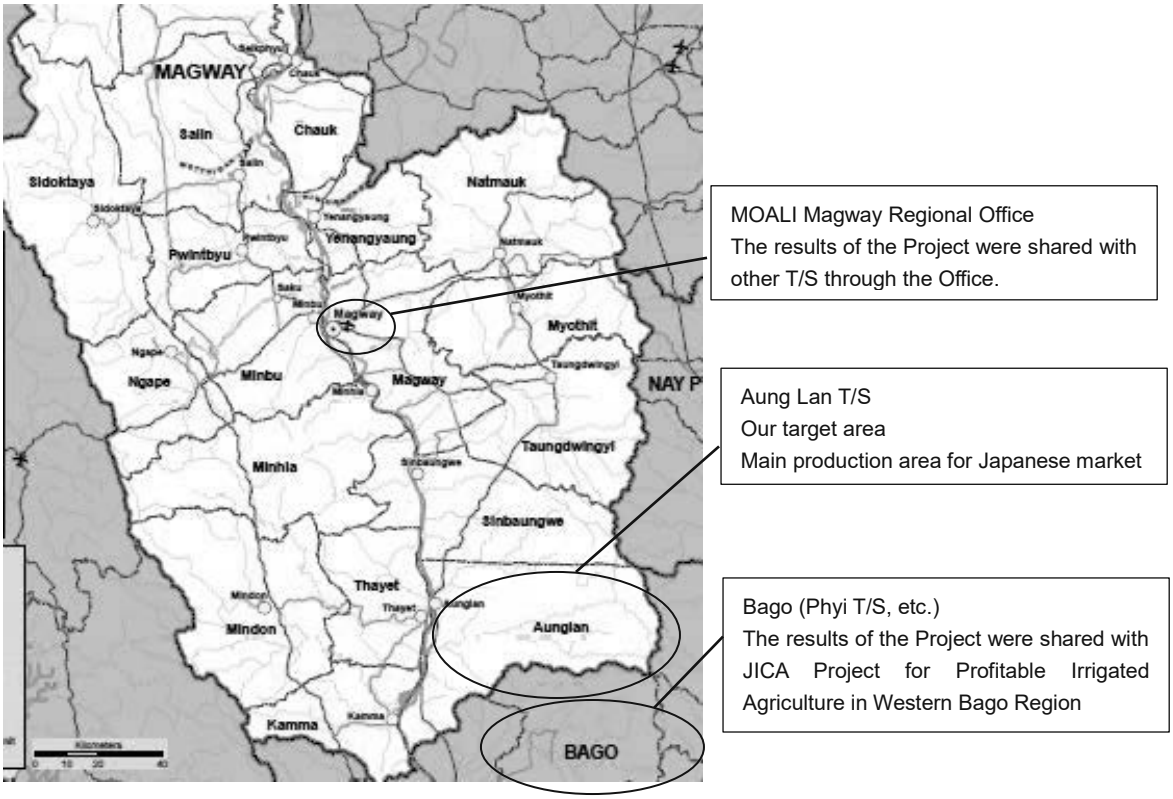


Figure 1-3. Map of Magway (Myanmar Information Management Unit)

2. Contents of the Project

We supported the Myanmar sesame farmers in improving the productivity in order to increase their income and to meet the demand for quality sesame in the global market, especially the Japanese one. We first conducted preliminary survey by surveying the current situation of sesame farmers in Magway regions. Secondly, we conducted drying test, pest survey and held workshops to the local farmers and extension officers. In addition to that, we prepared the manuals for extension workers to use so that technical training can be sustainably implemented at field.

1) Preliminary Survey

We firstly dispatched survey team from Japan to Myanmar to grasp the situation of sesame cultivation in target area and selected farmers who would participate in the drying test. We deliberated the test method as preparation of technical guidance with discussing with DOA.

Before dispatching the survey team to Myanmar, we had collected the information, the sesame manufacturers to confirm their needs.

Survey team

Members	Survey period	Contents
Akiyo Nishiyama (Assistant Director, Operations Dept., JAICAF) Shunichiro Nishino (Senior Researcher, Operations Dept., JAICAF)	June 3 - June 15 (for 13 days)	1. Coordiation for implementing the Project with organizations concerned 2. In the target area, (i) check the status of sesame cultivation and harvest (ii) check the status of sesame sowing and sowing date (iii) selection of farmers who participate in the drying test and preparation of the test

2) Drying test, pest survey and workshop

We conducted the the test to clarify correlation between drying methods and sesame quality and survey to find out the occurrence situation of pest during harvest and drying period in cooperation with farmers and extension workers by dispatching Japanese experts on edible sesame, pest and marketing.

We also held the workshops to share the results of drying test and pest survey and to introduce the needs of Japanese market to local farmers, extension workers, distributors of agricultural chemicals and collectors of sesame.

① Experts dispatched

Expert	Duration	Assigned area
Dr. Azusa Fujiie (Pest control)	Aug. 19 – Sept. 13 Dec. 4 – Dec. 16	- Survey on pest occurrence during harvest and drying period - Training on pest survey method to extension workers by OJT - Recommended method of drying sesame based on the result of pest survey
Mr. Manau Misono (Edible sesame)	Aug. 19 – Aug. 29	- Sesame quality and taste - Standard of sesame for Japanese market
Shunichiro Nishino (Drying test)	Aug. 19 – Sept. 13	- Drying test and identification of recommended method for drying sesame in terms of acid value
Akiyo Nishiyama (Marketing)	Dec. 4 – Dec. 16	- Quality management - Recommended method for drying sesame based on the drying test - Importance of market needs and value chain

② Equipment and materials used

Purpose	Type	Utilization method
Drying test	● AV checker	Used for checking the impact of drying methods on acid value
Pest survey	● Compact stereoscopic microscope ● Yellow sticky trap	Confirming the actual occurrence status of the pests

③ Workshop

Time	Venue	Contents
December 8	DOA Magway Regional Office	− Market needs for black sesame − Post-harvest treatment to produce high quality black sesame: Pest occurrence and acid value
December 11	DOA Aung Lan T/S Office	− Importance of quality management Presentation: ① Current practice and problems of post-harvest and plant protection in sesame production ② Sesame quality and drying method ③ Sesame insect pests and natural enemies of harvest season in Myanmar

3) Follow-up and Technology extension

We prepared and distributed the manuals as it is difficult to transfer the adequate understanding and technology properly in only one year.

The topics of the manuals are;

- Acid Value and Market Needs
- Insects pests of piled-up-drying sesame and stand-drying sesame in Myanmar

Additionally, we issued and distributed the project reports written in English and in Japanese. These reports are posted on the JAICAF Web Site (http://www.jaicaf.or.jp).

Chapter 2 Preliminary Survey

Members: Akiyo Nishiyama, Assistant Director, Operations Department, JAICAF
Shunichiro Nishino, Senior Researcher, Operations Department, JAICAF

Schedule: June 3, 2018 (Sun.) – June 15, 2018 (Fri.), 13 days

Date		Schedule		Stay
June 3	Sun	11:25 16:05	Dep. Narita (ANA: NH813) Arr. Yangon	Yangon
June 4	Mon	7:00 13:00 14:00 15:30	Dep. Yangon (Car) Arr. Nay Pyi Taw Department of Agriculture, MOALI Department of Agricultural Research, MOALI (Yezin)	Nay Pyi Taw
June 5	Tue	7:00 12:00 14:00	Dep. Nay Pyi Taw(Car) Arr. Magway DOA Magway regional office	Magway
June 6	Wed	9:00 11:00 13:30 14:00	DAR Magway Farm Dep. Magway (Car) Arri. Aunglan DOA Aungalan T/S Office	Pyi (Bago)
June 7	Thu	AM PM	Visit PROFIA Project (Pyi, Bago West) Visit sesame farmers	Pyi (Bago)
June 8	Fri		Visit sesame farmers	Pyi (Bago)
June 9	Sat		Visit sesame farmers	Pyi (Bago)
June 10	Sun		Report writing	Pyi (Bago)
June 11	Mon	9:00 10:30 13:00 15:00	DOA Aunglan T/S Office Dep. Aunglan (Car) Arr. Magway DOA Magway regional office	Magway
June 12	Tue	9:00 12:00 14:00	Dep. Magway (Car) Arr. Nay Pyi Taw DOA, MOALI	Nay Pyi Taw
June 13	Wed	11:00 16:00	Dep. Nay Pyi Taw (Car) Arr. Yangon	Yangon
June 14	Thu	10:00 14:00 21:45	Japan Embassy JICA Office Dep. Yangon （ANA：NH814）	
June 15	Fri	6:50	Arr. Japan	

1. Purpose of the Survey

① To grasp current status of black sesame cultivation, drying situation and pest occurrence in the target area

② To select candidate farmers who would participate in the drying test and prepare the test

2. Survey Results

Double cropping, sesame and legume or legume and legume, is basic pattern of cultivation and grand nuts and cotton are added sometimes in major area of Aung Lan T/S. On the other hand, in the southern part of the T/S, irrigated area, major crops are rice and sugarcane. Maize, green gram, ground nut and sesame are cultivated additionally there.

Occurrence of leafhoppers, seed bugs, scarabs, pyralid moths, tiger moths and owlet moths (cutworms) were confirmed in Magway region. We observed phytoplasma (phyllody)-infected farms by *Orusius albicinctus*, a variety of leafhoppers. We also interviewed farmers in the preliminary survey and they told us that most severe problem during cultivation is phyllody and seed bugs are biggest trouble during harvest period. They, however, did not take measures to prevent seed bugs.

DOA Magway Regional Office promoted introduction of Myanmar GAP to agricultural production in the region, including black sesame cultivation. In Ye Paw Village, Aung Lan T/S, where we surveyed several farmers were learning about GAP

2) Selection of farmers for the drying test

In FY 2019, our Project activities were planned to implement in Aung Lan T/S. We visited Ye Paw Village and Duyingabo Village to decide on the location of drying test. (Fig. 2-1) By surveying, we selected Ye Paw Village as the place where we would conduct the test. In the village, sesame are cultivated as major crop traditionally.

During survey, we also selected 4 farmers as candidates who would participate in the drying test. The drying test would be conducted in cooperation with 2 farmers, so at harvesting time, 2 cooperate farmers would be decided among 4 candidates. By deciding candidates, the desirable conditions of selection were; i) the timing of harvest was scheduled in late August, ii) 3 plots for the test (piling up, standing and in-door) could be set, iii) 4 candidates were in the neighboring area (not so far each other) and iv) pest occurrence survey could be conducted at the same plots for the test.

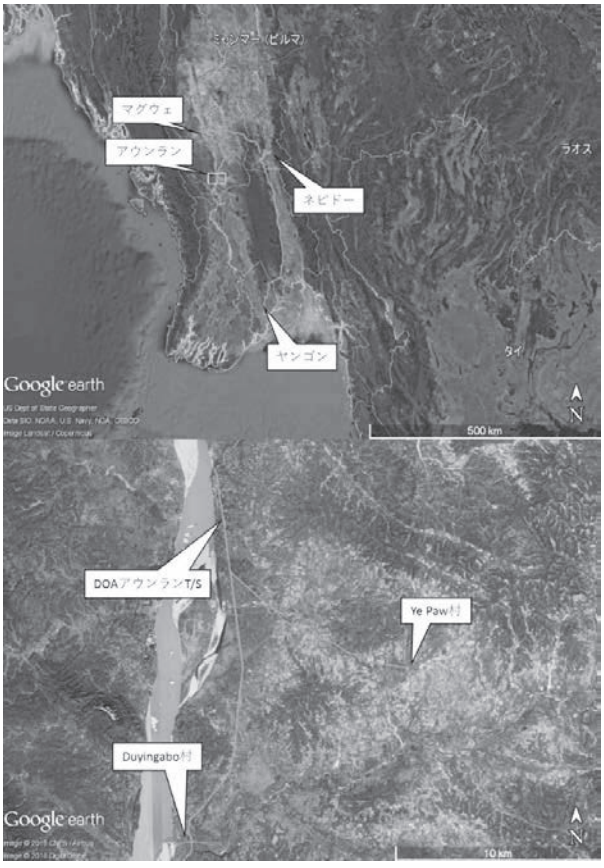


Fig. 2-1　2 villages visited

Chapter 3　Technical Instruction- Drying test, pest survey and workshop

I　Overview

1. Dispatched Experts and Assigned Area

Dr. Azusa FUJIIE
(the former Director of Chiba Prefecture Agriculture and Forestry Research Center): Pest control
Mr. Manabu MISONO (Katagi Foods Co., Ltd, Manager of Purchasing Section): Edible sesame / quality control
Mr. Shunichiro NISHINO (JAICAF Senior Researcher): Drying test / quality control
Ms. Akiyo NISHIYAMA (JAICAF Assistant Director): Marketing / quality control

2. Dispatch Period

1st dispatch: August 19, 2018 (Sun) – September 18, 2018 (Thu)
2nd dispatch: December 4, 2018 (Tue) – December 16, 2018 (Sun)

3. Technical Instruction Schedule

1st dispatch

Date		Activity		Visit
19-Aug-18	sun	11:25 16:05	Departure from Narita Arrival at Yangon	Yangon
20-Aug-18	Mon	7:00 14:00 15:30	Move from Yangon to Nay Pyi Taw Visit of DOA Visit of DAR	Nay Pyi Taw
21-Aug-18	Tue	7:00 14:00 15:30	Move from Nay Pyi Taw to Magway Visit of DOA Magway Visit of DAR Magway	Magway
22-Aug-18	Wed	9:00 13:30 15:00	Move from Magway to Aunglan Visit of DOA Aunglan T/S office Visit of candidate farmers	Pyay (Bago)
23-Aug-18	Thu		Visit of Candidate farmers Decision of target farmers And start of the drying test	Pyay (Bago)
24-Aug-18	Fri		Test and instruction on the field	Pyay (Bago)
25-Aug-18	Sat		Test and instruction on the field	Pyay (Bago)
26-Aug-18	Sun		Documentation	Pyay (Bago)
27-Aug-18	Mon		Test and instruction on the field	Pyay (Bago)
28-Aug-18	Tue		Test and instruction on the field	Pyay (Bago)
29-Aug-18	Wed		Test and instruction on the field	Pyay (Bago)

Date		Activity		Visit
30-Aug-18	Thu		Test and instruction on the field	Pyay (Bago)
31-Aug-18	Fri		Test and instruction on the field	Pyay (Bago)
1-Sep-18	Sat		Test and instruction on the field	Pyay (Bago)
2-Sep-18	Sun		Documentation	Pyay (Bago)
3-Sep-18	Mon		Test and instruction on the field	Pyay (Bago)
4-Sep-18	Tue		Test and instruction on the field	Pyay (Bago)
5-Sep-18	Wed		Test and instruction on the field	Pyay (Bago)
6-Sep-18	Thu		Test and instruction on the field	Pyay (Bago)
7-Sep-18	Fri		Test and instruction on the field	Pyay (Bago)
8-Sep-18	Sat		Test and instruction on the field	Pyay (Bago)
9-Sep-18	Sun	AM PM	Test and instruction on the field Move from Aunglan to Magway	Magway
10-Sep-18	Mon	9:00 10:30 11:00	Reporting to DOA Magway Reporting to DAR Magway Move from Magway to Aunglan	Pyay (Bago)
11-Sep-18	Tue	AM PM	Test and instruction on the field Reporting to DOA Aunglan T/S office	Pyay (Bago)
12-Sep-18	Wed	9:00 21:45	Move from Pyay to Yangon Departure from Yangon	
13-Sep-18	Thu	6:50	Arrival to Narita	

2nd dispatch (After 12th December, we conducted follow-up)

Date		Activity		Visit
4-Dec-18	Tue	11:00 16:30	Departure from Narita Arrivatl to Yangon	Yangon
5-Dec-18	Wed	7:00 15:00 16:00	Move from Yangon to Nay Pyi Taw Visit of DOA Visit of DAR	Nay Pyi Taw
6-Dec-18	Thu	7:00 14:00 15:30	Move from Nay Pyi Taw to Magway Visit of DOA Magway Visit of DAR Magway	Magway
7-Dec-18	Fri		Preparation of workshop	Magway
8-Dec-18	Sat	9:30	Hosting of the workshop at Magway	Magway
9-Dec-18	Sun	9:00	Move from Magway to Aunglan	Pyay (Bago)
10-Dec-18	Mon	9:30	Visit of DOA Aunglan T/S office Preparation of workshop	Pyay (Bago)
11-Dec-18	Tue	9:30	Hosting of the workshop at Aunglan	Pyay (Bago)
12-Dec-18	Wed		Follow-up and hearing survey (farmers, extension staff, DOA T/S office)	Pyay (Bago)
13-Dec-18	Thu	8:30 14:00	Move from Aunglan to Magway Visit of DOA Magway	Magway
14-Dec-18	Fri	7:00 14:00	Move from Magway to Nay Pyi Taw Visit of DOA	Nay Pyi Taw
15-Dec-18	Sat	9:00 22:10	Move from Nay Pyi Taw to Yangon Departure from Yangon	
16-Dec-18	Sun	6:45	Arrival to Narita	

4. Contents of Technical Instruction

In this chapter II to IV, each expert reported on the current state, issue and activities of the assigned area.

5. Workshop

On 8th December at the DOA Magway Region Office, and on 11th December at the DOA Aung Lan T/S Office, we held two workshops. 46 people at Magway, and 61 people at Aung Lan participated respectively (Table 3-1 and Table 3-2). Contents of the workshop were same. After introducing the purpose of the workshop and the outline of the project from JAICAF staff, we announced the following results of activities: (1) Outline and current situation of Myanmar Sesame GAP (by DOA Magway), (2) Quality control and drying method of black sesame (by Ms. Nishiyama), (3) Occurrence of sesame pest in harvest season (by Dr. Fujiie).

Table 3-1 Participants list of the workshop at Magway

No	Township	Extension staff		Farmer		Shop/Buyer		Total	
		Male	Female	Male	Female	Male	Female	Male	Female
1	Min Buu	1	1	2	-	1	-	4	1
2	Pwint Phyu	1	-	2	-	1	-	4	
3	Salin	-	1	2	-	1	-	3	1
4	Say Htot Tayar	1	-	2	-	-	-	3	
5	Nha Phae	-	1	2	-	-	-	2	1
6	Magway	1	1	3	-	2	-	6	1
7	Chauk	-	1	1	-	-	-	1	1
8	Yae Nan Chaung	1	-	1	-	-	-	2	
9	Naut Mauk	1	-	2	-	-	-	3	
10	Myo Thit	1	-	2	-	-	-	3	
11	Taung Twin Gyi	-	1	1	-	-	-	1	1
12	Gant Gaw	1	-	1	-	-	-	2	
13	Hti Lin	1	-	1	-	-	-	2	
14	Saw	1	-	1	-	-	-	2	
15	Kyauk Htu	1	-	1	-	-	-	2	
Total		11	6	24	-	5	-	40	6

Table 3-2 Participants list of the workshop at Aung Lan

No	Township	Extension staff		Farmer		Shop/Buyer		Total	
		Male	Female	Male	Female	Male	Female	Male	Female
1	Magway	2	-	-	-	-	-	2	
2	Aung Lan	6	-	12	-	4	-	22	
3	Sin Paung Wae	2	-	2	-	-	-	4	
4	Min Tone	2	-	2	-	-	-	4	
5	Min Hla	2	-	2	-	-	-	4	
6	Thayet	3	-	2	-	-	-	5	
7	Kan Ma	2	2	2	-	-	-	2	2
8	Pyay	2	6	1	-	7	-	10	6
Total		19	8	23	-	11	-	53	8

II　Drying Method and Market Needs

Akiyo NISHIYAMA
Shunichiro NISHINO

1. Objectives of the Activity

In sesame, which is one of oil crops, oil deterioration is a quality deterioration.

In Myanmar, farmers stack the harvested sesame plant in a corner of the field, dry them (called pile-drying), then stand up and dry (called stand-drying). However, it is said that piled-up-drying method increases the amount of free fatty acids of sesame and the acid value rises. Japanese sesame makers doesn't want farmers to carry out piled-up-drying and want them to do stand-drying as soon as they harvest. Therefore, we conducted a drying test to compare acid value for each drying method to show the effect of each drying method on acid value, and to motivate farmers to apply stand-drying. At the same time, we conducted OJT to extension staff of Aung Lan T/S on the test and survey.

Oil deterioration

It means that oil is oxidized and decomposed by oxygen, light, heating, etc. Depending on the extent of deterioration, not only will it deteriorate the flavor but it will cause harmful substances to the human body.

Acid value

Acid value is related to degree of purifying of oil and degree of deterioration of heated oil. When oil is hydrolyzed by heating or enzymatic reaction etc., the free fatty acid increases and the acid value rises.

（Japan Food Research Laboratories: http://www.jfrl.or.jp/item/nutrition/-330330550.html）

2. Outline of Activities

1) Drying test

(1) Test plot

We selected a field from each of the two farmers to conduct the test and set the following test plot.

(1) Piled-up-drying plot: 2m×1m×1m（$2m^3$）
(2) Stand-drying plot: 2m×1m（$2m^2$）
(3) Indoor-drying plot: Standing and drying in roof covered warehouse, 2m×1m（$2m^2$）
(4) General practice plot (piling and standing): The method that many farmers normally do. After 5days piled-up-drying, they make shift to stand-drying.

Photo 3-1 Piled-up-drying

Photo 3-2 Stand-drying

Photo 3-3 Indoor-drying

(2) Test method

Each test plot was repeated 1 times, and we collected sesame seeds three times on the 0 th, 7 th, and 15th day from starting of the test (figure 3-1).

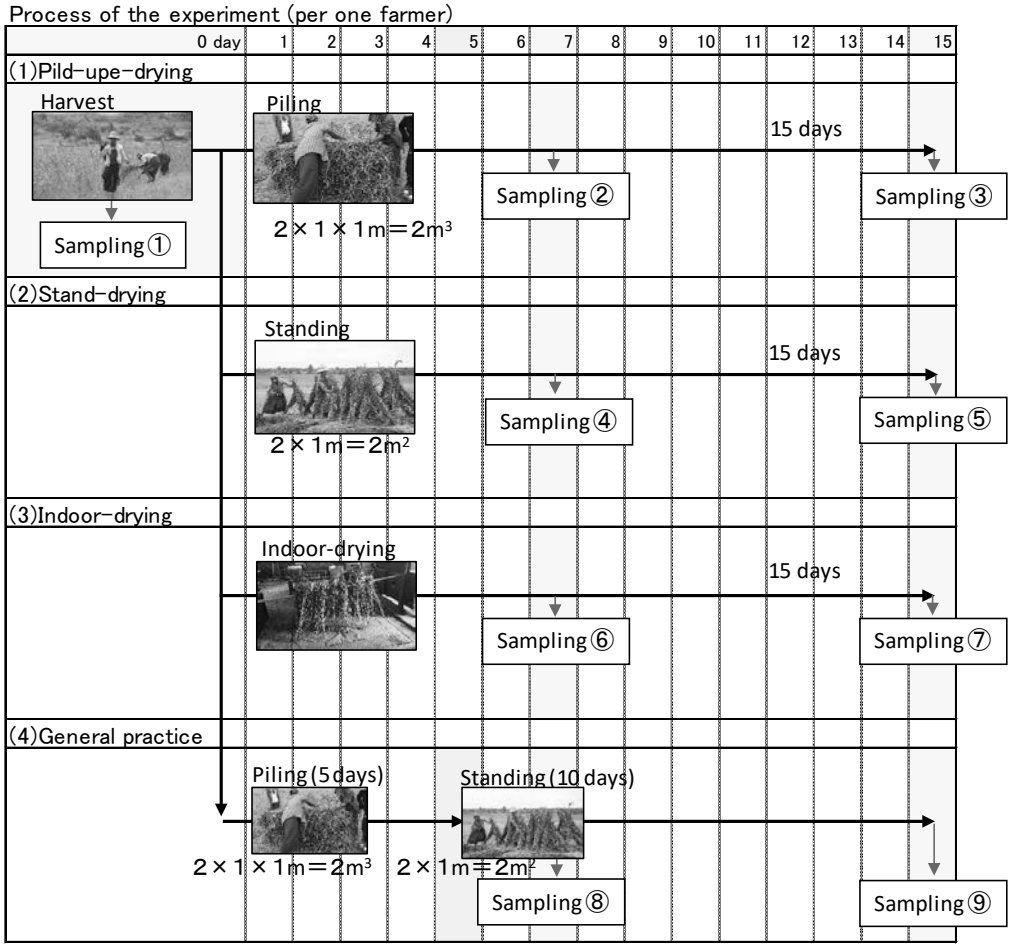


Figure 3-1 Test method

However, in farmer No.1, sesame of general practice plot was sold before the end of the test, and the third sampling could not be done. Therefore, a total of 17 samples, 8 samples for farmer No. 1 and 9 samples for farmer No. 2, were collected. In addition, temperature and humidity of each test plot was measured.

(3) Sampling

We sampled about 20 plants and removed the pods from the plant body at the site and brought them back to the hotel. In the evening, in the room of the hotel, seeds were taken out from the pods and about 50 to 100 g was put in a paper envelope and kept at room temperature. In addition, the sample seeds were also subjected to sensory analysis.

For analysis of acid value, although it is necessary to have 500g or more as one sample for the accuracy of the value, we got only 25g (10g for once measurement, 15g as backup) as the minimum quantity required by the analytical institution because preparing 500g of sample at the site within a limited time and budget was very difficult.

(4) Analysis

We brought all 17 samples to Japan and conducted acid value analysis at Japan Food Research Laboratories. As ancillary data, acid value was confirmed by AV checker as a simple test method during the test.

3. Result of the test

The acid values of each sample were shown in table 3-3 and figure 3-2.

Table 3-3 Acid value of each drying method

Plots	Simple test*	Farmer No. 1**			Farmer No. 2			Average of No. 1 and No. 2		
	7 days	0 day	7 days	15 days	0 day	7 days	15 days	0 day	7 days	15 days
Piled-up-drying	2.50	0.83	2.03	1.19	0.45	0.85	1.99	0.64	1.44	1.59
Stand-drying	0.50		0.52	0.94		0.94	2.07		0.73	1.51
Indoor-drying	0.50		0.60	0.69		0.54	0.61		0.57	0.65
General practice	1.50		1.20			0.71	1.79		0.96	1.79

* Simple test using AV checker

** Farmer No.1 sold sesame seed of general practice plot during the test, we could not sample on the 15th day.

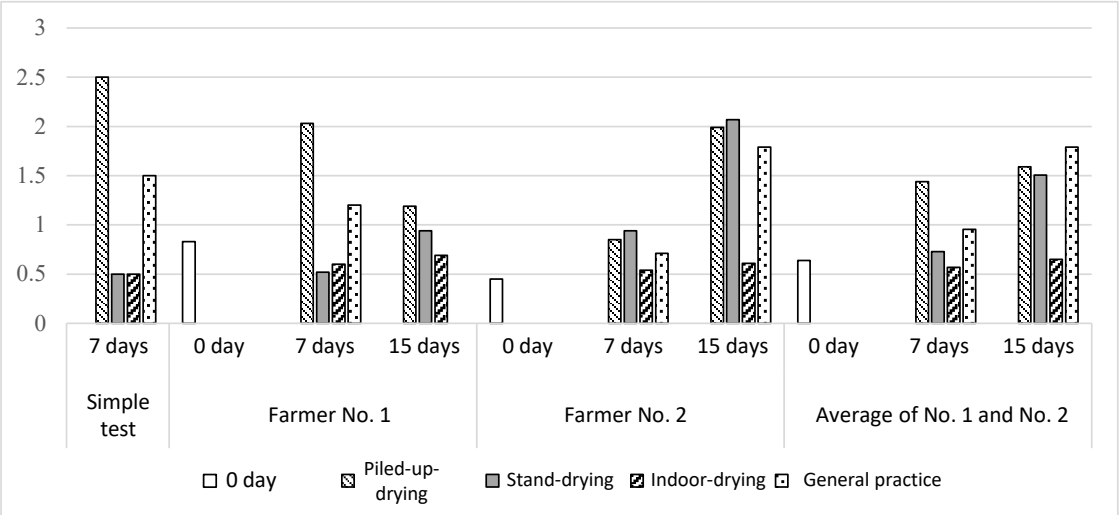


Figure 3-2 Acid value of each drying method

In farmer No. 2, although piled-up-drying < stand-drying, the tendency of indoor-drying < stand-drying < general practice and piled-up-drying was observed when looking at the average value of two farmers.

Also, in piled-up-drying of farmer No. 1, it was observed that mold occurred inside the stacked plants on the 5th day (see photo 13, p. ii).

The temperature and humidity of each test plot were as shown in Figures 3-3 to 3-6.

Temperature was around 30℃ in all test plots, except for the latter half of piled-up-drying of farmer No. 2. In farmer No. 1, it was piled-up-drying < stand-drying≒indoor-drying, but in farmer No. 2, the tendency of stand-drying <indoor-drying <piled-up-drying was observed.

The humidity increased in the order of indoor-drying < stand-drying < piled-up-drying. While the humidity of the piled-up-drying was always over 90%, the stand-drying and indoor-drying had shifted from 70% to 90% according to the one-day cycle. During the test, cloudy weather continued, occasionally heavy rain occurred. The weather conditions may have affected on the results, on the other hand, it was consistently high humidity in piled-up-drying.

In farmer No. 1 general practice, both temperature and humidity were the same as pile-drying before switching from piled-up-drying to stand-drying, and the same result as stand-drying was shown after switching.

Acid value rises as oil is hydrolyzed and free fatty acid is increased[2], and moisture and mold also affect. In farmer No. 1 and simple tests, acid value rose already on 7th day of piled-up-drying and high humidity possibly affected on acid value.

Also, in stand-drying, sesame plants were dry outdoors, so some sesame seeds were exposed to the rain directly and absorbed moisture. In the bundled point of sesame plant body, occurrence of mold

[2] Website of Japan Food Research Laboratories

was observed on the 15th day. As we describe in the pest section (IV of this chapter), there are reports that sucking by bugs also increase acid value.

From these results, it is desirable to switch from piled-up-drying to stand-drying, and, in future, to indoor-drying.

The seeds of the sesame, the samples, were solid, and it was considered that the individual difference of sample was large. In this test, the amount of prepared sample was only 25g, 1/20 of 500 g, recommended amount by the analytical institution. It was inferred that it was one of the factor for different result between No. 1 and No. 2.

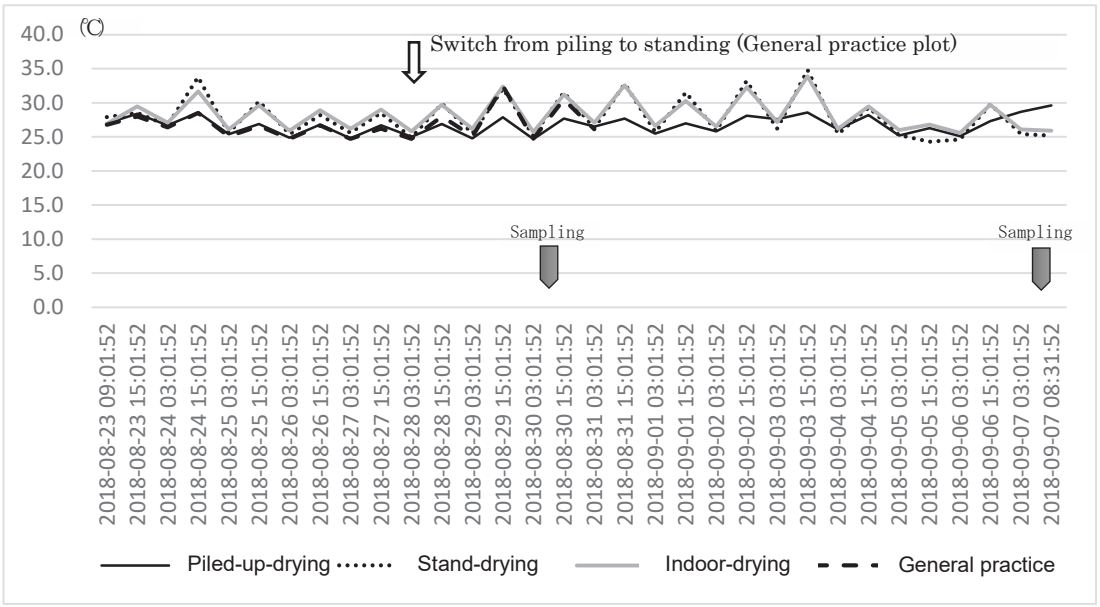


Figure 3-3 Change in temperature in each test plot of farmer No. 1

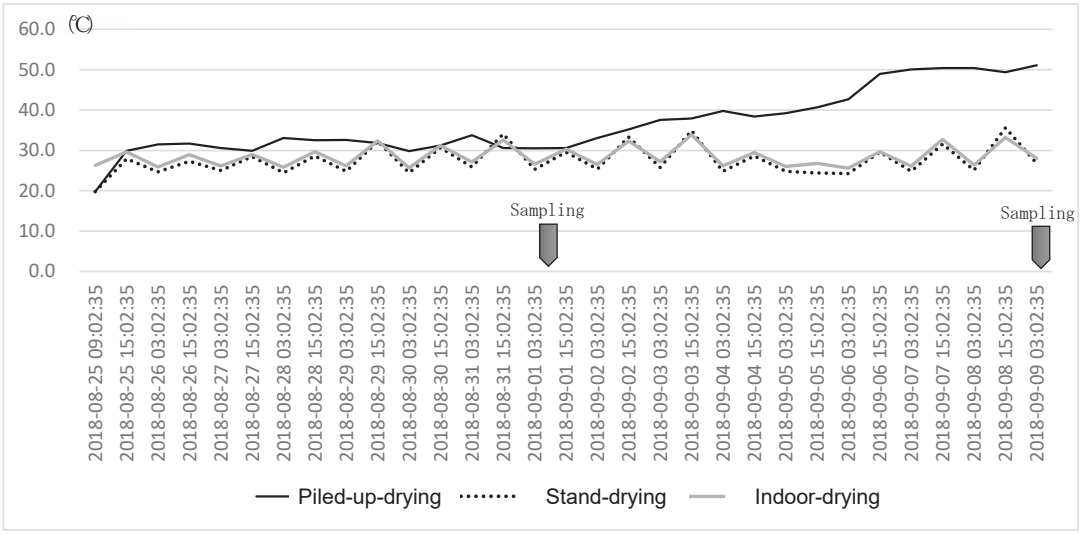


Figure 3-4 Change in temperature in each test plot of farmer No. 2

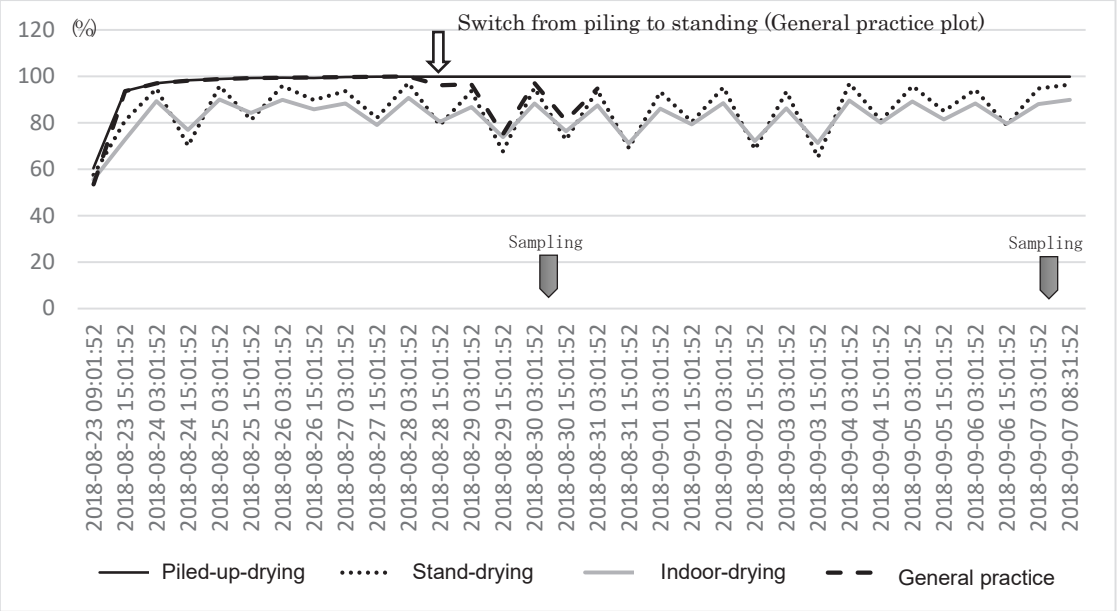


Figure 3-5 Change in humidity in each test plot of farmer No. 1

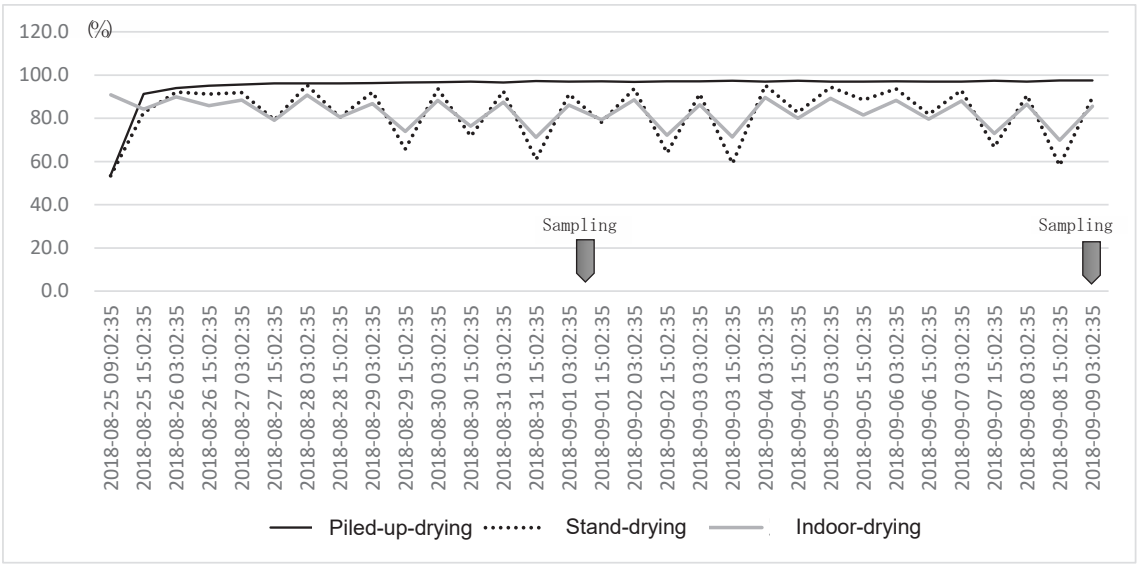


Figure 3-6 Change in humidity in each test plot of farmer No. 2

(3) Wide-area Survey (patrol survey)

In parallel with the drying test, we interviewed sesame farmers and sampled some black sesame in Aung Lan T/S as extensively as possible with the extension staff of DOA during the survey period.

We visited 14 farmer fields and took samples, where pest surveys also conducted (see Figure 3-7).

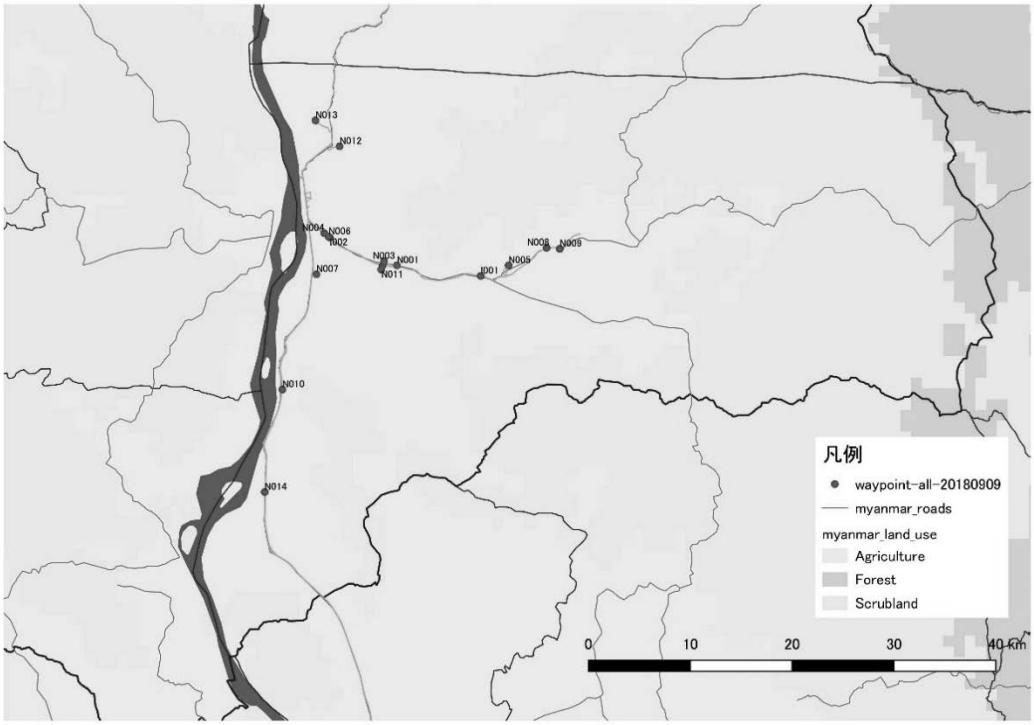


Figure 3-7 Surveyed fields in Aung Lan T / S

*"N" means that both interviews and pest surveys were carried out, and "I" means only pest surveys.

By the interviewing of 14 farmers, we confirmed the situation of piled-up-drying and stand-drying after harvest, the situation of field use, cultivation, sales, fertilizer pesticide application, and GAP participation (see Annex 3). All 14 farmers adopted the general practice for drying that they switched to stand-drying after piled-up-drying, but the periods of piled-up-drying were different, 7 farmers spent 2 nights, 4 farmers spent 3 nights, and 1 farmer spent 5 nights. Among farmers who answered they spent 2 nights, 6 farmers had experience of GAP training. Even in the remaining one, the woman who responded to the interview said that her brother had responsible for agriculture and he may have been participating in GAP. Only one farmer, who spent 2 nights had a piled-up-drying period longer than 2 days even though he participated in the GAP program.

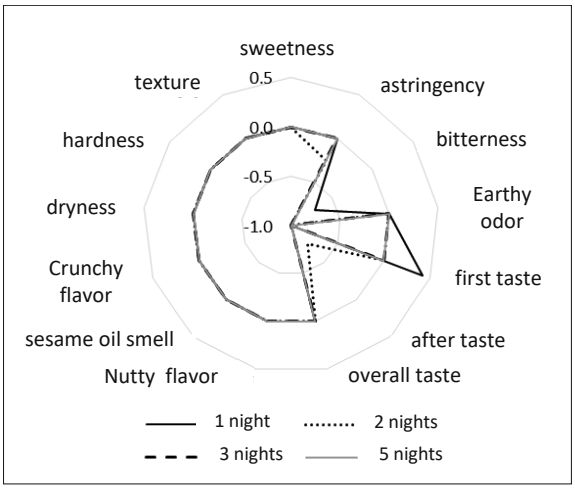


Figure 3-8 Average value for each pile-drying period of the eating quality test (In the overall evaluation, the sample of only one night was 0.7 points higher than the others)

In addition, samples collected at 14 sites were subjected to sensory analysis with the cooperation of Katagi Foods Co., Ltd (refer to the next section "III Quality Control – Appropriate Drying Method"). While the

Japanese market seeks sesame with good eating quality, recently the taste of Myanmar black sesame has deteriorated. Therefore, the sensory test was carried out. In particular, there are many complaints from consumers regarding "mold odor". Since the information of the quality required by the market did not reach the producer, we conducted sensory test and shared the results with them so that they were also interested in good eating quality about "taste" and "aroma".

III Quality Control - Appropriate Drying Method

KATAGI FOODS CO.,LTD
Manabu MISONO

1. Purpose of this mission

Purpose of this mission was to communicate with Myanmar farmers and government officials on quality of black sesame Japanese market demands in order to strengthen the partnership on sesame trade between Japan and Myanmar. This year, we took on the problem of the “piling up method” which seems to be the cause of high fatty acid in sesame. We extended the appropriate drying method by implementing a demonstration on how Free Fatty Acid (FFA) changes with time and how it affects sesame quality.

2. History of Japan’s black sesame import

Up until 2001, most of the black sesame consumed in Japan used to come from China. However, the flood of Yangtze River in 2001 caused a devastating damage to the main production area of black sesame, Jiangxi province and Anhui province. Shortage of black sesame supply led to the soar in its price. Japan started to work on the development of a new production area in Myanmar to secure black sesame supply and thereby freeing itself from dependence on China. Myanmar was selected because it has been growing sesame traditionally. However, in Myanmar, black sesame was not separately collected from other types of sesame and it was difficult to obtain black sesame without contamination of white sesame and brown sesame. Therefore, it was difficult to select high quality black sesame for Japanese market.

Katagi Foods implemented sampling inspection on every single bag brought by the importer from various areas of Myanmar. Two major problems of Myanmar sesame were high acid value and severe color mixture. Farmers were drying the sesame using piling up method and threshing without stand-drying afterwards. To tackle the problem of high acid value, Katagi Foods manualized a desired drying method and went around villages for extension. To overcome color mixture, Katagi Foods gathered sesame only from Aung Lan area and strictly instructed sesame collectors to collect black sesame separately from reddish black sesame. From the following year, black sesame from Myanmar started to attract attention from Japanese food companies as alternative to the black sesame from China. Later, China became an importer of sesame due to population increase and decrease in sesame production. As a result, Chinese black sesame price soared and Japanese companies shifted their procurement site from China to Myanmar. Today, about 80% of black sesame consumed in Japan come from Myanmar and it can be said that Japan is highly dependent on Myanmar when it comes to black sesame supply.

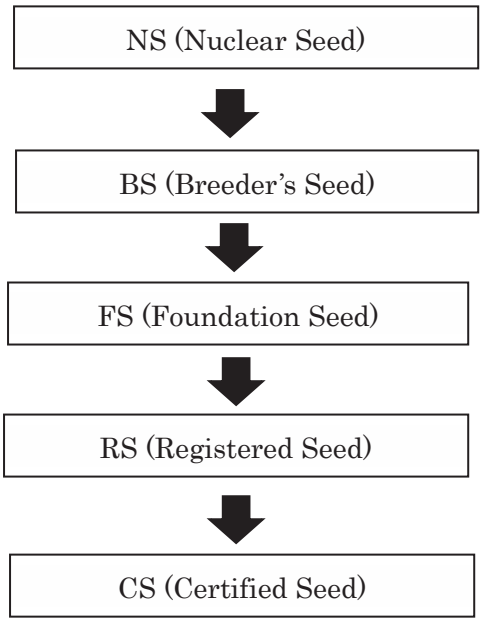
3. Varieties cultivated in Myanmar

In Myanmar, black sesame are graded in two categories called NB (Normal Black) and SB (Science Black). NB indicates low quality black sesame with not-so-good color and SB means high quality sesame with deep black color. Local collectors classify NB and SB when buying the sesame from farmers and have different rates for them. This classification emerged when sampling with the exporters. Black sesame from Aung Lan had the best taste and Japanese food companies started to purchase black sesame from Aung Lan as the most tasty black sesame. Later, one of the exporter who started exporting black sesame to Japan named the black sesame Japanese people liked to be called "Science Black" since Japanese people love science and technology. Myanmar people call SB "Teppan Nei". Teppan means science and Nei means black. Price of black sesame started to rise in 2010. Today, market price is not in its highest but remains high. This created difference in price compared to white sesame. From the expectation of more profit, more farmers turned to black sesame cultivation and areas where originally growing white sesame and brown sesame became black sesame cultivation areas. Magway, on the north of Aung Lan, became a new black sesame production area and variety grown there is "Sin Yadaner 3" developed by DAR. Sin Yadanar 3 is recommended by DAR because of high yield and resistance to heat and rain. It has bitter taste and color is relatively gray compared to SB. When Japanese companies purchase sesame, it is impossible to distinguish Sin Yadanar 3 from SB. There are only two classifications, NB and SB because local collectors buy from farmers based on difference in color. Thus Sin Yadaner 3 sesame is bought as SB if the color is pure black.

In Myanmar, DAR Oil Crop Research Centre in Magway is managing, producing and selling seeds. However, most farmers self-seed. They keep their harvest and use as seed next year. Thus, once mixture of varieties happens, it is difficult to separate a variety from others and there is a danger that excellent tasting native variety become extinct. Also there is no quality assessment on taste at collecting point but purchasing price from famers are determined by the color and mixture checked visually and water contents measured by hands.

Farmers tend to choose high yielding varieties since profit often depends not on quality buy on quantity. Therefore, it is important to breed and preserve good varieties and for farmers to be able to select and purchase Certified Seed (CS). In this mission, Oil Crop Research Centre presented four DAR recommended varieties so that we could implement quality assessment on different varieties on top of the main demonstration on drying method.

■ Breeding at Oil Crop Research Centre, Magway DAR



When breeding, they grow NS (Nuclear Seed) in four 15-feet lines, select several plants from each lines and clip the flowers to avoid pollinating with other flower's pollen and to self-pollinate. The seeds collected from these clipped flowers become the NS as seeds from other flowers will be BS. DAR makes CS but DOA also breed from BS distributed by DAR. They are able to sell seed of sesame and legumes beyond RS. One of the division manager is in charge of producing CS. Also, there are two farmers contracted as breeders. DOA also has farmers to grow seed but the number of farmers are not confirmed (later, DOA Magway said they do not produce seed). There is no inspection on seed growers and there is no labels to identify CS for selling CS. DAR Magway sells CS to farmers all over Myanmar. They sell mainly four varieties, namely Teppan Nei, Sin Yadanar 3, Magway 1/13 and Sin Yadanar 14. Selling price of those seeds are 50,000 kyat/basket.


Photo3-4,3-5,3-6 Drying the test growing seed at Oil Crop Research Centre

Photo 3-7 Clipping the flower

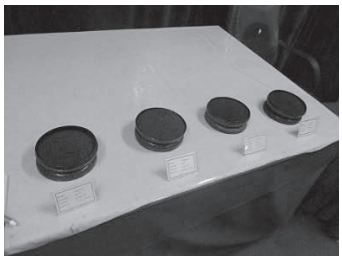


Photo 3-8 Recommended varieties

4. About Quality

When Japanese food companies import sesame from Myanmar, they purchase sesame via trading companies. Common requirements are 1) moisture content 7% max, 2) Free Fatty Acid 2.0 max, 3)

admixture 0.5% max, 4) pesticide residue within set limit, and 5) aflatoxin undetected.

Black sesame from Myanmar suffer from high moisture and high acid value due to rain during drying process. Moisture can decrease gradually but FFA (high acid value) will not decrease once it has increased. Regarding pesticide residue, imidacloprid used to be detected frequently but detection risk lowered after residue limit for imidacloprid was revised from 0.01ppm to 0.05ppm in July 2017. On the other hand, limit for some other agrochemicals are revised to be stricter. It is important to get the latest updates at all time and work hard on the appropriate agrochemical use. Sesame does not have a lot of registered agrochemicals and therefore uniform standard is applied for most agrochemicals. As a result, limit for agrochemical residue on sesame is very strict under positive list system. If products did not meet the requirements, they will be shipped back to Myanmar. When that happens, exporters bear the expenses but collectors and farmers are free from this risk.

5. Taste-test of demonstration sesames

1) Taste-testing method

Roasting: wash and drain the sesame and leave it for 20 – 30 minutes. Roast the sesame using a pan (About 8 minutes on 180 – 200℃).

Color：color of the sesame, color unevenness, color skips
Grain：sort out the sesame using mesh and measure the composition ratio to specification
Flavor：sensory evaluation by export
Texture, sweetness, astringency, bitterness, sourness, earthy odor, first taste, aftertaste, depth of taste, nutty flavor, sesame oil smell, crunchy flavor, dryness, firmness, mouthfeel
Aw：electric hygrometer method
Moisture：non-pressurized heating drying method
Acid value：quick test using test paper

2) Demonstration plot

We selected two plots and dried sesame in four different methods namely “Piled up-drying”, “Stand-drying”, “Indoor drying” and “General practice (5day piling up + stand drying)”. For each method, we collected the pods from the day of the harvest, 7 days after the harvest and 15 days after the harvest.

Photo 3-9 Piling up

Photo 3-10 Stand-drying

Photo3-11 Indoor drying

■Plot No:N-001　※no sample pods of 15 days after the harvest for Piled up method and Stand method

Sample	Color	Grain	Flavor	Aw	Moisture	FFA
Harvest day	7	4	5	0.53	5.95%	less than2
Piled up drying 7 days later	5	4	5	0.49	5.61%	less than4
Piled up dryig 15 days later	4	4	4	0.48	5.09%	less than2
Stand drying 7 days later	6	4	5	0.5	5.92%	less than2
Stand drying 15 days later	7	4	5	0.48	5.43%	less than2
Indoor drying 7 days later	8	4	5	0.5	5.57%	less than1
Indoor drying 15 days later	5	4	5	0.5	5.45%	less than2
Piled up +Stand drying 7 days later	4	4	5	0.51	5.49%	less than2
Piled up + Stand drying 15 days later	-	-	-	-	-	-

■Plot No.N-002

Sample	Color	Grain	Flavor	Aw	Moisture	FFA
Harvest day	10	4	5	0.51	6.06%	less than1
Piled up drying 7 days later	8	4	5	0.51	6.15%	less than2
Piled up dryig 15 days later	7	4	5	0.5	4.82%	less than3
Stand drying 7 days later	9	4	5	0.5	5.46%	less than2
Stand drying 15 days later	7	4	5	0.51	5.63%	less than3
Indoor drying 7 days later	9	4	5	0.51	5.66%	less than0.5
Indoor drying 15 days later	9	4	5	0.52	5.69%	less than0.5
Piled up +Stand drying 7 days later	10	4	5	0.53	6.05%	less than0.5
Piled up + Stand drying 15 days later	7	4	5	0.53	6.09%	less than2

■CS obtained from Magway Oil Crop Research Centre

Variety	Color	Grain	Flavor	Aw	Moisture	FFA
Teppan	7	5	4	0.74	8.22%	more than4
Sin Yadanar3	5	4	4	0.74	7.74%	less than2
Sin Yadanar14	8	4	5	0.69	7.88%	less than2
Sin Yadanar1/13	8	4	5	0.67	7.53%	less than4

3)　Observation

Katagi foods consider buying sesame when evaluation for flavor is 6 or higher. Moisture must be lower than 7% and FFA must be lower than 4. In our demonstration, all samples have lower than 7% moisture and lower than 4 FFA. It rains every day on drying period and it takes days to dry the harvested sesame. Pods are green color when harvested but they gradually become black in patches and top of the pods open up. When rains, water gets inside the pods and heighten moisture and FFA of the sesame seeds. Drying period for monsoon crops is from mid-August to early September which is at the end of rainy season and the beginning of dry season. Change in climate causes rain in unwanted time which affects the quality of the sesame. The year of this demonstration had a longer rainy season and rained a lot. We observed white molds when standing up the sesame from piles on

5th day. Sesame tasted and smelled moldy. Sesame on the top of the pile gets dried but inside the pile does not get dried. Therefore, piled up drying requires more time to dry. We harvested pods and dried before threshing. Thus moisture decreased and acid value did not increase badly. In real situation, famers often store sesame with high moisture from rain so the moisture remain on the sesame and cause automatic increase of acid value. If sesame can be dried indoor where there is no damage from rain, moisture can be maintained at low level and so is acid value. However, in Myanmar, it is not realistic to make farmers dry their sesame indoors. The best practice is to stand up the sesame right after the harvest and finish drying in shorter period of time. In this test, there was no difference in flavor but score was low overall with bitterness. We could not find tasty sesame even from CS obtained from Oil Crop Research Centre. All sesame had low flavor score. Complex causes are considered such as climate during the drying period and variety mixture. Good flavor we used to taste could not be found during this mission and even CSs are losing their flavor.

6. Issues to be solved in the future

In Myanmar, farmers bring their produce to collectors and collectors buy them with simple grading. Farmers profit more from quantity than quality. Farmers will not be held accountable for any problems such as pesticide residue and moldy smell once their sesame were sold to collectors. Exporters implement sample checks when buying sesame from collectors but FFA are rarely checked. Exporters take the risk of ship-back when the sesame did not meet the specifications in Japan. Collectors have the power in sesame value chain. It is difficult to establish traceability in this situation. However, foreign NGOs are promoting Myanmar GAP and train farmers on cultivation methods such as record-keeping, use of agrochemicals, fertilizer management and soil survey. Myanmar GAP is different from Global GAP. Myanmar GAP is aiming to improve the value chain from farmers to processors and designed to suit the situation of Myanmar. If there is a record, it is possible to trace when, who, how products were made and consumers would feel safe. Some are providing trainings on drying method after harvest in order to prevent high acid value. Myanmar GAP is still at its starting stage but farmers who are following Myanmar GAP have high level of awareness and their sesame tend to have low acid value. Problem of pesticide residue is expected to be solved as well. Myanmar GAP opens up the possibility for high quality sesame Japanese market is looking for. If products following Myanmar GAP are proven to be safe and low in acid value, Japanese food companies will purchase them with premium. As a result, we can expect the local farmer’s income to be improvement.

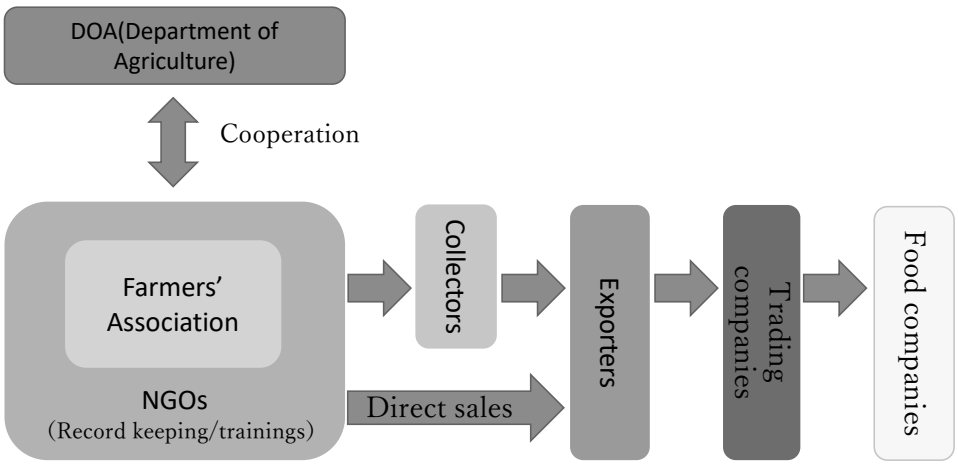


Figure 3-9　Myanmar GAP in Value Chain

Farmers get certified as Myanmar GAP farmers if they received trainings and keep the cultivation record. Training are implemented following the guideline with 16 components.

16　components
1) Soil, 2) Irrigation, 3) Seed/variety/seed law, 4) Fertilizer, 5) Agrochemicals,
6) Cultivation method, 7) Agricultural machinery, 8) Harvest,
9) Storage/transportation, 10) Storing facility, 11) Storage pest, 12) Record keeping,
13) Monitoring, 14) Training 15) Problems, 16) Health

Photo 3-12 Note for record keeping

Photo 3-13 Text for training

IV　Occurrence of Sesame Insect Pest during Harvest Period in Myanmar

Azusa FUJIIE

1. Goals of the Activity

In cultivating sesame in Myanmar, the farmers temporarily pile up the harvested sesame in a corner of their fields (called “piling sesame”), then they prop the sesame each other in a corner of their fields (called “standing sesame”). Sesame is piled up for various reasons, such as convenience, whereas standing is mainly used for drying. Although farmers are concerned that pest insects will infect their piling sesame and standing sesame, there is not sufficient information on sesame pest insects. Therefore, appropriate measures cannot be taken to ward off pest insects so that the farmers are either more concerned about them than necessary or they are ignored. Moreover, using pesticides during this period could cause problems related to pesticide residue. In order to cope with pest in an appropriate manner, we aimed to clarify the actual occurrence status of pest insects in piling sesame and standing sesame.

The survey was conducted with local participants (sesame farmers, extension workers, etc.), and we shared knowledge and information about sesame pests and damage by them. In addition, we informed others about the importance of quality control for sesame and the meaning of these activities through workshops and manuals. This series of activities were conducted for extension workers as on-the-job training, and we instructed them on how to notify farmers about the sesame pest survey and its meaning. We also expected that, through these activities, more farmers showed interest in producing high quality and highly marketable sesame. These activities were conducted by JAICAF as part of the "Technical Cooperation Project for Agricultural Productivity and Quality Improvement in Myanmar -2018-" , funded by the Ministry of Agriculture, Forestry and Fisheries of Japan.

2. Activity Periods and Activity Locations

Activity periods:　August 19 to September 13, 2018 (26 days), December 4 to 16 (13 days)
Activity locations:　Aung Lan T/S, Magway Region, Myanmar

3. Activity Results

1) Piling-up and Standing

DOA and DAR of MOALI say that piling up (Photo 3-14) can increase the free fatty acid of sesame and other problems, but farmers still use this method for a variety of reasons. It is said that piling up is necessary because it is more convenient when working, it makes it easier to estimate the harvested amount, it makes it easier to arrange for workers to harvest the crops, it makes it easier to calculate

the payment for the workers, etc. Moreover, some farmers said that these measures helped the sesame ripen and improved the color and gloss of the seeds. At Magway T/S that we visited in 2017 to conduct a survey, it was said that piling was almost one hundred percent executed for a certain period. However, according to the DOA headquarters, as of 2018, they instructed farmers that using stand-drying immediately after harvesting was desirable (Photo 3-15), but if piling up was to be done, it was recommended for only two to three days (two nights and three days). In addition, for farmers who were involved in GAP, they were being instructed to restrict piling up for only one to two days (one night and two days)[3]. Stand-drying was used for about seven days. However, both piled-up-drying and stand-drying could be longer depending on the amount of rain.


Photos 3-14 and 3-15. Piled-up drying (left) and stand-drying (right) of harvested sesame

2) Pest Survey Period and Survey Methods[4]

We conducted the survey during August and September 2018. Patrol observation surveys for sesame pests were conducted by patrolling 25 fields (observation survey fields: U#1 to U#25) and fixed point surveys were conducted at two fields (fixed point survey fields: F#1 and F#2). (Table 3-4) At these fields we conducted pest surveys, damage surveys, and interviews. (Table 3-5) The selection of the fields and assistance during the surveys was provided by extension workers from DOA Aung Lan T/S.

[3] According to interviews conducted on August 20, 2018.
[4] Note that the cultivation stages of sesame have been categorized into "cultivating: early cultivation, late cultivation" and "after cultivation: piling period, standing period."

Table 3-4. Fields used to survey piling sesame and standing sesame in Myanmar

Symbol	Date	Location	Piling or standing
Patrol survey field	2018	Aung Lan T/S	
U#1	24-Aug	Yay Paw	Piling (being harvested)
U#2	24-Aug	Yay Paw	Standing
U#3	28-Aug	San Kalay	Piling
U#4	29-Aug	Than Gyate	Piling
U#5	29-Aug	San Kalay	Standing
U#6	30-Aug	San Kalay	Standing
U#7	30-Aug	San Kalay	Piling
U#8	30-Aug	San Kalay	Piling
U#9	31-Aug	San Kalay	Piling (being harvested)
U#10	1-Sep	Inn Gone	Piling
U#11	4-Sep	A Lea Ywar	Piling
U#12	4-Sep	Ywar Ma Hlone	Standing
U#13	4-Sep	Ywar Ma Hlone	Standing
U#14	4-Sep	Ywar Ma Htone	Piling
U#15	4-Sep	Ywar Ma Hlone	Piling
U#16	4-Sep	Ywar Ma Hlone	Standing
U#17	4-Sep	Ywar Ma Hlone	Standing
U#18	5-Sep	Nan Zu Pin	Piling (being harvested)
U#19	5-Sep	Nan Zu Pin	Piling
U#20	5-Sep	Ye Paw	Standing
U#21	6-Sep	Whwe Nyaung Pin	Standing
U#22	6-Sep	Shwe Nyaung Pin	Standing
U#23	6-Sep	Gwae Gone	Standing
U#24	6-Sep	Gwae Gone	Standing
U#25	7-Sep	Nga Pyin	Piling
Fixed-point survey fields	2018	Aung Lan T/S	
F#1-P, F#1-S	(1) 23-Aug, (2) 30-Aug, (3) 7-Sept	Ye Paw	Piling • Standing
F#2-P, F#2-S	(1) 25-Aug, (2) 1-Sept, (3) 9-Sept	Ye Paw	Pilimg • Standing

Table 3-5. Methods of pest survey, damage survey, and interview

Survey method	Patrol survey field	Fixed-point survey field
Pest survey		
Visual inspection	Directly observing pests in piling sesame and standing sesame	Same as left. Additionally, shake out into an insect net to find sesame seed bugs.
Netting	Swing an insect net 40 times in a field after harvesting to catch pests	Not conducted
Yellow sticky trap	Not conducted	Use three yellow sticky traps (20 cm × 10 cm)
Damage survey	Study of damaged leaves and pods in 30 piling sesame plants and 10 to 30 standing sesame bundles (three small bundles bound together make one bundle)	Same as left. Additionally, 2000 standing sesame seeds examined under a microscope to count the number of empty/non-fulfilling seeds.
Interviews	Four questions for farmers (pests, damage from pests, pesticide use with respect to the piling sesame and standing sesame, and phytoplasma during cultivation)	Same as left.

The weather at the Aung Lan T/S survey area during the survey period was mostly light cloud cover with some sunshine breaking through and some light rain. There were also some heavy squalls. The rainfall was heavy this year with some sesame fields being flooded and this had an adverse effect on the growth of sesame. Moreover, Myanmar as a whole witnessed a great deal of rainfall and there was flooding around the country.

(1) Patrol observation surveys for pests and damage (patrol surveys)

① At the 25 arbitrarily selected fields (piling at 13 fields and standing at 12 fields), pest observation surveys, pest netting surveys, and damage surveys were conducted one time for each field.

② At each field, the types and numbers of pests in piling sesame and standing sesame were visually examined (observation survey). Any pests that were discovered during the surveys were caught and the types of minute pests were confirmed with microscopes.

③ After harvesting was completed at fields, we used insect nets (36 cm diameter) to catch pests (40 swings, back and forth 20 times) and examine the number of remaining pests in the net (netting method). Of the pests caught, the types of minute pests were confirmed with microscopes.

④ For 30 piling sesame plants and 10 to 30 standing sesame bundles (a bundle is defined as three smaller bundles bound together), we studied the damage caused by pests to the leaves and pods (shells).

(2) Fixed point surveys for pests and damage (fixed point surveys)

① At the two predetermined fields (free fatty acid test fields), we conducted three observation surveys for pests, two yellow sticky trap surveys, and one damage survey.

② The types and numbers of pests in piling sesame and standing sesame were visually examined (observation survey). Any pests that were discovered during the surveys were caught and the types of minute pests were confirmed with microscopes. In addition, in the final (third) survey, we looked for sesame seed bugs which are a type of stink bug by putting a sesame plant in an insect net and shaking out any pests and counted them.

③ We placed three yellow sticky slopes (20 cm x 10 cm) at each field and examined the number of pests caught (yellow sticky trap method).

④ For 30 piling sesame plants and 10 to 30 standing sesame bundles, we studied the damage caused by pests to the leaves and pods. In addition, at the field where sesame seed bugs had proliferated (F#2), we retrieved seeds from the standing sesame. We checked each of two thousand seeds under a microscope to examine the number of seeds that were only husks.

(3) Interviews regarding pests

We interviewed 16 farmers through an interpreter to ask the following questions:

Question 1. What kinds of pests do you see in piling sesame and standing sesame?

Question 2. What kinds of damage are caused in piling sesame and standing sesame?

Question 3. Do you use pesticides on piling sesame and standing sesame? What kinds of pesticides do you use?

Question 4. Do you know about sesame phytoplasma? What kinds of countermeasures are you taking?

The phytoplasma (Phyllody) in Question 4 is an infectious disease specifically caused by a specie of hopper that is known as sesame jassid (*Orosius albicinctus*). This disease causes a significant decrease in the number of husks so that there is a huge decrease in yields. Because the plants are deformed, they are obvious in piling sesame and standing sesame, but these are plants that have been affected by the disease during late cultivation. It has been a concern that farmers are lacking in the knowledge and information about this disease and how to prevent it. Therefore, we asked about it in order to emphasize the importance of this disease.

3) Pest occurrence

During a survey conducted in 2017 (JAICAF project ""Technical Cooperation Project for Agricultural Productivity and Quality Improvement in Myanmar -2017-""), the following pests were confirmed in sesame that was being cultivated: hoppers, stink bugs, scarabs, pyralids, sphinx moths, tiger moths, and Noctuidae. (JAICAF, 2018) In addition, it seemed that coccids and nematodes also occurred. The prevalent diseases were phytoplasma, viruses, and black stem. The preliminary surveyby JAICAF in June 2018 found that cultivated sesame suffered from stink bugs, termites, aphids (viral disease carrier), tiger moths, Bostrichidae, sphinx moths, and phytoplasma (carried by a hopper).

This survey (August to September 2018) was centered on the occurrence of pests in piling sesame and standing sesame at fields after harvesting. The names of pests and their categorization was from the Myanmar Crop Protection Branch (1999), the PP application distributed by DOA, the Japanese Society of Applied Entomology & Zoology (2006), and Ishikawa, et al's work (2012). With respect to the sesame jassids which is a type of hopper and sesame seed bugs which are a type of stink bug which have no Japanese names, we have used their English names.

The results of the various surveys conducted at each patrol survey field and fixed point survey field were described below. Table 3-6 shows the main pests and damage caused in relation to sesame in Myanmar based on the knowledge and information that has been collected to date.

(1) Patrol surveys

In the visual inspections of piling sesame and standing sesame, we confirmed the occurrence of the following: Leafhoppers/Jassids (Cicadellidae), stink bugs (Lygaeoidea, Pentatomoidea, Coreoidea), scarabs (Scarababidae), sphinx moths (Sphingidae), tiger moths (Arcitiidae), termites (Termitidae), mealybugs (Pseudococcidae), and flatid planthoppers (Flatidae). In the netting survey conducted in fields after harvesting, we confirmed the occurrence of leafhoppers and stink bugs. The varieties of pests confirmed during the piling and standing periods (after harvesting) were mostly the same as during early and late cultivation (during cultivation). (Table 3-6)

Table 3-6. Main pests of and damage on sesame in Myanmar

Type of pest	Aphids (viral disease carrier)	Leafhoppers (Phytoplasma carrier)	Stink bugs	Scarabs	Pyralids	Sphinx moths	Tiger moths	Owlet moths (cutworms)	Termites
Damage	Suckers (adults/larvae: leaves, stalks)	Suckers (adults/larvae: leaves, stalks)	Suckers (adults/larvae: seeds, etc.)	Mastication (larvae: roots)	Mastication (larvae: leaves, pods)	Mastication (larvae: leaves)	Mastication (larvae: leaves, pods)	Mastication (larvae: leaves, stems)	Mastication (adults, larvae: leaves, stems)
Piling/Staning period	(After harvesting)								
(1) Pest	○	○	●	○	×	○	○	○	○
(2) Damage	×	×	●	×	×	×	○	×	×
Early/Late cultivation	(During cultivation)								
(1) Pest	○	●	○	○	○	○	○	○	○
(2) Damage	○	●	○	○	○	○	○	○	○

Note 1. Occurrence of pests and damage: × = None, ○ = Occurrence, ● = Major occurrence

Note 2. The pests that are causing major damage are sesame seed bugs which are a type of stink bug in piling sesame and standing sesame, and sesame jassids which are a type of hopper that carries phytoplasma during the early and late cultivation periods of sesame. Major occurrences of other pests must be watched out for.

Note 3. There were also occurrences of whiteflies, geisha distinctissima, and rats.

Most of the pests confirmed in piling sesame and standing sesame occurred or were introduced during late cultivation. However, we believe that most of the stink bugs flew to the piling sesame and standing sesame after harvesting. The types of stink bugs identified were Lygaeoidea, Pentatomoidea, and Coreoidea, and sesame seed bugs (*Elasmolomus sordidus*), a type of Lygaeoidea were proliferating. Sesame seed bugs were previously referred to as *Aphanus sordidus*, but today they are considered to be *E. sordidus* of *Elasmolomus* within Rhyparochromidae. In recent years, the categorization of Lygaeoidea has undergone major changes. This paper used the categories by Ishikawa, et al (2012). There were occurrences of Lygaeoidea that were both smaller and larger than sesame seed bugs. The length (average ± standard deviation) and torso width (average ± standard deviation) were 9.0±0.5 mm and 3.3±0.3 mm for sesame seed bugs, 8.8±1.2 mm and 2.6±0.6 mm for smaller types, and 13.0±1.1 mm and 4.2±0.2 mm for larger types.

Although we found many types of hoppers, during our patrol surveys we did not confirm the occurrence of sesame jassids, a carrier of phytoplasma. We found a few scarab larvae. Sphinx moths and tiger moths occur during late cultivation, but we didn't observe them on the leaves that were still green in the piling sesame. Because sphinx moths and tiger moths are large, farmers can find them easily.

Although termites mainly damage withering plants and trees, they sometimes damage the parts of cultivated plants near the soil and their roots. We confirmed the occurrence of termites in piling sesame in the stalks that had been near the soil. We found termite nests in the form of small mounds (about 30 cm in height) and in sesame plants, but we were not able to confirm the type that was damaging sesame. In addition to the above, we also observed some mealybugs and flatid planthoppers.

(2) Fixed-point survey

In the visual inspections of piling sesame and standing sesame, we confirmed the occurrence of the following: Leafhoppers/Jassids, stink bugs, scarabs, sphinx moths, tiger moths, owlet moths (Noctuidae), termites, and mealybugs. These pests were the same as those confirmed during our patrol surveys, except for the owlet moths. In addition, we also confirmed the occurrence of rats (Muridae) in the piling sesame.

We conducted visual inspections of the two fixed-point survey fields three times each. During the first and second inspections, we examined the outsides of the piling sesame and standing sesame, but in the third (final survey day) we also examined the insides of the piling sesame and standing sesame by breaking them down, and we found many stink bugs. They were especially prevalent in standing sesame. When we put piling sesame and standing sesame in an insect net and shook them, we found many sesame seed bugs and their larvae. (Photos 3-16 and 3-17). Although we did not find any eggs, we believed that the sesame seed bugs flew into the piling sesame and standing sesame, laid eggs, and increased. Although sesame seed bugs were also found during the patrol surveys, only a few were found. Although we examined the appearance of piling sesame and standing sesame during our patrol surveys, these stink bugs had a dark coloration and were camouflaged in piling sesame and standing sesame so they were difficult to find. If we conducted net shaking examinations at the patrol survey fields as we did at the fixed-point survey fields, there was the possibility that we would have found many specimens. We also observed an occurrence of some large Lygaeoidea.

At the fixed-point survey fields, we found scarabs flying to the standing sesame placed on blue tarps. The adult scarabs do not eat the standing sesame, so there is a possibility that they were attracted to the color blue of the tarps. In addition to the common hairy caterpillar (*Spilosoma obliqua*) of tiger moths that we found, we also found a type of black tiger moth caterpillar that we could not identify. Such tiger moth larvae in Japan are referred to as “kumakemushi”.

We caught aphids (Aphididae), leafhoppers/jassids, stink bugs, and whiteflies (Aieyrodidae) with the yellow sticky traps. Although many different types of hoppers were found, we also confirmed sesame jassids. Aphids and whiteflies were not confirmed in the 2017 survey, but these pests are known to be carriers of viral diseases. With respect to sesame, green patch aphids (*Myzus percicae*) and *Aphis craccivora* are known carriers of mosaic disease which is a type of viral disease. (Sreenivasulu, et al., 1994).

Photos 3-16 and 3-17. Sesame seed bug adults (left) and adults and larvae occurring in standing sesame (right)

Although the occurrence of many pests was confirmed in piling sesame and standing sesame as a result of the occurrence survey results, we determined that sesame seed bugs, a type of stink bug, were the most harmful.

Plants with phytoplasma were found in all fields in piling sesame and standing sesame, so that sesame jassids that carried phytoplasma to sesame under cultivation were considered especially harmful. Caution is also necessary in case any other pest proliferates.

4) Damage caused by pests

Table 3-6 and Photos 3-18 to 3-20 show the damage caused in piling sesame and standing sesame. There was considerable feeding damage to leaves. These feeding damage were caused by sphinx moths and tiger moths during late cultivation. The sphinx moths and tiger moths carried to the sesame after harvesting continued to feed on green leaves in piling sesame and standing sesame, but this was not serious. There was damage from nibbling on the pods. We guessed that the feeding damage to the pods was by tiger moths during the late cultivation and piling sesame stages. Moreover, there was burrowing damage by pests to pods. These were caused by snoutworms during late cultivation. These damages to pods were serious.

Scarab larvae are a harmful pest because they feed on the roots of sesame during early and late cultivation if they proliferate. It is possible that they damage the piling sesame that is on contact with the soil, but they should not damage standing sesame. Termites occur during late cultivation and damage the interior of stalks near the soil, but they are not so dangerous to piling sesame and standing sesame. In addition to these pests, mealybugs and flatid planthoppers also damaged sesame. Although the damage caused during cultivation was not clear, they did not cause serious damage to piling sesame and standing sesame.

Photos 3-18, 3-19, and 3-20. Feeding damage to leaves by pests (left), nibbling damage to pods (center), and burrowing damage to a pod (right)

Damage by leafhoppers and other sucking pests (pests that suck fluids out of plants) is more difficult to assess than damage from pests that actually feed on them (that chew the plants), and the DOA PP application does not seem to include any direct damage from leafhoppers. However, if these pests should occur in high numbers, there is the concern about damage from too much sucking or sooty mold (black hypha forms on the few secreted by leafhoppers).

Furthermore, all the piling sesame and standing sesame examined had phytoplasma symptoms that were carried by the sesame jassids. Although the symptoms become prevalent in later cultivation, they are infected during early cultivation. Some of diseased plants were harvested together with healthy plants. Many farmers tried to separate and remained diseased plants on fields, that meant leaving diseased plants in fields. Diseased plants have fewer pods or sometimes no pods at all. However, the farmers did not have sufficient knowledge about this disease. Many farmers ever knew that it was carried by pests but they did not have any detailed knowledge about the carrier pests. There were some farmers who thought that it occurred when they had bad seeds and we heard that there were even some farmers who thought that the sesame with pods were female plants and the ones without pods were male plants. Phytoplasma is a serious disease that causes a major decrease in the yield of sesame seeds in Myanmar. (Photos 3-21 and 3-22) This disease is also a major problem for sesame growers in Iran where they recognize the carrier to be sesame jassid (*Orosius albicinctus*). (Esmailzadeh-Hosseini, et al., 2007)

Photos 3-21 and 3-22. Diseased piling sesame (left), healthy plants with pods (top right), and diseased plants without pods (bottom right)

A viral disease (mosaic disease) also causes dramatic decreases in the number of pods in the same way as phytoplasma. This disease is carried by aphids and infects sesame during cultivation. This disease also effects sesame in Myanmar so caution is necessary. This disease does not have any apparent symptoms as phytoplasma does. The symptom of this viral disease that appears on sesame in Myanmar is a mosaic-like pattern on leaves.

The occurrence of stink bugs was recognized widely by farmers, however because they also sucked the fluids from plants as did leafhoppers, it was difficult to recognize the damage. It seemed that the farmers did not accurately recognize the damage caused by stink bugs on sesame. Stink bugs caused smaller yields and lower quality by sucking the fluids out of sesame plants. When we examined the seeds from standing sesame in which there were many sesame seed bugs, a type of stink bug, under a microscope, we found seeds that were only husks (Photo 3-23). They accounted for 7.8 percent of the total. Empty husks have many causes, but there is a high probability that the empty husks discovered in this study were the result of fluid being sucked out by sesame seed bug adults and larvae. The yield from sesame that has been subjected to damage by sesame seed bugs is significantly lower because of the empty husks (Berhe, et al., 2008; Elamin, et al., 2015). Moreover, yields are not only decreased just because of the fluids being sucked out. Their quality is also lower because the quantity of free fatty acid is also increased. (Elamin, et al., 2015)

Photo 3-23. Empty husk seeds (Top: empty husks; bottom: health seeds)

Deterioration of Sesame seeds quality are caused physically, such as water, temperature, light, etc. The main cause of deterioration is the increase in free fatty acids. The quantity of free fatty acids is indicated by "acid value" (The value that is the index for free fatty acid quantity by indicating the KOH necessary in mg to neutralize the free fatty acid in 1 g of oil.) However, increase in free fatty acid is not only from physical causes. It is also caused by biological factors (such as damage by sesame seed bugs), so that caution is necessary. It is said that deterioration is initially gradual, but at a certain point it will be accelerated rapidly. (Namiki and Hayashi, 1989) Regarding ground nuts which is

also an oil crop, it has been reported that stink bugs (*Elasmolomus sordidus* and *Rhyparochromus littoralis*) have caused increases in free fatty acid. (Ranga Rao, et al., 2010; Samaila and Malgwi, 2012)

5) Interviews regarding pests

Table 3-7 showed the results of the interviews conducted with 16 farmers. In reply to "Question 1. What kinds of pests do you see in piling sesame and standing sesame?", 62.5 percent of the farmers (10) gave stink bugs as a specific pest. However, in reply to "Question 2. What kinds of damage are caused in piling sesame and standing sesame?", 81.3 percent (13) said that there was no damage. Although many farmers recognized the occurrence of stink bugs, because they suck fluids from plants and produce little visible damage most of the farmers did not recognize the damage. In reply to "Question 3. Do you use pesticides on piling sesame and standing sesame? What kinds of pesticides do you use?", the farmers seemed to know about DOA instruction and other information, but all of them said that they did not use pesticides. In answer to "Question 4. Do you know about sesame phytoplasma? What kinds of countermeasures are you taking?", all of the farmers said that they knew about phytoplasma. Many of the farmers seemed to know that pests were the carrier and 62.5 percent (10) said they sprayed pesticides to prevent the disease. However, only one farmer knew that leafhoppers were the carrier of phytoplasma. This farmer's understanding was that all leafhoppers carried the disease. It seemed that the knowledge and information about this disease among farmers was insufficient. Phytoplasma is prevalent throughout sesame producing areas and because there is a concern that it is a major cause of lower revenues, this is a serious state of affairs for sesame production in Myanmar and should be acted upon as soon as possible.

Table 3-7. Interviews regarding pests (August and September 2018)

Question	Responses	Responses (Number)	Remarks
Question 1. What kinds of pests do you see in piling sesame and standing sesame?	16	[1] Pests: Leafhoppers (0), stink bugs (10), scarabs (0), sphinx moths (0), tiger moths (0), termites (0), other (0) [2] None (6) [3] Not sure (0)	Ten of the farmers knew about stink bugs.
Question 2. What kinds of damage are caused in piling sesame and standing sesame?	16	[1] Damage: Leaves (2), pods (0), other (0) [2] None (13) [3] Not sure (1)	Farmers did not recognize any damage because damage is difficult to assess for suckers such as stink bugs and leaphoppers.
Question 3. Do you use pesticides on piling sesame and standing sesame? What kinds of pesticides do you use?	16	[1] Yes (0) [2] No (16)	Farmers had been informed by DOA about not using pesticides on piling sesame and standing sesame.
Question 4. Do you know about sesame phytoplasma? What kinds of countermeasures are you taking?	16	[1] Yes (16) Prevention: Spraying of Cypermethrin, Acephate, Chlorpyrifos, etc. (10), replace seeds (1), none (5) [2] No (0)	Although all farmers knew about phytoplasma, many of them were not sure about information regarding the leafhoppers that carried it. There was also a farmer who responded that seeds were the problem.

4. Promoting GAP and Pesticide Problems

In regard to sesame production in Myanmar, under the guidance of the DOA and with the cooperation of ITC and other organizations, GAP has been promoted since 2017 and guidelines have been created for corn, oil crops, and beans. (DOA, 2018) According to DOA Magway, the following items are instructed when promoting GAP. (From the interview held on September 10, 2018.)

① Farmers are to be instructed on all processes of sesame production from cultivation to sales. When farmers participate in GAP, extension workers provide detailed instruction on varieties, field soil, chemical fertilizers, chemical pesticides, records, etc. Each extension worker is in charge of about ten farmers.

② As soon as a sesame is harvested, they are put to stand-drying. If piling sesame cannot be avoided, then it is limited to one or two days (one night, two days), and the height of piles is to be 1.5 m at the maximum.

③ If pests occur, then actions should be taken according to Integrated Pest Management (IPM). The need for pesticides is considered, and if it is determined that they are needed, then instruction is provided regarding the type of pesticide, the timing of spraying, and the spraying method.

④ Use of chemical pesticides and disinfectants should be avoided if possible and natural pesticides should be used (neem, ginger, garlic, soap, sulphur, copper vitriol, Bordeaux mixture (copper vitriol + hydrated lime)). If natural pesticides are not sufficient, only then should chemical pesticides be sprayed. Chemical pesticides should only be used within 45 days after sowing seeds, and they should not be used during late cultivation, during piling sesame, and during standing sesame.

The DOA PP application recommends Acephate, Chlorpyrifos, Cypermethrin, Dimethoate, Fenitrothion, Lambda-Cyhalothrin, and Thiamethoxam as pesticides for sesame, and Imidacloprid for processing seeds (Table 3-8).

We interviewed two chemical pesticide stores in Aung Lan (one was a branch of Awba, the largest chemical pesticide company in Myanmar, and the other was store selling relatively inexpensive pesticides). The results showed that Acephate, Imidacloprid, Cypermethrin, and a Chlorpyrifos and Cypermethrin mix were relatively popular. The containers of these pesticides indicated that they could be used for sesame or oil crops. Pesticide stores provide information about pests and pesticides and farmers depend on them as a source of information.

The labels on the pesticide containers had various information about the correct usage in Burmese, but the pesticides shown in the pesticide stores did not display anything on the correct dilution ratios. When we asked about, it was discovered that they recommended a ratio of 50 to 100 ml (g) per 4 gallons (about 16 L) of water for all pesticides. This is equivalent to diluting the pesticides from 160 to 320 times. They also said that the amount to spray was 16 gallons (about 64 L) per acre (about 40 a), that is, 16 L per 10 A. Many sesame farmers said that they were using less than that recommended

by pesticide stores at about 40 ml (g) per 4 gallons of water. This is equivalent to diluting pesticide by about 400 times. In either case, in Myanmar, the concentration of pesticides is higher and the amounts sprayed are lower than in Japan.

Table 3-8. Pesticides recommended for sesame according to the Myanmar DOA PP application (2018)

Commercial name	Target pests according to the app	Features
Acephate	Leafhoppers, stink bugs, pyralids, sphinx moths, tiger moths, owlet moths (cutworms)	* Organochlorine insecticide, systemic pesticide * Main targets in Japan (commercial name): Aphids, lepidopteran, etc. (Orutoran)
Chlorpyrifos	Scarabs, sphinx moths, tiger moths, owlet moths (cutworms)	* Organophosphorus insecticide * Main targets in Japan (commercial name): Aphids, lepidopteran, etc. (Daazuban)
Cypermethrin	Scarabs, sphinx moths, tiger moths, owlet moths (cutworms)	* Synthesis pyrethroid insecticide * Main targets in Japan (commercial name): Aphids, stink bugs, lepidopteran, etc. (Agurosurin)
Dimethoate	Leafhoppers, scarabs, pyralids, owlet moths (cutworms)	* Organophosphorus insecticide, systemic pesticide * Main targets in Japan (commercial name): Aphids, leaphoppers, coccids, etc. (Jimetoeeto)
Fenitrothion	Sphinx moths	* Organophosphorus insecticide, developed in Japan * Main targets in Japan (commercial name): Aphids, stink bugs, scarabs, lepidopteran, etc. (Sumichion)
Lambda-Cyhalothrin	Scarabs	* Synthesis pyrethroid insecticide, Shiharotorin in Japan * Main targets in Japan (commercial name): Aphids, lepidopteran, etc. (Saiharon)
Thiamethoxam	Leafhoppers, stink bugs	* Neonicotinoid insecticide, systemic pesticide * Main targets in Japan (commercial name): Aphids, leaphoppers, stink bugs, whiteflies, scarabs, etc. (Akutara)

Note 1. As a preventive measure for leafhoppers, seeds are processed with Imidacloprid (Neonicotinoid insecticide).

Note 2. Created from the Plant Protection Mobile Application (viewed in August 2018), DOA, and the Myanmar and Japan Plant Protection Associations (2006).

In Myanmar, knapsack sprayers (capacity 4 gallons or about 16 L) are used to spray pesticides on the huge sesame fields. Under such conditions, spraying smaller amounts of more concentrated pesticides is very effective from the point of view of workability. However, many aspects must be verified, such as pesticide residue, safety of sprayers, effectiveness, etc. Although pesticides may cause various problems if used incorrectly, they are also an important way of preventing diseases. Using appropriate pesticides appropriately is important in cultivating sesame.

5. Pest Problems, Piling Sesame and Standing Sesame

Various types of pests can be seen in piling sesame and standing sesame. Many of them occur during late cultivation and are transferred when the crops are harvested. However, sesame seed bugs fly to piling sesame and standing sesame and then do damage. Of the various pests that occur, sesame seed bugs are especially troublesome with respect to piling sesame and standing sesame.

Piling sesame might lead to lower quality crops because of the increase in free fatty acid in sesame, so that using standing sesame immediately after harvesting is desirable. Although increase in free fatty acid can be caused by physical reasons (water content, temperature, light, etc.), it is also caused by biological factors (damage by sesame seed bugs). (Elamin, et al., 2015) Standing sesame is very effective for reducing the physical causes of free fatty acid. However, when biological factors are considered, the occurrence of sesame seed bugs and damage to sesame by them also requires caution with respect to standing sesame. Note that the DOA PP application gives the following countermeasures for sesame seed bugs.

① Remove eggs as soon as they are discovered.
② Adults and larvae gather together, so shake them off and kill them if discovered.
③ Collect any adults discovered when thrashing and bury them underground.
④ Remove any weeds around fields or spray them with pesticides.
⑤ These pests gather at specific trees, so cut such trees down or spray with pesticides.
⑥ Follow the instructions on the labels of pesticides when using them. The pesticides that can be used are Thiamethoxam (neonicotinoid), Acephate (organic phosphorous), and Dimethoate (organic phosphorous).

In March 2018, 11 μg/kg of the harmful substance aflatoxin produced by aspergillus was discovered in a shipment of sesame seed from Myanmar to Japan (according to the website of the Ministry Health, Labour and Welfare of Japan). In Japan, any aflatoxin is not permitted. The aspergillus that produces aflatoxin is from southern climates and is widely found in tropical and subtropical areas. This can be produced in various stages of the storing and shipping of sesame, but there is also a strong possibility that the high temperature and high humidity conditions during piling sesame and standing sesame in fields could be related. This is especially true for piling sesame because although the surface is dried, the interior remains humid and can develop mold.

In order to cope with the problems of free fatty acid and aflatoxin, we believe that it is necessary to conduct a general review of sesame drying methods. For the time being, using standing sesame immediately after harvesting as recommended by the DOA is desirable. However, there is the possibility of inclement weather and long periods of rain. When standing sesame is used under such conditions, the dry sesame plants easily absorb water making it difficult to dry the sesame so that mold develops. Moreover, increased free fatty acid caused by damage from sesame seed bugs is another concern. In order to produce high quality Myanmar sesame seed that is indispensable for exports, drying facilities for sesame with roofs and screens in all openings are desirable (Fig. 3-8).

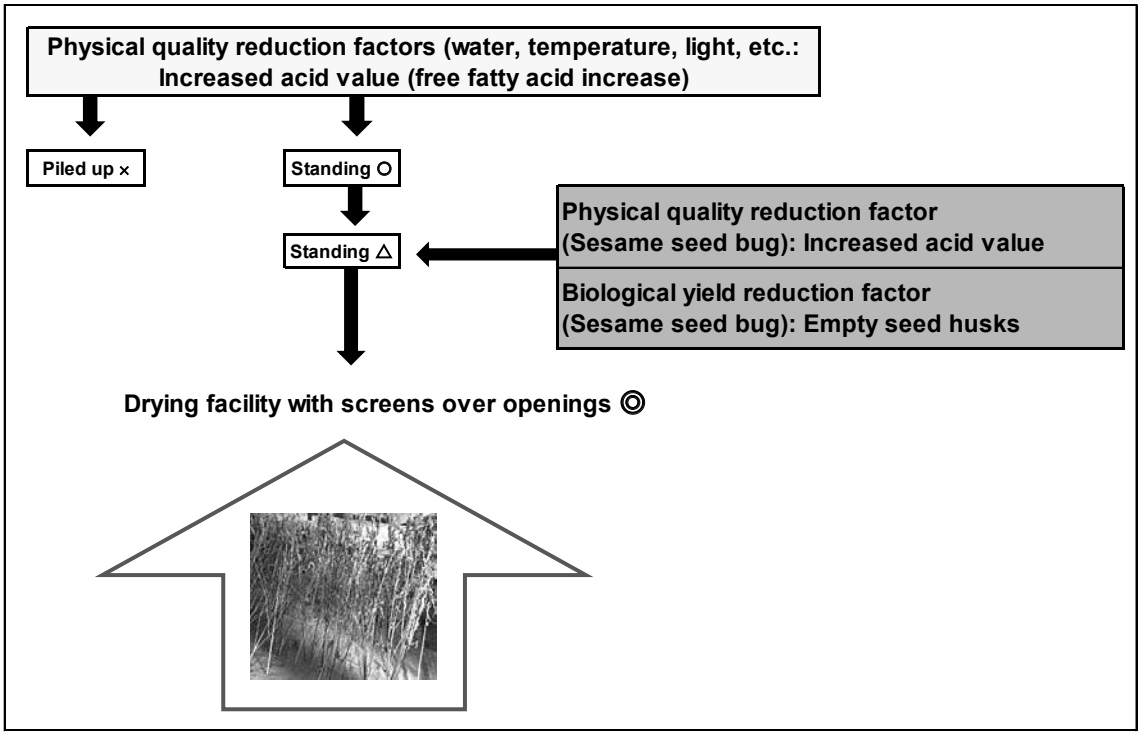


Fig. 3-10. Causes for increase in free fatty acid in sesame and desirable drying method

6. Goal of the Project, Development of Human Resources and Technological Transfer

This project aims to "develop core farmers who want to understand the market needs, and hope to meet those needs," and, "develop extension workers who can support such forward-thinking farmers and extension workers who understand the survey methods and instruction methods for local development." By conducting pest surveys concerning piling sesame and standing sesame together with sesame farmers and extension workers, we shared our knowledge and information about sesame pests and the damage they cause. Furthermore, we held workshops and produced manuals. Through this technological exchange, we attempted to deepen the understanding by farmers and extension workers concerning sesame yields and quality as well as develop human resources that are interested in producing high quality and highly marketable sesame seed that Japanese companies want.

As a specific example, we received a request from the extension workers of the DOA Aung Lan T/S and some farmers asking to conduct pest surveys on their own. They already started trying some surveys with homemade yellow traps and trial and error. Pest countermeasures are very important for the production of high quality sesame and knowing the occurrence of pests is a major step towards that goal. If the concept of the production of high quality sesame has spread through pest countermeasures, that is a wonderful thing.

The farmer at one of the fixed-point survey fields (F#2) took part in the workshop held in 2017 and became interested in sesame pests. He said that he would like to know more about eliminating them.

We held workshops on December 8, 2018 (Magway Region) and on the 11th (Aung Lan T/S), and provided the knowledge and information acquired through this project to all related parties (farmers, extension workers, etc.). In the question and answer period concerning pests, there were questions about countermeasures for sesame seed bugs, and about the proliferation of phytoplasma (Phyllody) that is carried by a type of leafhopper and how to counter that problem. DOA Magway was strongly aware of the problem concerning phytoplasma and said that they wanted to take some kind of countermeasure.

In addition, we developed a technical manual concerning piling sesame and standing sesame pests for farmers and extension workers. The manual covers pests and how to study pests and damage caused by pests in piling sesame and standing sesame, how to identify pests, and pest problems and piling sesame and standing sesame. With respect to sesame seed bugs which are a major pest with respect to piling sesame and standing sesame, we proposed pest survey methods, damage survey methods, and countermeasure methods that extension workers can conduct together with farmers.

(The detailed survey data on pest occurrence has been included as "ANNEX 1".)

Chapter 4 Follow up

1. Follow up

We conducted interviews with the farmers who took part in the drying tests, the extension workers who received on-the-job training, and DOA personnel about the results of the technical instruction and any new efforts.

The farmers who took part in the tests are considering changing to stand-drying next year (2019). Securing the manpower necessary for drying was a concern, but they believed that it would be possible if they start collecting workers from a very early stage. By conducting comparative tests in villages and sharing the results, the many other farmers who watched the project have also become very interested. Well-implemented efforts of the DOA Office on the drying method and acid value made them accept our results easily.

When we visited in December 2018, the extension workers of the DOA Aung Lan T/S Office and farmers in Aung Lan T/S were cooperating to conduct drying tests for dry-season sesame. They created piled-up-drying plots and stand-drying plots and compared the acid value by measuring with an AV checker.

Extension workers who received on-the-job training from pest specialists have become interested in pest surveys and have even made their own yellow sticky sheets through trial and error.

Both extension workers and farmers said, "We were surprised that the tests could be conducted in such a short time, the results compiled, and announced at a workshop." This told us that conducting the tests with the farmers and extension workers and sharing the results with them left a strong impression on them.

In order to follow up on the project, we created two manuals: a manual on pests and a manual on drying methods and quality. (Annex 3)

Table 4-1. Contents of the manuals and target users

Category	Contents	Target users	Format
Pests in piling sesame and standing sesame	Pests and damage during dry season Important pests during growing season	Extension workers and farmers	Brochure
Drying methods and sesame quality	Drying methods and acid value, and Japanese market needs	Farmers	Folded flier

Chapter 5 Summary

1. Overview of Activities to Date

In fiscal 2017, in the Magway region located in Myanmar's central dry zone, we conducted technical instruction and development in order to help improve the productivity and quality of black sesame. Before we conducted the technical instruction, we studied the problems related to the quantities and quality required by Japanese companies. We also talked to the people in the supply chain on the Myanmar side who did business with those Japanese companies, and asked the DOA and DAR personnel about the status quo and problems. Based on those results, we dispatched experts on soil, pesticides, and pests to conduct instruction on the appropriate use of fertilizers (improving the soil) and pesticides.

We found that the amount of fertilizer being used in the target region for black sesame production was very small. We made easily understood and illustrated cards on how to fertilize different types of soil, using livestock manure and crop residue to make compost. We also made manuals that extension workers could use when instructing farmers locally. When we surveyed the soil and how it was being managed, we also gave on-the-job-training to the extension workers.

Sesame exporters, government officials, and extension workers considered pesticide residue as a serious problem, but at the producer level, farmers used pesticide inappropriate manner in 2017. In fact, the underlying cause of the "pesticides problem" is the "pest problem." There is a need to study the occurrence of pests every year and take effective countermeasures according to the survey results. From this point of view, we conducted a pest survey at farmer fields in order to give extension workers on-the-job training for conducting pest studies. We also studied natural enemies and instructed extension workers. At the end of the activities in FY 2017, the manual was issued on how to identify pests and natural enemies. In order to promote the appropriate use of pesticides, we included the thinking of IPM in the manual.

In FY 2018, we focused on the harvest period. Recently, sesame seed imported from Myanmar sometimes exceeded the standards for acid value and pesticide residue in Japan. Sesame manufacturers in Japan concern them very much. There was also an awareness that sesame quality was low with smell of mold.

We believed that the high acid values and smell of mold were correlated with piled-up-drying method that caused high humidity and high temperatures. Japanese companies and shippers wanted farmers to quite piled-up drying and adopt stand-drying (binding sesame plants in bundles and using multiple bundles together to support each other to stand up) immediately after harvesting. Therefore, in fiscal 2018, we conducted tests with farmers and extension workers to see the effect on different drying methods on acid values. The results indicated that they needed to switch from piled-up drying to stand-drying. With respect to acid values, there is a limit to how much sunlight drying is possible in the rainy season, so that indoor drying is even more desirable than stand-drying. The cost and

location of drying locations are problems, and immediately changing to indoor drying is difficult, but it has been recognized as a future option.

We also conducted a taste study and shared the results at a workshop. We are sure that the farmers were interested in how their products were being evaluated as producers.

Our fiscal 2017 survey showed that some farmers were using pesticides before piling sesame so that pesticide residue could be a big factor. Therefore, we tried to understand the occurrence of pests which were the trigger for using pesticides. In our interviews for the fiscal 2018 project, farmers told that they did not use pesticides from the late cultivation period. It became clear, however, that the occurrence of stink bugs during the harvest period led to lower yields and quality. Knowing the occurrence of pests and the damage they cause are critically important to develop the basic production technics, including appropriate use of pesticides, and we saw that the farmers were interested in this. We conducted pest survey during the harvest period with extension workers and also instructed them on how to conduct such surveys so that they can continue them in the future by themselves.

By conducting these tests and surveys together with farmers and extension workers increased their interest in these subjects and led to better understanding.

2. Remaining Tasks

At the workshop held in the DOA Aung Lan T/S Office, one farmer talked about his problems with Phyllody. He related that there were some fields with so much damage with almost no harvest. During our pest survey in August and September, all 25 of the fields visited in the survey were affected by Phyllody. This disease prevents seeds from being produced and we believe that it is the biggest concern for sesame farming in Myanmar in these days.

There is a time lag between the infection of phytoplasma which is the cause and the appearance of the disease, and it cannot be treated once the symptoms become apparent. The lack of understanding of the cause of Phyllody was noted in the report by pest specialists in section III, Chapter 3.

Preventing Phyllody is closely related to the appropriate use of pesticides. At the present time, farmers don’t so much use pesticides appropriately as they are just avoiding pesticides. This has led them to simply think that they must not use Imidacloprid which has been cause for ship back from Japan for several years. However, such simplistic thinking must be avoided and pesticides must be used appropriately to prevent pests and the diseases they carry, satisfying the requirements on pesticide residue. Not taking the correct preventive measures in the early stages of cultivation will only cause rampant Phyllody which in turn will lead farmers to use pesticides at late cultivation stage. The pest expert clearly mentioned that the number of days before harvesting up to which pesticides can be used must be clearly stated under Myanmar's current conditions. It added that this must be done in a way that will reduce damage from pests, that is acceptable to farmers, and that do not result in any food safety problems.

Sesame seed prices increased in 2018. Therefore, more farmers said that they wanted to produce sesame during the dry season. However, the buying price of dry-season sesame is lower than that for sesame produced during the monsoon. According to farmers, there are fewer pests and the amount of pesticides needed is smaller. Conversely the sesame manufacturer have said that dry-season sesame is not as good in taste. We must examine the cause of the decrease in taste and if there is anything else affecting the difference in price.

In the workshops in this project, we shared the information on the taste and flavor demanded by the Japanese market. The farmers, extension workers, and researchers must all work together to understand the quality required by the target market. It is important to select varieties, cultivation methods, and drying methods, and develop technology from this perspective. All stakeholders in entire value chain from upstream to downstream should share the information on requirements and needs of the target market and work continuously to meet them. As the pest specialists have mentioned in the report, this project aimed at developing core farmers who were sensitive to the needs of their markets. Through the instruction projects held in fiscal 2017 and 2018, farmers have appeared who were conscious of pesticide residue, acid value, and flavor which are things that cannot be seen. However, the information that they can acquire is still small and their contacts with their markets are limited. We must continue our activities by looking at the entire value chain from the producers to market to consider the entire value chain.

ANNEX

ANNEX Table 1. Types and density of insects pests of piling sesame and standing sesame in Myanmar(visual inspection, patrol survey、Aug.-Sept., 2018)

Abbreviation	Aphids	Leafhoppers (Sesame jassid etc.) and Phytoplasma (+ -)	Bugs (Sesame seed bug etc.)	Scarabs (Sesame black beetle etc.)	Pyralid moths (Sesame leafroller)	Sphinx moths (Death's head moth etc.)	Tiger moths (Common hairy caterpillar)	Owlet moths (Cotton bollworm etc.)	Termites	Others	Remarks
U#1	0	0 Phyto (+)	0	0	0	0	0	0	0		
U#2	0	0 Phyto (+)	0	0	0	0	0	0	0		
U#3	0	0 Phyto (+)	6(Larva)	0	0	1(larva)	1(larva)	0	0	2(Mealybugs)	
U#4	0	0 Phyto (+)	0	0	0	0	0	0	0	1(Flatid planthoppers)	
U#5	0	0 Phyto (+)	0	0	0	0	0	0	0		
U#6	0	0 Phyto (+)	0	0	0	0	0	0	0		
U#7	0	0 Phyto (+)	0	0	0	0	0	0	0		
U#8	0	0 Phyto (+)	0	0	0	0	0	0	0		
U#9	0	1 Phyto (+)	7(Adult・Larva、Sesame seed bug 2)	1(larva)	0	0	0	0	0		
U#10	0	0 Phyto (+)	1(Larva)	0	0	0	0	0	>50		Habitat of Termaites is in stems on contact points with ground
U#11	0	0 Phyto (+)	5(Adult、Sesame seed bug 3、Lygaeoidea 2)	0	0	0	0	0	0		Lygaeoidea other than Sesame seed bug
U#12	0	0 Phyto (+)	0	0	0	0	0	0	0		
U#13	0	0 Phyto (+)	2(Larva)	0	0	0	0	0	0		
U#14	0	0 Phyto (+)	0	0	0	0	0	0	0		
U#15	0	0 Phyto (+)	0	0	0	0	0	0	0		
U#16	0	0 Phyto (+)	0	0	0	0	0	0	0	1(Flatid planthoppers)	
U#17	0	0 Phyto (+)	0	0	0	0	0	0	0		
U#18	0	0 Phyto (+)	4(Adult、Sesame seed bug 1、Lygaeoidea 3)	0	0	0	0	0	0		Lygaeoidea other than Sesame seed bug
U#19	0	0 Phyto (+)	0	0	0	0	0	0	0		
U#20	0	0 Phyto (+)	0	0	0	0	0	0	0		
U#21	0	0 Phyto (+)	1(Adult、Lygaeoidea 1)	0	0	0	0	0	0		Lygaeoidea other than Sesame seed bug
U#22	0	0 Phyto (+)	0	0	0	0	0	0	0	2(Flatid planthoppers)	
U#23	0	0 Phyto (+)	0	0	0	0	0	0	0		
U#24	0	0 Phyto (+)	0	0	0	0	0	0	0		
U#25	0	0 Phyto (+)	0	0	0	0	0	0	0	1(Mealybugs)	
Total (Piling)	0	1	23	1	0	1	1	0	>50	1(Mealybugs) 1(Flatid planthoppers)	
Average (Piling)	0.00	0.08	1.77	0.08	0.00	0.08	0.08	0.00	>3.85	0.08 (Mealybugs) 0.08(Flatid planthoppers)	
Total (Standing)	0	0	3	0	0	0	0	0	0	3(Flatid planthoppers)	
Average (Standing)	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.25(Flatid planthoppers)	
Sum total	0	1	26	1	0	1	1	0	>50	1(Mealybugs) 4(Flatid planthoppers)	
Sum average	0.00	0.04	1.04	0.04	0.00	0.04	0.04	0.00	>2.00	0.04 (Mealybugs) 0.16(Flatid planthoppers)	

1:Insects pests are;Aphids (Aphididae), Leafhoppers / Jassids (Cicadellidae: Sesame jassid etc., *Orosius* albicinctus etc.), Bugs (Lygaeoidea: Sesame seed bug etc., Elasmolomus sordidus etc.、Pentatomoidea, Coreoidea, Pyrrhocoroidea), Scarabs (Scarabaidae: Sesame black beetle etc., Anomala antiqua etc.), Pyralid moths(Pyralidae: Sesame leafroller, Antigastra catalaunalis), Sphinx moths (Sphingidae :Death's head moth etc.、Acherontia styx etc.), Tiger moths (Arctiidae: Common hairy caterpillar etc., Spilosoma obliqua etc.), Owlet moths (Noctuidae: Cotton bollworm etc., Helicoverpa armigera etc.), Termites (Termitidae), Mealybugs(Pseudococcidae), Flatid planthoppers(Flatidae)

2:Sesame seed bug had been called as *Aphanus sordidus*, however, is now identified as *E. sordidus* of Elasmolomus within Rhyparochromidae. Recently, the categorization of Lygaeoidea has undergone major change. This paper used the categories by Ishikawa, et al (2012)

3: The number of idividual pests were investigated at U#1-U#25, patrol survey fileds.

4:The dencities are equal the number of individual pests of piling sesame and standing sesame in this table.

ANNEX Table 2. Types and density of insects pests at sesame fields after harvesting in Myanmar(by netting, patrol survey、Aug.-Sept., 2018)

Abbreviation	Aphids	Leafhoppers (Sesame jassid etc.)	Bugs (Sesame seed bug etc.)	Scarabs (Sesame black beetle etc.)	Pyralid moths (Sesame leafroller)	Sphinx moths (Death's head moth etc.)	Tiger moths (Common hairy caterpillar)	Owlet moths (Cotton bollworm etc.)	Others	Remarks
U#1	0	0	6(Adult・Larva、Sesame seed bug 2)	0	0	0	0	0		
U#2	Uninvestigated									
U#3	0	5(Adult・Larva)	4(Adult・Larva、Sesame seed bug 1)	0	0	0	0	0		
U#4	0	11(Adult・Larva)	5(Adult・Larva、Sesame seed bug 2)	0	0	0	0	0		
U#5	0	1(Adult)	1(Adult・Larva)	0	0	0	0	0		
U#6	Uninvestigated									
U#7	0	0	1(Adult・Larva、Sesame seed bug 1)	0	0	0	0	0		
U#8	0	0	4(Adult・Adult・Larva)	0	0	0	0	0		
U#9	0	0	10(Adult・Larva、Sesame seed bug 2)	0	0	0	0	0		
U#10	0	4(Adult・Larva)	8(Adult・Larva、Sesame seed bug 2)	0	0	0	0	0		
U#11	Uninvestigated									
U#12	0	1(Adult)	2(Adult)	0	0	0	0	0		
U#13	0	0	1(Adult、Sesame seed bug)	0	0	0	0	0		
U#14	0	2(Adult)	2(Adult・Larva)	0	0	0	0	0		
U#15	0	0	1(Adult)	0	0	0	0	0		
U#16	Uninvestigated									
U#17	Uninvestigated									
U#18	0	3(Adult・Larva)	0	0	0	0	0	0		
U#19	Uninvestigated									
U#20	Uninvestigated									
U#21	Uninvestigated									
U#22	Uninvestigated									
U#23	Uninvestigated									
U#24	Uninvestigated									
U#25	0	0	0	0	0	0	0	0		
Total (Piling)	0	23	41	0	0	0	0	0		
Average (Piling)	0.00	2.09	3.73	0.00	0.00	0.00	0.00	0.00		
Total (Standing)	0	2	4	0	0	0	0	0		
Average (Standing)	0.00	0.67	1.33	0.00	0.00	0.00	0.00	0.00		
Sum total	0	25	45	0	0	0	0	0		
Sum average	0.00	1.79	3.21	0.00	0.00	0.00	0.00	0.00		

1:Investigations were conducted by swing an insect net (30cm diameter) 40 times, back and forth 20 times each at each fields.

2:The dencities are equal the number of individual pests caught by swing net 40 times.

ANNEX Table 3. Types and density of insects pests of piling sesame and standing sesame in Myanmar(visual inspection, fixed ppoint survey,Aug.-Sept., 2018)

Abbreviation	Aphids	Leafhoppers (Sesame jassid etc.) and Phytoplasma (+ -)	Bugs (Sesame seed bug etc.)	Scarabs (Sesame black beetle etc.)	Pyralid moths (Sesame leafroller)	Sphinx moths (Death's head moth etc.)	Tiger moths (Common hairy caterpillar)	Owlet moths (Cotton bollworm etc.)	Termites	Others	Remarks
F#1-P(1)	0	4(Adult) Phyto (+)	9(Adult・Larva、Sesame seed bug 2)	0	0	3(Larva)	3(Larva)	0	>50		Habitat of Termaites is in stems on contact points with ground
F#1-P(2)	0	0 Phyto (+)	0	0	0	0	0	0	0		
F#1-P(3) 3rd time	0	0 Phyto (+)	>50(Adult・Larva、Sesame sesame seed bug >50)	0	0	0	0	1	0	1(Rats)	Repetition of Sesame seed bugs was confirmed by shaking out from standing sesame in the 3rd survey.
F#2-P(1)	0	0 Phyto (+)	10(Adult・Larva、Lygaeoidea1,)	0	0	3(Larva)	5(Larva)	0	0	1(Mealybugs)	2 types of Tiger moths were observed.
F#2-P(2)	0	0 Phyto (+)	0	0	0	0	0	0	0		
F#2-P(3) 3rd time	0	0 Phyto (+)	>30(Adult・Larva、Sesame seed bug >30)	0	0	0	0	0	0	1(Rats)	Repetition of Sesame seed bugs was confirmed by shaking out from standing sesame in the 3rd survey.
Total (Piling)	0	4	>99	0	0	3	8	1	>50	2(Rats) 1(Mealybugs)	
Aaverege (Piling)	0.00	0.67	>16.5	0.00	0.00	0.50	1.33	0.17	>8.33	0.33(Rats) 0.17 (Mealybugs)	

Abbreviation	Aphids	Leafhoppers (Sesame jassid etc.) and Phytoplasma (+ −)	Bugs (Sesame seed bug etc.)	Scarabs (Sesame black beetle etc.)	Pyralid moths (Sesame leafroller)	Sphinx moths (Death's head moth etc.)	Tiger moths (Common hairy caterpillar)	Owlet moths (Cotton bollworm etc.)	Termites	Others	Remarks
F#1-S(1)	0	0 Phyto (+)	0	0	0	0	0	0	0	0	
F#1-S(2)	0	0 Phyto (+)	0	5(Adult)	0	0	0	0	0	0	Adults of Scarabs were possibly attracted by blue tarps.
F#1-S(3) 3rd time	0	0 Phyto (+)	>250(Adult・Larva、Sesame seed bug >250)	0	0	0	0	1	0	0	Repetition of Sesame seed bugs was confirmed by shaking out from standing sesame in the 3rd survey.
F#2-S(1)	0	0 Phyto (+)	2(Adult)	0	0	0	0	0	0	0	
F#2-S(2)	0	0 Phyto (+)	0	3(Adult)	0	0	0	0	0	0	Adults of Scarabs were possibly attracted by blue tarps.
F#2-S(3) 3rd time	0	0 Phyto (+)	>200(Adult・Larva、Sesame seed bug >200)	2(Adult)	0	0	0	0	0	0	Repetition of Sesame seed bugs was confirmed by shaking out from standing sesame in the 3rd survey.
Total (Standing)	0	0	>452	10	0	0	0	1	0	0	
Average (Standing)	0.00	0.00	>75.33	1.67	0.00	0.00	0.00	0.17	0.00	0.00	
Sum total	0	4	>551	10	0	3	8	2	>50	2(Rats) 1(Mealybugs)	
Sum average	0.00	0.33	>45.92	0.83	0.00	0.25	0.67	0.17	>4.17	0.17(Rats) 0.08 (Mealybugs)	

1:The number of idividual pests were investigated 3 times at fixed-point survey fields, F#1 on 23, 30 Aug. and 7 Sept., and at F#2 on 25 Aug. and 1 and 9 Sept.

2:The dencities are equal the number of individual pests of piling sesame and standing sesame in this table.

ANNEX Table 4. Types and density of insects pests at sesame fields after harvesting in Myanmar(yellow sticky trap, fixed point survey、Aug.-Sept., 2018)

Abbreviation	Aphids	Leafhoppers (Sesame jassid etc.)	Bugs (Sesame seed bug etc.)	White flies	Others	Remarks
F#1-(1)	Setting					
F#1-(2)-1	1	2	0	1		
F#1-(2)-2	2	3	0	0		
F#1-(2)-3	0	0	0	0		
F#1-(3)-1	0	13(Sesame jassid 1)	0	0		
F#1-(3)-2	0	2	0	0		
F#1-(3)-3	0	15(Sesame jassid 7)	0	0		
F#1 total	3	35	0	1		
F#1 average	0.50	5.83	0.00	0.17		
F#2-(1)	Setting					
F#2-(2)-1	0	0	1	0		
F#2-(2)-2	0	1	0	0		
F#2-(2)-3	0	0	1	0		
F#2-(3)-1	0	0	0	1		
F#2-(3)-2	0	33(Sesame jassid 1)	0	0		
F#2-(3)-3	0	6	0	0		
F#2 total	0	40	2	1		
F#2 averege	0.00	6.67	0.33	0.17		
Sum total	3	75	2	2		
Sum average	0.25	6.25	0.17	0.17		

1:3 yellow sticky traps were placed at each fixed point survey fields (F#1、F#2) on 23 and 25 August. (Yellow sticky traps: width 10cm、height 30cm)

2:Individual number of pests trapped were counted at each field twice (F#1-(2) and F#1-(3):30 Aug. and 7 Sept. and F#2-(2) and F#2-(3):1 Sept. and 9 Sept.)

3:The dencities are equal theindividual number of pests trapped in this table.

ANNEX Table 5. Damage by insects pests of piling sesame and standing sesame in Myanmar (Patrol survey and fixed point survey, Aug.-Sept., 2018)

Abbreviation	Plant number with damaged leaves (%)	Major perpetrator	Plant or bundle with damaged pods (%)	Major perpetrator	Remark
U#1	100% (30 plants/30 plants)	Tiger moths, Sphinx moths (estimated)	20% (6 plants/30 plants)	Snoutworms, Tiger moths (estimated)	Piling (harvesting), Phytoplasma symptoms
U#2	100% (30 bundles/30 bundles)	Tiger moths, Sphinx moths (estimated)	3% (1 bundle/30 bundles)	Snoutworms, Tiger moths (estimated)	Standing, Phytoplasma symptoms
U#3	70% (21 plants/30 plants)	Tiger moths, Sphinx moths	7% (2 plants/30 plants)	Tiger moths	Piling, Phytoplasma symptoms
U#4	53% (16 plants/30 plants)	Tiger moths, Sphinx moths (estimated)	3% (1 plants¥/30 plants)	Snoutworms, Tiger moths (estimated)	Piling, Phytoplasma symptoms
U#5	30% (3 bundles/10 bundles)	Tiger moths, Sphinx moths (estimated)	0% (0 bundle/10 bundles)		Standing, Phytoplasma symptoms
U#6	uninvestigated				Standing, Phytoplasma symptoms
U#7	uninvestigated				Piling, Phytoplasma symptoms
U#8	13% (4 plants/30 plants)	Tiger moths, Sphinx moths (estimated)	0% (0 plant/30 plants)		Piling, Phytoplasma symptoms
U#9	57% (17 plants/30 plants)	Tiger moths, Sphinx moths (estimated)	7% (2 plants/30 plants)	Snoutworms, Tiger moths (estimated)	Piling (harvesting), Phytoplasma symptoms
U#10	23% (7 plants/30 plants)	Tiger moths, Sphinx moths (estimated)	7% (2 plants/30 plants)	Snoutworms, Tiger moths (estimated)	Piling, Termites damage, Phytoplasma symptoms
U#11	uninvestigated				Piling, Phytoplasma symptoms
U#12	uninvestigated				Standing, Phytoplasma symptoms
U#13	uninvestigated				Standing, Phytoplasma symptoms
U#14	13% (4 plants/30 plants)	Tiger moths, Sphinx moths (estimated)	0% (0 plant/30 plants)		Piling, Phytoplasma symptoms
U#15	uninvestigated				Piling, Phytoplasma symptoms
U#16	uninvestigated				Standing, Phytoplasma symptoms
U#17	uninvestigated				Standing, Phytoplasma symptoms
U#18	7% (2 plants/30 plants)	Tiger moths, Sphinx moths (estimated)	0% (0 plant/30 plants)		Piling (harvesting), Phytoplasma symptoms
U#19	uninvestigated				Piling, Phytoplasma symptoms
U#20	uninvestigated				Standing, Phytoplasma symptoms
U#21	uninvestigated				Standing, Phytoplasma symptoms
U#22	uninvestigated				Standing, Phytoplasma symptoms
U#23	uninvestigated				Standing, Phytoplasma symptoms
U#24	uninvestigated				Standing, Phytoplasma symptoms
U#25	uninvestigated				Piling, Phytoplasma symptoms
F#1-P	60% (18 plants/30 plants)	Tiger moths, Sphinx moths	0% (0 plant/30 plants)		Occurrence of Sesame seed bug, Termites damage, Phytoplasma symptoms
F#2-P	87% (26 plants/30 plants)	Tiger moths, Sphinx moths	7% (2 plants/30 plants)	Snoutworms, Tiger moths (estimated)	Occurrence of Sesame seed bug, Phytoplasma symptoms
F#1-S	90% (9 bundles/10 bundles)	Tiger moths, Sphinx moths (estimated)	0% (0 bundle/10 bundles)		Occurrence of Sesame seed bug, Phytoplasma symptoms
F#2-S	40% (4 bundles/10 bundles)	Tiger moths, Sphinx moths (estimated)	10% (1 bundle/10 bundles)	Snoutworms, Tiger moths (estimated)	Repetition of Sesame seed bug, occurrence rate of empty sesame was 7.6% by investigation 2,000 seeds of standing sesame under stereoscopic microscope, Phytoplasma symptoms

1:30 plants of piling sesame and 10-30 bundles of standing sesame (1 bundle made by 3 small bundles) were investigated.

2:The damage of leaves and stems by the pests actually frrd the plants such as Tiger moths and Sphinx moths are easily observed, on the other hand, the damage by sucking pests such as Aphids, leafhoppers and bugs are different to identified. Sucking pests are known as disease vector as well as bad influence on yeild and quality.

3:The symptoms of the damage were as shown in the photos. Empty seeds are occurred by various factors but sucking by sesame seed bug is possibly the main cause in this case.

ANNEX Table 6. Interviews on sesame pest in Myanmar (Aug. – Sept., 2018)

Abbreviation	Question 1 (Insect pest)	Question 2 (Damage)	Question 3 (Pesticide)	Question 4 (Phytoplasma)	Remarks
Patrol survey farmres					
U#1	No pest in piling sesame and standing sesame	No damage in piling sesame and standing sesame	No pesticide to piling sesame and standing sesame	I know: spraying Cypermethrin during cultivation	Worry about insect pests
U#2	uninvestigated				
U#3	No pest in piling sesame and standing sesame	No damage in piling sesame and standing sesame	No pesticide to piling sesame and standing sesame	I know: spraying insecticide within 30 days after seeding and remove diseased plants, but don't know the vector insect	Hope to gain information on pests and control measures
U#4	No pest in piling sesame and standing sesame	No damage in piling sesame and standing sesame	No pesticide to piling sesame and standing sesame	I know (but no countermeasures)	Follow the cultivation method of sesame which father told
U#5	uninvestigated				
U#6	uninvestigated				
U#7	uninvestigated				
U#8	uninvestigated				
U#9	Bugs in piling sesame and standing sesame	No damage in piling sesame and standing sesame	No pesticide to piling sesame and standing sesame	I know, I think it caused by seeds and I will buy good seeds next year.	
U#10	Bugs in piling sesame and standing sesame	No damage in piling sesame and standing sesame	No pesticide to piling sesame and standing sesame	I know: spraying insecticide within 25 days and 45 days after seeding. I think insects transmit the disease.	Select pesticide according to the reccommendation of pesticide distributor
U#11	Bugs in piling sesame and standing sesame	Damage on leaves in piling sesame and standing sesame	No pesticide to piling sesame and standing sesame	I know (but no countermeasures)	
U#12	uninvestigated				
U#13	uninvestigated				
U#14	Bugs in piling sesame and standing sesame	No damage in piling sesame and standing sesame	No pesticide to piling sesame and standing sesame	I know (but no countermeasures)	
U#15	uninvestigated				
U#16	uninvestigated				
U#17	uninvestigated				
U#18	Bugs in piling sesame and standing sesame	No damage in piling sesame and standing sesame	No pesticide to piling sesame and standing sesame	I know: spraying Acephate 3 times in early cultivation period.	
U#19	uninvestigated				
U#20	Bugs in piling sesame and standing sesame	No damage in piling sesame and standing sesame	No pesticide to piling sesame and standing sesame	I know: spraying Avermectin within 25 days and 45 days after seeding.	
U#21	Bugs in piling sesame and standing sesame	No damage in piling sesame and standing sesame	No pesticide to piling sesame and standing sesame	I know (but no countermeasures)	
U#22	uninvestigated				
U#23	Bugs in piling sesame and standing sesame	Damage on leaves in piling sesame and standing sesame (defoliation)	No pesticide to piling sesame and standing sesame	I know (but no countermeasures)	
U#24	uninvestigated				
U#25	Bugs in piling sesame and standing sesame	No damage in piling sesame and standing sesame	No pesticide to piling sesame and standing sesame	I know: spraying insecticide within 15 days after seeding.	Hope to gain information on pests and control measures
Fixed point survey farmers					
F#1	No pest in piling sesame and standing sesame	No damage in piling sesame and standing sesame	No pesticide to piling sesame and standing sesame	I know: spraying Chlorpyrifos during cultivation	Insufficient information in vector insect of phytoplasma
F#2	Bugs such as Sesame seed bug in piling sesame and standing sesame	N.A.	No pesticide to piling sesame and standing sesame	I know, I used to spray Imidacroprid before participation in GAP. No, after participation in GAP, I spray mixed pesticide of Cypermethrin and Chlorpyrifos once during cultivation. I know leafhopper as vector. (misunderstand various species are same)	Participated in the WS held by JAICAF in 2017 at DOA Magway Regional Office/Hope to gain information on pests and control measures
Other farmers					
1	No pest in piling sesame and standing sesame	No damage in piling sesame and standing sesame	No pesticide to piling sesame and standing sesame	I know: spraying Chlorpyrifos during cultivation	Insufficient information in vector insect of phytoplasma
2	No pest in piling sesame and standing sesame	No damage in piling sesame and standing sesame	No pesticide to piling sesame and standing sesame	I know: spraying Chlorpyrifos during cultivation	

1: Questions were followings;

Question 1. What kinds of pests do you see in piling sesame and standing sesame?
Question 2. What kinds of damage are caused in piling sesame and standing sesame?
Question 3. Do you use pesticides on piling sesame and standing sesame? What kinds of pesticides do you use?
Question 4. Do you know about sesame phytoplasma? What kinds of countermeasures are you taking?

2: Details of insecticeds were showin in table 3-8. Avermectin is Macrolide insecticide and Thrips and Agromyzidae are the target opest in Japan.

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မြန်မာ့နှမ်းနှင့် အရည်အသွေးနှင့် အခြောက်ခံခြင်းနည်းလမ်းများ

၂၀၁၈ ဒီဇင်ဘာ

နိရှိယာမ အာခိယို

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နှမ်းနက်၏ စံနှုန်းများ

ဂျပန်နိုင်ငံရှိ နှမ်းထုတ်လုပ်သူများ သတ်မှတ်ထားသော စံချိန်စံညွှန်းများ

■အစိုဓါတ် ၇% ထက် မကျော်ရ။

■Free Fatty Acid (FFA) 2.0 ကို မကျော်ရ။

■အရောအနှောများ 0.5% ထက်မပိုရ။

■ဓါတုဓါတ်ကြွင်းများကို သတ်မှတ်ထားသော စံနှုန်းတွင်သာ ရှိစေရန်။

■Aflaxtoxin မရှိစေရ။

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ဂျပန်နိုင်ငံရှိ အရည်အသွေး စံချိန်စံညွှန်းများ

◎ **ပိုးသတ်ဆေး၊ ဓါတုဓါတ်ကြွင်းများကိုလဲ သတ်မှတ်ထားသော စံနှုန်းများ ရှိပါသည်။**

ဧလှလာလိုပါက ဝိုတ်ဖျူးရေး ဓါတုဓါတ်ကြွင်း သတ်မှတ်ချက်များ ဇော်ပြထားသော စာမျက်နှာ
http://db.ffcr.or.jp/front/တွင် ဧလှလာနိုင်ပါသည်။

◎**အက်ဆစ်ပါဝင်မှုနှုန်းများကိုလဲ သတ်မှတ်ထားပါသည်။**

ဂျပန်တွင် အက်ဆစ်ပါဝင်မှု စံနှုန်း

FFA:2MAX

အကယ်၍ ဂျပန်သို့ တင်ပို့သော နှမ်းစေ့များသည် FFA-1 ရှိခဲ့ပါက ဂျပန်သို့ ရောက်ရှိချိန်တွင် FFA-1 ထက် ကျော်လွန်ပါလိမ့်မည်။

カタギ食品株式会社
KATAGI FOODS CO. Ltd

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နှမ်းစံချိန်စံညွှန်း

အရည်အသွေးကို သတ်မှတ်ရာတွင် အဓိကကျသောအချက်မှာ(AV) Acid Value အက်ဆစ်တန်ဖိုးပင် ဖြစ်ပေသည်။

- မြန်မာနိုင်ငံတွင် နှမ်းကို ရိတ်သိမ်းချိန်သည် ပိုးရာသီဖြစ်သည့်အတွက် အက်ဆစ်ပါဝင်မှုနည်း မြင့်လေ့ရှိပေသည်။
- ထို့ကြောင့် ဂျပန်မှ နှမ်းဖြင့် ထုတ်လုပ်သူများသည် အထူးသဖြင့် မြန်မာ့နှမ်း၏ အက်ဆစ်ပါဝင်မှုနှုန်းအား စိတ်ဝင်တစား ရှိပေသည်။

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စမ်းသပ်မှု၏ နောက်ခံသမိုင်းကြောင်းနှင့် ရည်ရွယ်ချက်

- မြန်မာနိုင်ငံတွင် နှမ်းရိတ်သိမ်းပြီးနောက် နှမ်းပွဲခြင်း (Pilling) ၊ နှမ်းထောင်ခြင်း (Standing) နည်းများဖြင့် အခြောက်ခံကြသည်။ နှမ်းပွဲခြင်း (Pilling) နည်းကို အသုံးပြုခြင်းဖြင့် အမှုန်အန် နှင့် စိုထိုင်းဆများ မြင့်မားချိန်တွင် အက်ဆစ်ဓာတ် (AV) မြင့်မားနိုင်ကြောင်း တွေ့ရှိရပါသည်။
- အခြောက်ခံနည်းလမ်းနှင့် လိုက်၍ အရည်အသွေး ကွာခြားနိုင်သည်ကို စမ်းသပ်မှုများ လုံလောက်သည်ဟု မဆိုနိုင်ပါ။
- သို့ပါသောကြောင့် ဦးစွာ မည်သည့်နည်း အသုံးပြုပါက အက်ဆစ်ဓာတ် မြင့်မားနိုင်သည်ကို လက်တွေ့ စမ်းသပ်စစ်ဆေးမှုများ ပြုလုပ်ခဲ့ပါသည်။

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အက်ဆစ်တန်ဖိုး (AV) ဆိုသည်မှာ...

- AV သည် အဆီများ ပျက်ဆီးခြင်းကြောင့် မြင့်တက်လာနိုင်ပါသည်။
  (အပူချိန်ပေါ် မူတည်၍ ဓါတ်ပြုပြောင်းလဲစေသောအခါ = အက်ဆစ်များ မြင့်တက်ခြင်း)
- FFA≒ 2 AV
- ဂျပန်တွင် စားသောက်ကုန်နှင့် စားသုံးဆီများအတွက် အက်ဆစ်ပါဝင်မှုနှုန်း
- (AV) ကို သတ်မှတ်စံနှုန်းများ ရှိပေသည်။

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အက်ဆစ်တန်ဖိုး (AV) ဆိုသည်မှာ...

【နှမ်းနှင့် ပတ်သက်၍】

- အက်ဆစ်တန်ဖိုး မြင့်တက်ပါက နှမ်းအရသာ လျော့နည်းကာ အနံ့လဲ မကောင်း ဖြစ်လာတတ်ပါသည်။ ကျန်းမာရေးကိုလဲ ထိခိုက်စေနိုင်ပါသည်။
- ဂျပန်တွင် တင်ပို့ကုန် လက်ခံချိန်တွင် FFA2 ကျော်လွန်ပါက အစားအသောက် ပြုလုပ်ရာတွင် အသုံးမပြုပေ။ AV 4 နီးပါးလောက် ရှိသွားသောကြောင့် ဖြစ်ပေသည်။
- မြန်မာနိုင်ငံမှ ဂျပန်သို့ တင်ပို့သော ခရီးသည် ရှည်လျားလွန်းသည်။ခရီးစဉ်အတွင်း အက်ဆစ်ဓာတ် မြင့်မားလာတတ်သောကြောင့် မတင်ပို့စဉ်အချိန်မှစ၍ အက်ဆစ်ဓါတ်အား မမြင့်စေရန် ပြုလုပ်သင့်ပေသည်။

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အက်ဆစ်တန်ဖိုး (AV) ဆိုသည်မှာ....

အက်ဆစ်တန်ဖိုး အပေါ် သက်ရောက်စေသော အရာများမှာ....

- ■ လေ
- ■ အပူချိန်
- ■ အစိုဓါတ်
- ■ စားသောက်ကုန် တွင် ပါသော ရေ (PH)
- ■ သတ္တု
- ■ အလင်းရောင် စသည်ဖြင့်...

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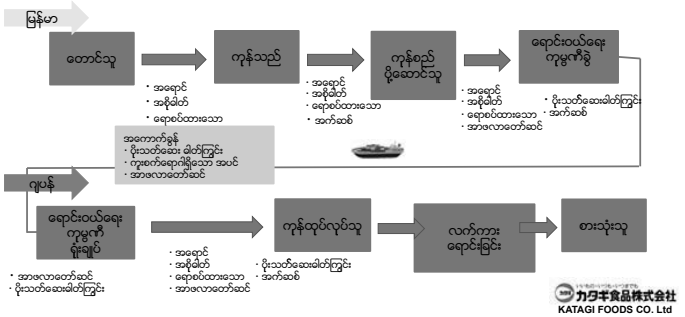
နှမ်း၏ အက်ဆစ်သည် မည်သည့်နေရာတွင် မြင့်တက်သွားနိုင်သည်ကို လေ့လာခြင်း?



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သတ်မှတ်ရည်ရွယ်သည့် အက်ဆစ်ပါဝင်မှုနှုန်း

- လူကြီးမင်းတို့ ဒေသမှ ဂျပန်ဆိပ်ကမ်း ရောက်ချိန်အထိ ရက် ၂၀ နီးပါး ကြာပေသည်။ ခရီးစဉ်အတွင်း ဓလန္ဒ ထိတွေ့ခြင်း၊ အပူချိန်နှင့် စိုထိုင်းဆများ၏ ပြောင်းလဲခြင်းကို ခံရပေသည်။
- လူကြီးမင်းတို့ ဒေသမှ ဂျပန်ထိ နှမ်းကို တင်ပို့မည်ဆိုပါက နှမ်းတွင် ပါဝင်သော AV အက်ဆစ်ပါဝင်မှုနှုန်း သည်
  - ◆ <u>အက်ဆစ်ပါဝင်မှုနှုန်း 2အောက် (3～နှင့် သုံး အထက် သည် အဆင်မပြေပါ)</u>
- အတတ်နိုင်ဆုံး အက်ဆစ်ပါဝင်မှုနှုန်းကို လျော့ချနိုင်ခြင်းသည် အကောင်းဆုံးဖြစ်သည်။

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၈-၉ လပိုင်းတွင် အခြောက်ခံစမ်းသပ်ခြင်း

- စမ်းသပ်မှုအကျဉ်းချုပ်

□အခြောက်ခံနည်း ၃ မျိုးဖြင့် စမ်းသပ်ပြီး အခြောက်ခံနည်းအလိုက် AV အက်ဆစ်တန်ဖိုး ပါဝင်မှု ကွာခြားခြင်းကိုစစ်ဆေး
①နှမ်းပုံခြင်း (Piling) 、②နှမ်းထောင်ခြင်း (Standing) 、③အခန်းတွင်း အခြောက်ခံခြင်း

□စမ်းသပ်သည့် ဒေသ မဂွေးတိုင်း အောင်လံမြို့နယ်

□တောင်သူ နှစ်ဦး၏ လယ်ကွင်း

□①ရိတ်သိမ်းသည့်ရက် (စတင် အခြောက်ခံသည့်နေ့=0ရက်) ၊ ②7ရက် ဓနာက်၊ ③15ရက်နောက်တွင် နှမ်းစေ့ရွေသည်

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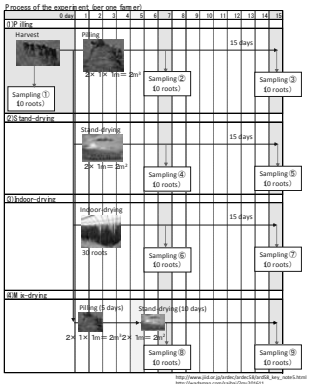

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၈-၉ လပိုင်းတွင် အခြောက်ခံစမ်းသပ်မှုပုံ

နှမ်းပုံခြင်း

နှမ်းထောင်ခြင်း

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၈-၉ လပိုင်းတွင် အခြောက်ခံစမ်းသပ်မှု

အခန်းတွင်းအခြောက်ခံခြင်း

နှမ်းပုံ→နှမ်းထောင်

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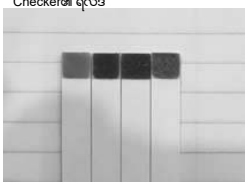
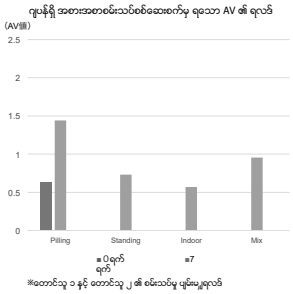
အခြောက်ခံစမ်းသပ်မှု၏ ရလဒ်

ခြောက်သွေ့ခြင်းနည်းလမ်း ကွဲပြားခြင်းကြောင့် AV အက်ဆစ်တန်ဖိုး ကွဲပြားနိုင်သည်။

တောင်သူ① ဂု ရက်မြောက်နေ့ : AV Checker၏ ရလဒ်



ဝါမှ နှမ်းပုံ (AV=၂.၅)၊ နှမ်းထောင်ခြင်း(၀.၉)အခန်းတွင်းအခြောက်ခံခြင်း(၀.၉)၊ နှမ်းပြုပြင်း→နှမ်းထောင်ပြုပြင်း(၁.၉) အထိရောင်ထက် တခြားမြန်၊ အရောင်ရင့်သွားခြင်း



※တောင်သူ ၁ နှင့် တောင်သူ ၂ ၏ စမ်းသပ်မှု ပျမ်းမျှရလဒ်

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အခြောက်ခံစမ်းသပ်ခြင်း၏ ရလဒ်

■ နှမ်းပုံခြင်း

- နှမ်းမှုန်များဆဲတွင် ပိုများစွာ ဝေလွှိရသည်။
- နှမ်းဆွတ်ချိန်တွင် ပသိသာသော်လဲ ပိုနဲ့ များကွန်ပုံခြင်း၊ အရသာလဲ သိသာစွာ လျော့နဲသွားခြင်း

■ နှမ်းထောင်ခြင်း

- ဝန်ထောက်မှု အခြောက်ခံသော နှမ်းထောင်ခြင်းကြောင့် ပိုများ ပွဲကပ်ခြင်း မရှိပါ။

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အစားအစာ(စီးပွားဖြစ်သီးနှံ) တွင် အဓိကကျသော အရာ

- စိတ်ချယုံကြည်စွာ စားလို့ရခြင်း = စိတ်ချခြင်း

- စားသုံးသူများက " စားချင်လိုက်တာ "လို့ ဖြစ်စေတဲ့ အရာ = "အရသာရှိခြင်း"အကြောင်းတစ်ခု

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「အရသာရှိတယ်」 ဆိုတာ ဘယ်လိုမျိုးလဲ.....

- ***ကျပန်ထုတ်လုပ်သူများဘက်မှ နှမ်းဝယ်ယူရန်တွင် အဓိကကြည့်သည့် အချက်များ***

အကြည်းအရာ	ထပ်မံတိုးချဲ့ချက်များ
အရောင်	နှမ်းစေ့အရောင်၊ အရောင်ညီညာခြင်း၊ အရောင်အနှောများ
နှမ်းစေ့	နှမ်းစေ့ဆွဲလွယ်မလွယ်ခြင်း၊ နှမ်းအဆွဲသစ်အားအဖြန်းနှမ်းစေ့ကဆောင်အလေးချိန်
အနံ့အရသာ	ယာဘက်တွင် မိုးသော ပုံ + **ဆားပုံဖြစ်၍ စစ်ဆေးခြင်း**

သတ်မှတ်ချက်ထက် အနံ့အရသာ၏ တန်ဖိုးသည် ၆ ထက် ကျော်လွန်ရပေမည်။

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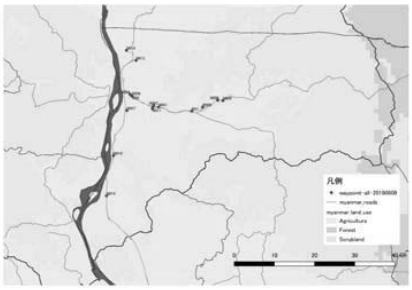
၈-၉ လပိုင်းတွင် အခြောက်ခံစမ်းသပ်မှု



စစ်တမ်းကောက်ယူ ဒေသများ
အနီစက်လေးသည် စမ်းသပ်နေရာ
- Nက္ခ ဖိုက်ဝင်းတစ်ခုလုံးနှင့် ပိုးမွှားစစ်တမ်း
- Iက ပိုးမွှားစစ်တမ်းတစ်ခုတည်းသာ

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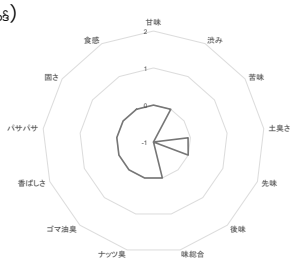
၈-၉ လပိုင်းတွင် အရသာစမ်းသပ်မှုရလဒ်

- အရသာစမ်းသပ်မှုရလဒ် (ပျမ်းမျှရလဒ်)



အနှံအရသာအားလုံး၏ ပျမ်းမျှရလဒ်=၄.၉

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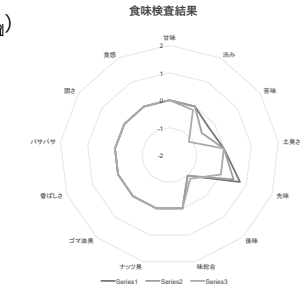
၈-၉ လပိုင်းတွင် အရသာစမ်းသပ်မှုရလဒ်

- ၁၄ နေရာ၏ အရသာစမ်းသပ်မှုရလဒ် (ပျမ်းမျှ)
  စုစုပေါင်းပျမ်းမျှရလဒ်=5.4

	総合評価
ရေဖေါ်	6.5
GAP	5.9
GAP မဟုတ်သော	4.9
TOTAL	5.4



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	အရောင်	အရွယ်
စာခြောက်ခံနေ့	8.5	4.0
နှမ်းပုံခြင်း(၇ရက်မြောက်နေ့)	6.5	4.0
နှမ်းပုံခြင်း(၁၅ရက်မြောက်နေ့)	5.5	4.0
နှမ်းထောင် (၇ရက်မြောက်နေ့)	7.5	4.0
နှမ်းထောင် (၁၅ရက်မြောက်နေ့) (နမူနာ ၁ ခုတည်းသာ)	7.0	4.0
အခန်းတွင်းအခြောက်ခံ (၇ ရက်မြောက်နေ့)	8.0	4.0
အခန်းတွင်းအခြောက်ခံ (၁၅ ရက်မြောက်နေ့)	8.5	4.0
နှမ်းပုံ→နှမ်းထောင် (၁၀ ရက်မြောက်နေ့)	7.5	4.0
နှမ်းပုံ→နှမ်းထောင် (၁၅ ရက်မြောက်နေ့)	5.5	4.0

	အရောင်	အရွယ်
နှမ်းပုံ ၁ ညသိပ် (၇ နေရာ)	8.3	4.0
နှမ်းပုံ ၂ ညသိပ် (၄ နေရာ)	6.5	4.0
နှမ်းပုံ ၃ ညသိပ် (၂ နေရာ)	6.5	4.0
နှမ်းပုံ ၅ ညသိပ် (၁ နေရာ)	10.0	4.0

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အန္တရာယ်ကင်းခြင်းဆိုသည်မှာ...

- အက်ဆစ်ပါဝင်မှုနှုန်း = AV 2 အောက်
- မို့ = မပေါက်ပွားအောင် (အာဖလာတော်ဆင် ပေါ် မူတည်၍ ကုန်များ ပြန်ပို့နိုင်သောကြောင့်)
- ပိုးသတ်ဆေး = သတ်မှတ်ထားသည်ထက် လျော့နည်းရမည်
  ⇒ပိုးမွှားအန္တရာယ် ကာကွယ်ခြင်း

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အခြောက်ခံစမ်းသပ်မှုရလဒ်၏ အနှစ်ချုပ်

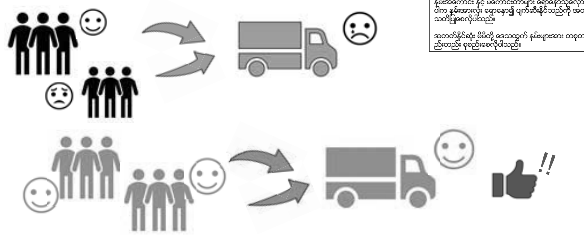
- နှမ်းပုံခြင်းဖြင့် အက်ဆစ်ဓါတ်ကို မြင့်စေနိုင်သည်။
- နှမ်းပုံခြင်းဖြင့် မို့ ဖြစ်ပွားမှုလဲ များစေနိုင်သည်။

⇒နှမ်းထောင်ခြင်းနည်းသည် အလွန် အကျိုးရှိပေသည်။
- သို့သော်လဲ ဒီနှစ်သည် မိုးများသောကြောင့် တချို့ သော နှမ်းများ အပြည့်အဝ မခြောက်သွေ့ပေ။
- နောင်အနာဂတ်တွင် မိုးလုံသောအခန်းတွင်း အခြောက်ခံသောနည်းလမ်းက ပိုမိုထိရောက်စေမည် ဟု မျှော်လင့်မိပါသည်။

JAICAFジェイカフ

ကျွန်းမာသန့်ရှင်း ရောဂါကင်းစင် အရသာမြိန်သော နမ်းနက်ဖြင့် မြန်မာ မှ ဂျပန်သို့ ရောက်ရှိပို့ဆောင် စီးပွားအောင်ကြပါစို့.......

- ဒေသအမျိုးမျိုးမှ နမ်းများအား
- ကုန်စည်စုဆောင်းခြင်း



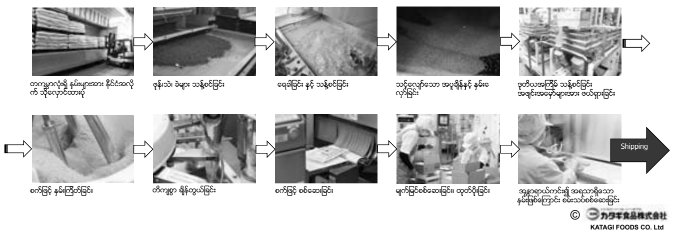
နမ်းအကောင်း နှင့် မကောင်းတာများ ရောနှောသိုလှောင်မိပါက နမ်းအားလုံး ရောနှော၍ ပျက်ဆီးနိုင်သည်ကို အထူးသတိပြုစေလိုပါသည်။

အတတ်နိုင်ဆုံး မိမိတို့ ဒေသထွက် နမ်းများအား တစုတစည်းတည်း စုစည်းစေလိုပါသည်။

JAICAFジェイカフ

ကျွန်းမာသန့်ရှင်း ရောဂါကင်းစင် အရသာမြိန်သော နမ်းနက်ဖြင့် မြန်မာ မှ ဂျပန်သို့ ရောက်ရှိပို့ဆောင် စီးပွားအောင်ကြပါစို့.......

- ဂျပန်တွင် အရည်သွေးကောင်းအောင် ဆောင်ရွက်ခြင်း



JAICAFジェイカフ

ကျွန်းမာသန့်ရှင်း ရောဂါကင်းစင် အရသာမြိန်သော နမ်းနက်ဖြင့်...... မြန်မာ မှ ဂျပန်သို့ ရောက်ရှိပို့ဆောင် စီးပွားအောင်စို့

- လူကြီးမင်းတို့ရဲ့ အရသာရှိလှသော နမ်းနက်ကို စောင့်မျှော်နေပါတယ်နော်

JAICAFジェイカフ

Thank you for your attention!

ယနေ့ပွဲလေးအား၊ ဂျပန်စိုက်ပျိုးရေး သစ်တောနှင့် ရေလုပ်ငန်းဝန်ကြီးဌာန (*MAFF, Japan*) ၏လုပ်ငန်းအား၊ စိုက်ပျိုးရေးနှင့်သစ်တော အပြည်ပြည်ဆိုင်ရာပူးပေါင်းဆောင်ရွက်မှုအဖွဲ့ (*JAICAF*) မှဆောင်ရွက်သည်။

နောက်ခံသမိုင်းနှင့် ရည်ရွယ်ချက်

- မြန်မာနိုင်ငံတွင် နှမ်းရိတ်သိမ်းပြီးသည့်နောက် နှမ်းပုံလေ့ရှိသည်။ ထို့နောက် နှမ်းထောင်သည်။ နှမ်းပုံခြင်း (Pilling Sesame) နှင့် နှမ်းထောင်ခြင်း (Standing Sesame) ဟု ခေါ်ဆိုကြသည်။

- တောင်သူအများစုသည် နှမ်းပုံ၊ နှမ်းထောင်ချိန်တွင် ကြုံရသော ပိုးမွှားများကို စိုးရိမ်လျက် ရှိသည်။ တကယ်တမ်းမှာ နှမ်းစိုက်ချိန်တွင် ပက်ဖျန်းခဲ့သည့် ပိုးသတ်ဆေးများ၏ ပိုးသတ်ဆေး အကြွင်းအကျန် များကို ပို၍ စိုးရိမ်သင့်ပေသည်။

ထို့ကြောင့် ဦးစွာ နှမ်းပုံခြင်း နှမ်းထောင်ခြင်းဖြင့် တွေ့နိုင်သော ပိုးမွှားအခြေအနေ ကို လေ့လာခဲ့ပါသည်။

2

အကြောင်းအရာ

3

၁။ လက်တွေ့ကွင်းဆင်းချိန် နှင့် စိုက်ကွင်း

4

(၁)လက်တွေ့ကွင်းဆင်းချိန်
၉.၈.၂၀၁၈ ~ ၁၃.၉ .၂၀၁၈

(၂)ဒေသ
အောင်လံမြို့နယ်
မကွေးတိုင်းဒေသ

(၃)ကွင်းဆင်းလေ့လာခြင်းနှင့် လေ့လာကြိမ်များ
စမ်းသပ်မှု တကြိမ်သာ ပြုလုပ်ခဲ့သည်မှာ ၂၅ နေရာ
စမ်းသပ်မှု သုံးကြိမ် ပြုလုပ်ခဲ့သည်မှာ ၂ နေရာ

မကွေး

5

ဇယား ၁　　နှမ်းပုံခြင်း နှင့်နှမ်းထောင်ခြင်း စစ်တမ်း

စဉ်	စစ်ဆေးသည့်နေ့	ဒေသ	နှမ်းပုံခြင်း(သို့)နှမ်းထောင်ခြင်း
စစ်တမ်းယူခဲ့သည့်နေရာများ	၂၀၁၈ ခုနှစ်	အောင်လံမြို့နယ်	
U#1	24-Aug	ရေပေါ်	နှမ်းပုံခြင်း(ရိတ်သိမ်းဆဲ)
U#2	24-Aug	ရေပေါ်	နှမ်းထောင်ခြင်း
U#3	28-Aug	စမ်းကလေး	နှမ်းပုံခြင်း
U#4	29-Aug	သံချိတ်	နှမ်းပုံခြင်း
U#5	29-Aug	စမ်းကလေး	နှမ်းထောင်ခြင်း
U#6	30-Aug	စမ်းကလေး	နှမ်းထောင်ခြင်း
U#7	30-Aug	စမ်းကလေး	နှမ်းပုံခြင်း
U#8	30-Aug	စမ်းကလေး	နှမ်းပုံခြင်း
U#9	31-Aug	စမ်းကလေး	နှမ်းပုံခြင်း(ရိတ်သိမ်းဆဲ)
U#10	1-Sep	အင်းတုန်း	နှမ်းပုံခြင်း
U#11	4-Sep	အလယ်ရွာ	နှမ်းပုံခြင်း
U#12	4-Sep	ရွာမထုံး	နှမ်းထောင်ခြင်း
U#13	4-Sep	ရွာမထုံး	နှမ်းထောင်ခြင်း
U#14	4-Sep	ရွာမထုံး	နှမ်းပုံခြင်း
U#15	4-Sep	ရွာမထုံး	နှမ်းပုံခြင်း
U#16	4-Sep	ရွာမထုံး	နှမ်းထောင်ခြင်း
U#17	4-Sep	ရွာမထုံး	နှမ်းထောင်ခြင်း
U#18	5-Sep	နန့်ရုပင်	နှမ်းပုံခြင်း(ရိတ်သိမ်းဆဲ)
U#19	5-Sep	နန့်ရုပင်	နှမ်းပုံခြင်း
U#20	5-Sep	ရေပေါ်	နှမ်းထောင်ခြင်း
U#21	6-Sep	ရွှေညောင်ပင်	နှမ်းထောင်ခြင်း
U#22	6-Sep	ရွှေညောင်ပင်	နှမ်းထောင်ခြင်း
U#23	6-Sep	ဝွေးကုန်း	နှမ်းထောင်ခြင်း
U#24	6-Sep	ဝွေးကုန်း	နှမ်းထောင်ခြင်း
U#25	7-Sep	ဝပျင်း	နှမ်းပုံခြင်း
定点調査圃場	2018年	အောင်လံမြို့နယ်	
F#1-P、F#1-S	(1) 23-Aug、(2) 30-Aug、(3) 7-Sept	ရေပေါ်	နှမ်းပုံခြင်း-နှမ်းထောင်ခြင်း
F#2-P、F#2-S	(1) 25-Aug、(2) 1-Sept、(3) 9-Sept	ရေပေါ်	နှမ်းပုံခြင်း-နှမ်းထောင်ခြင်း

6

၂။ စမ်းသပ်မှုနည်းလမ်း

7

ဇယား ၂ စစ်တမ်းကောက်ယူသည့်နည်း

စစ်တမ်းကောက်ယူသည့်နည်းလမ်း	လှည့်လည်စမ်းသပ်ခဲ့သည့်ယာဆင်းများ	သတ်မှတ်စမ်းသပ်ခဲ့သည့်ယာဆင်းများ
ပိုးမွှားစစ်တမ်း အမြင်အာဖြင့်သုံးသပ်နည်း ပိုးမွှားဖမ်းတံဖြင့် ဖမ်းကြည့်နည်း အဝါရောင်ကဒ်ဖြင့် ဖမ်းကြည့်နည်း	နှမ်းပုံ နှမ်းထောင်ချိန်တွင် ပိုးမွှားများအား အမြင်ဖြင့်စစ်ခြင်း ရိတ်သိမ်းပြီးယာဆင်းများတွင် ပိုးမွှားဖမ်းတံဖြင့် အကြိမ်ငှဝါယမ်၍ ကြည့်။ အပြည့်အဝမဟုတ်။	အထူးသဖြင့် နှမ်းစေ့ရုပ်ဂျိုးအား ပိုးမွှားဖမ်းတံဖြင့် ဖမ်းကြည့်။ အပြည့်အဝမဟုတ်။ အဝါရောင်ကဒ် (20cm×10cm) ဖြင့် ၃ ကဒ်ချိတ်၍ စမ်း။
ပျက်ဆီးဆုံးရှုံးမှုစစ်တမ်း	နှမ်းပုံထဲမှ နှမ်းပင် ၃၀၊ နှမ်းထောင်ပုံထဲမှ ၁၀ မှ ၃၀ နှမ်းပင်များကိုယူ၍ အရွက်နှင့် သီးတောင့်ရှိ ပျက်ဆီးမှုကိုစစ်ဆေး	ထိုအပြင် နှမ်းစေ့ ၂၀၀၀ ကိုယူ၍ မှန်ပြောင်းဖြင့် ကြည့်ကာ နှမ်းအဖျင်း မည်မျှရှိသည်ကို လေ့လာ။
မေးခွန်းများဖြင့် စစ်တမ်းယူခြင်း	တောင်သူအခြေပြု မေးခွန်းများဖြစ်ပြီး (နှမ်းပုံ နှမ်းထောင်ချိန် တွင် ပိုးမွှားဖြစ်မှားမှု၊ ပိုးမွှားအန္တရာယ်၊ ပိုးသတ်ဆေးသုံးစွဲ ပက်ဖျန်းမှု၊ Pytoplasma ရောဂါ အစရှိသည့် မေးခွန်း	ဘယ်ဘက်နှင့် အတူတူဖြစ်သည်။

8

ပိုးမွှားများ စမ်းသပ်စစ်ဆေးခြင်း

(ခ) Direct Counting Method
နေရာတခုစီတိုင်း လက်တွေ့လုပ်ဆောင်သည်။

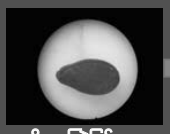
(ဂ) Sweeping Method
အဝ အချင်း ၃၆လက္ခ ရှိသော လက်ကိုင်ပိုက်ဖြင့် စမ်းသပ်စစ်ဆေးခြင်း

(ဃ) Yellow Sticky Trap Method

သတ်မှတ် လယ်ကွက်များတွင် အဝါရောင်ကဒ် (20cm✖10cm) ကို သုံး၍ စစ်ဆေးခြင်း

9

နှမ်းစိုက်ပျိုးခြင်းအဆင့်ဆင့်



မျိုးစေ့ကြဲခြင်း

နှမ်းမသီးခင်

ပန်းပွင့်ချိန်

(နှမ်းပုံ)
နှမ်းထောင်ချိန်

(နှမ်းပုံ)
နှမ်းပုံချိန်

နှမ်းသီးပြီးနောက်

10

၃။ နှမ်းပုံခြင်း နှမ်းထောင်ခြင်းဖြင့် ပိုးမွှားနှင့် ပျက်ဆီးမှု

11

နှမ်း၏ အဓိကကျသောပိုးမွှားများနှင့် ပျက်ဆီးဆုံးရှုံးမှု

ပိုးမွှားများ 害虫	Aphids (Vector) アブラムシ類（ベクター）	Leafhoppers (နှမ်းမြွေဟပ်) ヨコバイ類（ベクター）	Bugs (နှမ်းစေ့စုပ်ကျိုး) カメムシ類	Scarabs (နှမ်းကျိုးနက်) コガネムシ類	Pyralid moths (နှမ်းရွက်လိပ်ပို့) メイガ類	Sphinx moths (နှမ်းဖလံ) スズメガ類	Tiger moths (ရွက်စုံစားခွဲ) ヒトリガ類	Owlet moths (နှမ်းသီး လုံးဖောက်ပို့) ヤガ類	Termites シロアリ類
နှမ်းပုံ နှမ်းထောင်ချိန် (1) ပိုးမွှား	○	○	●	○	×	○	○	○	○
(2)ပျက်ဆီးမှု	×	×	●	×	×	×	○	×	×
မစိုက်ခိုင်မီ နှင့် စိုက်ခိုင်ပြီးနောက် (1) ပိုးမွှား	○	●	○	○	○	○	○	○	○
(2) ပျက်ဆီးမှု	○	●	○	○	○	○	○	○	○

သတိ : ×မဖြစ်, ○=ဖြစ်မှုး, ●=အများကြီးဖြစ်မှုး

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- နှမ်းပုံ နှမ်းထောင်ချိန်တွင် အမျိုးမျိုးသော ဖျက်ပိုးများကို တွေ့ရှိခဲ့ရသည်။ဖျက်ပိုးအများစုသည် ရိတ်သိမ်းပြီးနောက် ဖြစ်ပွားသောအရာ ဖြစ်သော်လဲ အမှန်မှာ ရိတ်သိမ်းစကာလ ကထဲက သယ်ဆောင်ပါလာခဲ့ခြင်းပင် ဖြစ်ပေသည်။
- အမှန်မှာ ဖျက်ပိုးများသည် နှမ်းပုံ နှမ်းထောင်ချိန်မှစ၍ ပိုးဥများ သယ်ဆောင်လာသည်။ တဖြေးဖြေး အကောင်ကြီးထွားချိန်တွင် အပင်ကို ဖျက်ဆီးကြခြင်း ဖြစ်သည်။

အမျိုးမျိုးသော ပိုးမွှားများကြောင့် ဖျက်ဆီးသည် ဆိုသော်လဲ နှမ်းစေ့စုပ်ကျိုးကဲ့သို့သော (Bugs)ကြောင့် ဖျက်ဆီးမှု ပိုများပေသည်။

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ကျိုး (နှမ်းစေ့စုပ်ကျိုး)

Sesame seed bug
Elasmolomus sordidus / Aphanus sordidus
ナガカメムシ上科 Lygaeoidea

အထူးသဖြင့် အန္တရာရယ်ပေးသောပိုးမှာ
နှမ်းစေ့စုပ်ကျိုး
ကြောင့် ဖြစ်ပွားခြင်း!

ဘာ့ကြောင့် အန္တရာရယ် ရှိပါသလဲ?
အထွက်နှုန်းလျော့ခြင်း နှင့် အရည်အသွေးကျခြင်း

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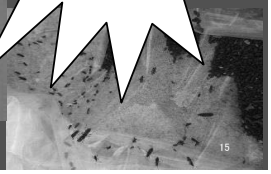
အထွက်နှုန်းလျော့ခြင်း
(しいなゴマ発生)

နှမ်းအဖျင်း
(အစေ့မအောင်သော နှမ်းနှံ)

အစေ့အောင် ပြည့်ဖြိုးသော နှမ်း

ပုံမှန် ရှိနှစ်စစ်တမ်း
နှမ်းအဖျင်း
၇.၆%



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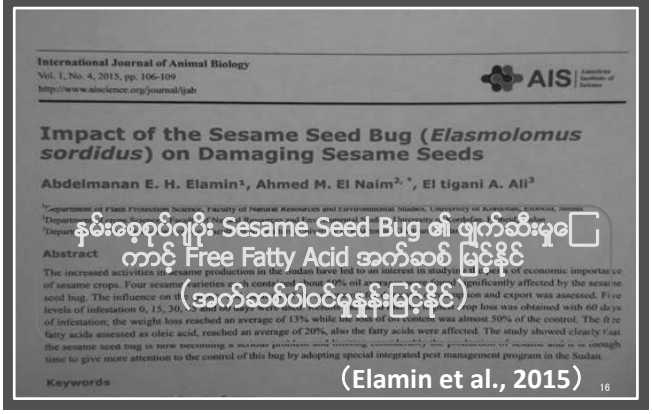
အရည်အသွေးကျဆင်းခြင်း (အက်ဆစ်ဓါတ်မြင့်ခြင်း)



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AIS

Impact of the Sesame Seed Bug (*Elasmolomus sordidus*) on Damaging Sesame Seeds

Abdelmanan E. H. Elamin[1], Ahmed M. El Naim[2, *], El tigani A. Ali[3]

Abstract

Keywords

နှမ်းစေ့စုပ်ကျိုး Sesame Seed Bug ၏ ဖျက်ဆီးမှုကြောင့် Free Fatty Acid အက်ဆစ် မြင့်နှုန်း (အက်ဆစ်ပါဝင်မှုနှုန်းမြင့်နှုန်း)

(Elamin et al., 2015)

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မြန်မာနိုင်ငံတွင်လဲ နှမ်းစေ့စုပ်ကျိုးကြောင့် ဖျက်ဆီးမှုများပြီး ထွက်နှုန်းနှုန်းခြင်း(လေလွင့်မှုများခြင်း)၊ အရည်အသွေး ကျဆင်းခြင်း (အက်ဆစ်ဓါတ် မြင့်မားခြင်း)တို့ ဖြစ်ပွားသည်ဟု ယူဆမိပါသည်။

မြန်မာနိုင်ငံတွင် နှမ်းပုံခြင်း၊ နှမ်းထောင်ခြင်းဖြင့် မည်ကဲ့သို့သော ဖျက်ဆီးမှုများရှိသည်ကို ပို၍ အသေးစိတ် လေ့လာဆန်းစစ်ရန် လိုအပ်ပေသည်။

17

နှမ်းစေ့စုပ်ကျိုး၏ မိတ်ဆွေပိုး

အကောင်သေး
Body Length- 8.8±1.2mm
Chest Width- 2.6±0.6mm

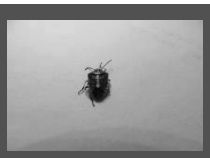
အကောင်ကြီး
Body Length- 13.0±1.1mm
Chest Width- 4.2±0.2mm

* နှမ်းပုံ နှမ်းထောင်ချိန်တွင် ထိုကဲ့သို့သော မိတ်ဆွေပိုးများကြောင့်လဲ ဖျက်ဆီးခံနိုင်သည်။
(Sesame seed bug
Body length-体長 9.0±0.5mm, Chest Width- 3.3±0.3mm)。

18

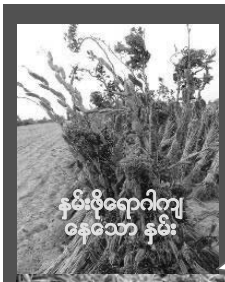
အမျိုးမျိုးသော ပိုးများ






* နှမ်းစိုက်ခင်းတွင် ထိုကဲ့သို့သော ပိုးများကို တွေ့နိုင်သည်။ သို့သော် နှမ်းပုံချိန် နှမ်းထောင်ချိန်တွင် တွေ့ရှိနိုင်သော်လည် အများကြီး အန္တရာယ် မပြုနိုင်ပေ။

19

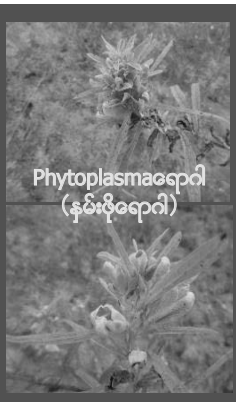


Leafhoppers (Jassid) နှမ်းပြုတ်ညို့ နှင့် Phytoplasma နှမ်းပိုရောဂါ (Phillody-နှမ်းပိုရောဂါ)

စိုက်ခင်း အားလုံးတွင် ဖြစ်ပွား

* နှမ်းစတင်စိုက်ပျိုးချိန်တွင် နှမ်းပိုဖြစ်စေသော ရောဂါ သယ်ဆောင်ကောင်မှာ ပြုတ်ညို့ပိုး ဖြစ်သည်။
* ထို့ကြောင့် နှမ်းပင်ငယ်စဉ်တွင် ဖျက်ပိုးကို နှိမ်နင်းရန် လိုအပ်သည်။

20



* အပင်ကြီးထွားစဉ်တွင် ရောဂါဖြစ်ပွားသည်။ ရောဂါဖြစ်သော နှမ်းတွင် အများအားဖြင့် နှမ်းစေ့မအောင်ပေ။ ထို့ကြောင့် နှမ်းထွက်ကို အလွန်ကျဆေနိုင်ပါသည်။

21

Aphids ပျ နှင့် ပိုင်းရပ်စ်ရောဂါ

* Aphidsသည် အပင်ကြီးစဉ်တွင် ရောဂါကို သယ်ဆောင်လာသည်။ ကူးစက်ရောဂါ သယ်ဆောင်လာသောကြောင့် ရောဂါဖြစ်သည့် နှမ်းတွင် နှမ်းစေ့အပြည့် အဝ မရှိနိုင်ပါ။

(လက္ခဏာမှာ ထင်ရှားခြင်းမရှိ)

22

Scarabs (နှမ်းကျိုင်းနက် စသည်ဖြင့်...)

* ပိုးလောင်းကောင်များသည် နှမ်းပင်အမြစ်ကို စားသည်။ နှမ်းပုံ နှမ်းထောင်ချိန်တွင် ထိုအကောင်များ မဖျက်ဆီးပါ။

23

Sphinx moths (နှမ်းဖလံ စသည်ဖြင့်...)

* ပိုးလောက်ကောင်များသည် အရွက်များကို ကိုက်ဖြတ်သည်။ နှမ်းပုံ နှမ်းထောင်ချိန်တွင် ထိုအကောင်များ မဖျက်ဆီးပါ။

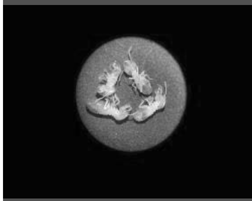
24

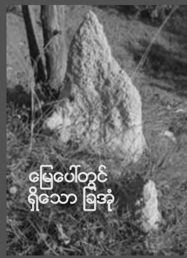
Tiger moths
(ရွက်စုံစားရူပါ စသည်ဖြင့်...)

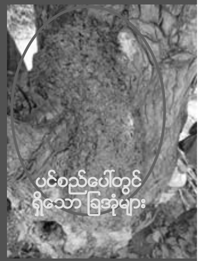
* ပိုးလောက်ကောင်သည် အရွက် နှင့် နမ်းသီးတောင့် ကိုပါ ဖျက်ဆီးတတ်သည်။
နမ်းပွံ့ နမ်းထောင်ချိန်တွင်လဲ နမ်းသီးတောင့်ကို ဆက်လက် ဖျက်ဆီးနိုင်သည်။

25

Termites- ခြများ







* အပင်ကြီးထွားပြီးနောက် ပင်စည်၏ အတွင်းပိုင်းကို ဖျက်ဆီးသည်။
နမ်းပွံ့ နမ်းထောင်ချိန်တွင် ထိုအကောင်များ မဖျက်ဆီးပါ။

26

အခြား

* နမ်းပွံ့ နမ်းထောင်ရာတွင်၊ Cotton bollworm နမ်းသီးလုံးဖောက်ပိုး၏ မိတ်ဆွေပိုးများဖြစ်သော Mealybugs၊ Flatid planthoppers၊ ကြွက်များ ၏ ဖျက်ဆီးမှုများလဲ ရှိပေသည်။သို့သော် အတိအကျကြီး မဟုတ်ပါ။

27

၄။ တောင်သူများနှင့် တွေ့ဆုံမေးမြန်းခြင်း

28

တောင်သူများနှင့် အမေးအဖြေစစ်တမ်း

မေးခွန်း	ဖြေ=ဦးရေ	အဖြေ (ဦးရေ)	မှတ်ချက်
မေး ၁ : နမ်းပွံ့ခြင်းနှင့် နမ်းထောင်ချိန်တွင် မည်ကဲ့သို့သော ပိုးများဖြစ်ပွားသည်ကို တွေ့ရသနည်း?	၁၆	① နမ်းဖြုတ်ညို (0)၊ ဂျပိုး (10)၊ နမ်းကျိုင်းနက် (0)၊ နမ်းဖလံ (0)၊ ရွက်စုံစားရူပါ (0)၊ ခြ (0)၊ အခြား (0) ②မဖြစ်ပွားပါ (6) ③မရေရာ (0)	ဖြေဆိုသူ ၁၀ ဦးမှာ နမ်းစေ့စုပ်ဂျပိုးအကြောင်း ကောင်းစွာ နားလည်။
မေး ၂ : နမ်းပွံ့ခြင်းနှင့် နမ်းထောင်ချိန်တွင် မည်သည့် ပိုးမွှား များ ကျလေ့ရှိသနည်း?	၁၆	① ကျသည့်အခြေအနေ (2)၊ နမ်းသီးပျက်ဆီးမှု (0)၊ အခြားပျက်ဆီးမှု (0)၊ ② ပျက်ဆီးမှုမရှိ (13) ③ မရေရာ (1)	နမ်းစေ့စုပ်ဂျပိုး နှင့် နမ်းဖြုတ်ညို အကြောင်းအား တောင်သူများ နားလည်ရန်ခက်ခဲသည့် အလျောက် သေချာသိသူ နဲပါး။
မေး ၃ : နမ်းပွံ့နမ်းထောင်ချိန်တွင်ပိုးသတ်ဆေး ပက်ဖျန်းပါသလား?အမည်ကို ပြောပါ။	၁၆	① ပက်ဖျန်းသည် (0) ② မပက်ဖျန်းပါ (16)	နမ်းပွံ့နမ်းထောင်ချိန်တွင်ပိုးသတ်ဆေး မပက်ဖျန်းသည့် အကြောင်းအား အားလုံးနားလည်ပြီး DOA၏ ညွှန်ကြားချက်တိုင်းလုပ်ဆောင်
မေး ၄ : နမ်းဗိုင်းရောဂါအကြောင်း သိပါသလား? မည်သို့ ကာကွယ်နှိမ်နင်းရမည့် နည်း လဲ သိပါသလား?	၁၆	① သိသည်။(၁၆)အဆီဖိတ်၊ကလိုရိုမီသရင်းစသည့်ဆေးများ သုံးရမည်ကိုသိသူ (10)၊ မျိုးပြောင်းစိုက်သူ(၁) သေချာမသိသူ (5) ② လုံးဝမသိသူ (0)	နမ်းဗိုင်းရောဂါကို သေချာသိသော်လဲရောဂါသယ်လာသည့်နမ်းဖြုတ်ညိုအကြောင်းအားသေချာမသိသူများ။မျိုးပြောင်းစိုက်သည်ဟုပြောသူလဲရှိ

29

မေး ၁ :နမ်းပွံ့ချိန်နှင့် နမ်းထောင်ချိန်တွင် မည်သည့်ပိုးများကို တွေ့မြင်ခဲ့သနည်း?
ဖြေ ၁ :Bugs(62.5%)、မတွေ့ပါ(37.5%)・・・Bugsအကြောင်းကိုတော့ သိပါတယ်။

မေး ၂ :နမ်းပွံ့ နမ်းထောင်ချိန်တွင် မည်သို့သောအချက်ကြောင့် ထိခိုက်ပျက်ဆီးစေပါသနည်း?
ဖြေ ၂ :ပျက်ဆီးမှုမရှိပါ(81.3%)、အရွက်များ ပျက်ဆီးခြင်း(12.5%)、မရေရာပါ(6.2%)・・・Bugsကြောင့် ပျက်ဆီး(ထွက်နှုန်းနဲခြင်းနှင့် အရည်အသွေးကျခြင်း ဟူသော အကြောင်းအား သေချာစွာ သိရှိခြင်း မရှိပါ)

မေး ၃ :နမ်းပွံ့ နမ်းထောင်ရာတွင် ပိုးသတ်ဆေး ဖျန်းပါသလား?မည်သည့်ဆေးဖြစ်သနည်း?
ဖြေ ၃ :မပက်ဖျန်းပါ(100%)・・・DOA၏ လမ်းညွှန်မှုအား ကောင်းစွာ နားလည်ကျင့်သုံး

30

ေမး ၄ : နှမ်းဗိုရောဂါအကြောင်းသိရှိပါသလား?ရောဂါဖြစ်ပါက မည်သို့ကာကွယ်သနည်း?

ဖြေ ၄ : နားလည်သိရှိ (100%) ၊ ပိုးသတ်ဆေးဖြင့် ကာကွယ်နိုင်မှန်း (Acephate၊ Chlorpyrifos၊ Cypermethrin)
ပက်ဖျန်း (62.5%) ၊ မပြည့်စုံ (31.3%) ၊ မျိုးစေ့ပြောင်းသုံး (6.2%)

…ပိုးသတ်ဆေးသုံးနည်း သိသော်လဲ သေချာစွာ နားမလည်သူများလဲ ရှိပါသည်။ တပြိုင်ထဲမှာပဲ ဘာ့ကြောင့် ထိုရောဂါ ဖြစ်သည်ကို သေချာမသိသူများလဲ ရှိပါသည်။

…အမှန် ထိုရောဂါကြောင့် ဆိုးဝါးစွာ ဖျက်ဆီးခြင်းခံရသောကြောင့် Sesame Jassid နှမ်းဖြူတ်ညို အကြောင်းနှင့် ကာကွယ်နိုင်မှန်းနည်းများအား ခုထက်ပို၍ အသိပညာပေးရန် လိုအပ်ပေသည်။

31

၅။ နှမ်းပုံခြင်းနှင့် ပိုးမွှားပြဿနာ - နှမ်းထောင်ခြင်း(အနှစ်ချုပ်)

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- နှမ်းပုံခြင်းနှင့်နှမ်းထောင်ခြင်းတွင်ဖျက်ပိုးအမျိုးမျိုးတွေ့ရှိရပါသည်။ အများစုမှာ ရိတ်သိမ်းချိန်ကတည်းကအတူပါလာကြခြင်းဖြစ်ပါသည်။ သို့သော် နှမ်းစေ့စုပ်ဂျိုးကတော့နှမ်းပုံထားချိန်နှင့်ထောင်ထားချိန်တွင်ရောက်ရှိလာပြီးထပ်မံဖျက်ဆီးသော ဖျက်ပိုးပင် ဖြစ်ပေသည်။

- နှမ်းပုံခြင်းကြောင့်နှမ်းအရည်အသွေးကျဆင်းခြင်း(Acid Value Rising, JAICAF ၂၀၁၈ခုနှစ်သုသေတနအဖြေအားကိုကား) ဖြစ်ပေါ်စေပါသည်။ အကြောင်းမှာမြင်သာသောရှုပ်ပိုင်းဆိုင်ရာ အကြောင်းအရင်းများဖြစ်သော(ရေဓာတ်ပါဝင်မှု၊ အပူချိန်) စသည်တို့ကြောင့်ဖြစ်ပါသည်။

- တစ်ဖန် ဇီဝဗေဒဆိုင်ရာအကြောင်းအရင်းဖြစ်သော(Sesame seed bug)ကြောင့်နှမ်းအရည်အသွေးကျဆင်းခြင်း(acid value မြင့်တက်ခြင်း) နှင့်ထွက်နှုန်းကျဆင်းခြင်း(နှမ်းစေ့မအောင်ခြင်းများ) ဖြစ်ပေါ်စေပါသည်။

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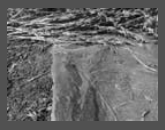
- နှမ်းပုံထောင်ခြင်းစနစ်ဖြင့်အခြောက်ခံရန်အကြိုပြုထားပါသည်။သို့သော်နှမ်းထောင်အခြောက်ခံခြင်းပြုလုပ်ရာတွင် Sesame seed bug မှာကျရောက်မှုများသောကြောင့်ရာနှုန်းပြည့်ကောင်းမွန်သည်ဟုတော့ပြောလို့မရပါ။နှမ်းထောင်စနစ်ဖြင့်အခြောက်ခံမည်ဆိုလျှင်ကြိတင်ကာကွယ်ဆောင်ရွက်မှုများလည်းလိုအပ်မည်ဖြစ်သော်လည်းဓာတ်ကြွင်းကျန်ရှိမှုအတွက်လည်းထည့်စဉ်းစားရမည်ဖြစ်သည့်အတွက်ပိုးသတ်ဆေးဖြန်းခြင်းလည်းပြုလုပ်လို့မရပါ။

- နှမ်းပုံထားခြင်းနှင့်နှမ်းထောင်ခြင်းအားအကာအကွယ်ဇကာပိုက်ခွန်ဖြင့်ဖုံးအုပ်ခြင်းသည်လည်းထိရောက်မှုရှိပါသည်။ သို့သော်အရည် **9.0±0.5mm**, အကျယ် **3.3±0.3mm** ဖြင့်ဆိုလျှင်ဇကာပိုက်အရွယ်အစားမှာသေးငယ်ပါသည်။ ဇကာပေါက်စိပ်သော **1~2mm**) အရွယ်အစားဖြင့်ပြုလုပ်ရန် လိုအပ်ပါသည်။ လက်တွေ့စမ်းသပ်မှုလည်းပြုလုပ်ကြည့်ရပါမည်။



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- မည်သို့ပင်ဖြစ်စေ၊ နှမ်းအခြောက်ခံစနစ်အားပြင်ဆင်ရန်လိုအပ်ပါသည်။ ဦးစားပေးစီမံချက်အနေဖြင့် DOA မှအကြံပြုဆောင်လျက်ရှိသည့်အတိုင်းရိတ်သိမ်းပြီးပြီးချင်းချက်ချင်းနှမ်းထောင်စနစ်ဖြင့်အခြောက်ခံခြင်းအားပြုလုပ်စေလိုပါသည်။

- သို့သော်ယခုတစ်လောပိုင်းတွင်မိုးများသောကြောင့်နှမ်းထောင်အခြောက်ခံခြင်းဖြင့်ပြုလုပ်သော်လည်း အလွယ်တကူမခြောက်သည့်အခါမျိုးလည်းရှိပါသည်။ Sesame seed bugကြောင့်ဖြစ်ပေါ်သောနှမ်းအရည်အသွေးကျဆင်းခြင်းနှင့်နှမ်းထွက်နှုန်းကျဆင်းခြင်းများအတွက်စိုးရိမ်ရပါသည်။

နှမ်းအခြောက်ခံစနစ်အားပြုပြင်ပြောင်းလဲကြပါစို့!

မြန်မာ့နှမ်းအားနှမ်းအရည်အသွေးလျော့ကျစေခြင်း(acid value rising) နှင့်နှမ်းထွက်နှုန်းလျော့ကျစေခြင်း(နှမ်းစေ့မအောင်ခြင်း) အကြောင်းအရင်းများအားအတွင်းကျကျအသေးစိတ်ရှာဖွေလေ့လာကြပါ။

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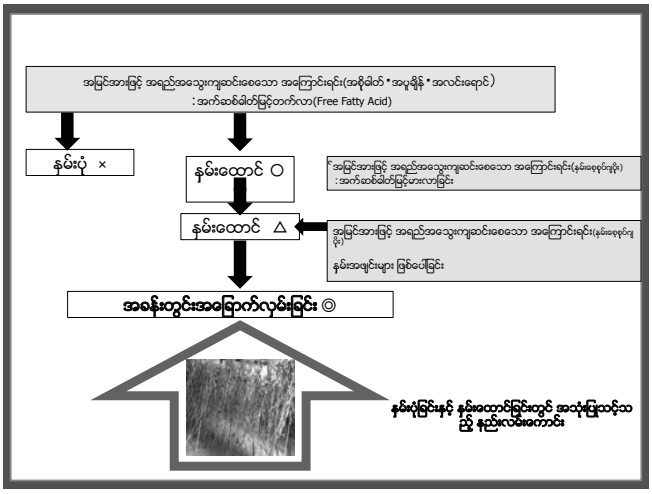

ပိုးသတ်ဆေးနှင့် ပတ်သက်သည့် နောက်ဆက်တွဲ အချက်အလက်များ

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DOA Plant Protection mobile applicationနှင့် ပတ်သက်၍ နှိမ်းတွက် သင့်တော်မည့် ပိုးသတ်ဆေးများ (၂၀၁၈ ခုနှစ်)

ပိုးသတ်ဆေးအမည်များ	Appသုံး ပါဝင်သောအဓိကနှိမ်နင်းသည့်ပိုးမွှား	လက္ခဏာ
Acephate	Jassids 、 Bugs 、 Sesame leafroller 、 Sphinx moths 、 Hairy caterpillars 、 Cotton bollworm etc.	※ Organochlorine insecticide、浸透性殺虫剤 ※ဖျန်းတွင်းဆေးကုန်ဆေးသည့်ပိုးမွှား (အဓိကဖောက်စားသူဆေးသည့်) : Aphids 、 Lepidopteran larvae, etc. (オルトラン)
Chlorpyrifos	Scarabs 、 Sphinx moths 、 Hairy caterpillars 、 Cotton bollworm etc.	※ Organophosphorus insecticide ※ဖျန်းတွင်းဆေးကုန်ဆေးသည့်ပိုးမွှား (အဓိကဖောက်စားသူဆေးသည့်) : Aphids 、 Lepidopteran larvae, etc. (ダーズバン)
Cypermethrin	Scarabs 、 Sphinx moths 、 Hairy caterpillars 、 Cotton bollworm etc.	※ (Synthesis pyrethroid insecticide) ※ဖျန်းတွင်းဆေးကုန်ဆေးသည့်ပိုးမွှား (အဓိကဖောက်စားသူဆေးသည့်) : Aphids 、 Bugs 、 Lepidopteran larvae, etc. (アグロスリン)
Dimethoate	Jassids 、 Bugs 、 Sesame leafroller 、 Cotton bollworm etc.	※ Organophosphorus insecticide、浸透性殺虫剤 ※ဖျန်းတွင်းဆေးကုန်ဆေးသည့်ပိုးမွှား (အဓိကဖောက်စားသူဆေးသည့်) : Aphida 、 Jassids 、 Scales, etc. (ジメトエート)
Fenitrothion	Sphinx moths	※ Organophosphorus insecticide、日本で開発 ※ဖျန်းတွင်းဆေးကုန်ဆေးသည့်ပိုးမွှား (အဓိကဖောက်စားသူဆေးသည့်) : Aphids 、 Bugs 、 Scarabs 、 Lepidopteran larvae, etc. (スミチオン)
Lambda-Cyhalothrin	Scarabs	※ Synthesis pyrethroid insecticide、日本ではシハロトリン ※ဖျန်းတွင်းဆေးကုန်ဆေးသည့်ပိုးမွှား (အဓိကဖောက်စားသူဆေးသည့်) : Aphids 、 Lepidopteran larvae, etc. (サイハロン)
Thiamethoxam	Jassids、Bugs	※ Neonicotinoid insecticide、浸透性殺虫剤 ※ဖျန်းတွင်းဆေးကုန်ဆေးသည့်ပိုးမွှား (အဓိကဖောက်စားသူဆေးသည့်) : Aphids 、 Jassids 、 Bugs 、 Whiteflies 、 Scarabs, etc. (アクタラ)

Plant Protection Mobile Application (2018ခုနှစ်8လ ဧပြီလဗားရှင်း) 、DOA, မြန်မာ နှင့် ကျယ်ပရိုသီးနှံကာကွယ်ရေးအသင်း (၂၀၁၆) မှ ထုတ်ဝေသောအချက်များ

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စျေးကွက်တွင်း ရောင်းချသော နှိမ်းပိုးသတ်ဆေးများ





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ကျေးဇူးတင်ရှိပါကြောင်း

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၁။ မြန်မာ့စိုက်ပျိုးရေး မွေးမြူရေးနှင့် ဆည်မြောင်းဝန်ကြီးဌာန
(၁) DOA, ရုံးချုပ်
(၂) DOA, မကွေးရုံး
(၃) DOA, အောင်လံမြို့နယ်ရုံး
(၄) DAR, ရုံးချုပ်
(၅) DAR, မကွေး ဆီထွက်သီးနှံသုတေသနစင်တာ

၂။ အောင်လံမြို့နယ် တောင်သူများနှင့် ပိုးသတ်ဆေးအရောင်းဆိုင်

၃။ JICA PROFIA

၄။ ITC

ယခုနေ့ ဆွေးနွေးပွဲအား ကျွန်ုပ်တို့စိုက်ပျိုးရေး သစ်တောနှင့် ဧရယိုင်းဝန်ကြီးဌာန MAFF, Japan နှင့် အပြည်ပြည်ဆိုင်ရာ လယ်ယာစိုက်ပျိုးရေးနှင့် သစ်တောရေးရာ အဖွဲ့အစည်းJAICAF တို့မှ ပူးပေါင်းဆောင်ရွက်သည်။

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ကျေးဇူးအထူးတင်ရှိပါသည်။

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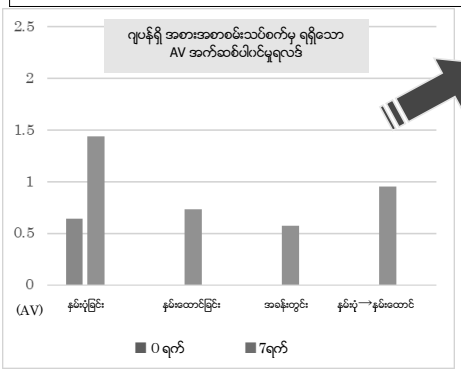
【ဂျပန်ဈေးကွက်】 2018နှစ်3လ

စိတ်ချစွာ စားဖို့ဆို ဘာတွေလိုလဲ?

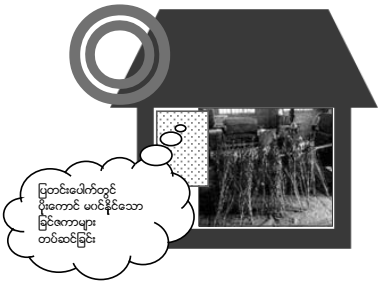
- **အက်ဆစ်ပါဂင်မှုနှုန်း=AV2အောက် ရှိရမယ်**
- **မို့ (အာဇလာတော်ဆင်) ရှိမနေရဘူး**
- **ပိုးသတ်ဆေးကိုလဲ သတ်မှတ်ထားသည်ထက် ဇလျှံနဲ့ရမယ်နော်**

နှမ်းရှိအက်ဆစ်ပါဂင်မှု (AV)

- AVမြင့်ရင် ➡အရသာမရှိ、အနံ့မကောင်း、ကျန်းမာရေးထိခိုက်နိုင်
- မြန်မာ မှ ဂျပန်အထိ ခရီးသည် ရှည်လျားလွန်းသည်။
- ခရီးစဉ်အတွင်း အက်ဆစ်ဓာတ် မြင့်မားလာနိုင်သည်။
- မိမိတို့ ဒေသမှ တင်ပို့မှိန်တွင် အက်ဆစ်ပါဂင်မှုAV ;
  2 အောက် (3 ～ဆို မကောင်းပါ)
- အဓိကမှာအက်ဆစ်ပါဂင်မှု နဲ့လေ ကောင်းလေ။
- AVအက်ဆစ်မမြင့်စေရန်、
  စိုထိုင်းမှု၊အပူချိန်၊အလင်းရောင်များရှောင်ရှားခြင်းပင်ဖြစ်သည်။



အခြောက်ခံနည်းလမ်းနှင့်
အက်ဆစ်ဓာတ်သက်ရောက်မှုများ



အခြောက်ခံရာ၌ ပိုး နှင့် ပိုးမွှားများကြောင့်
အက်ဆစ်မြင့်နိုင်သောကြောင့်

နောင်အနာဂတ်တွင်
အခန်းတွင်းအခြောက်ခံခြင်းနည်းဆုံးစေလို

ဆုံးရှုံးမှုနည်းရန်၊အစိုဓာတ်ထိန်းရန်၊ပိုးမွှားရန်
ကာကွယ်ရန်တွက် အခန်းတွင်းအခြောက်ခံခြင်းအား
စမ်းသပ်လုပ်ဆောင်စေလိုသည်။

နှမ်းပုံပြီး(၈)ရက်မြောက်နေ့မှာ မို့ များဖြစ်လာ

နှမ်းသီးတောင့်များပေါ်တွင် မှိုများအားသေချာ မမြင်ရသော်လဲ
အနံ့မကောင်း အရသာမရှိ ဖြစ်တတ်သည်။

မို့ဆိပ် တမျိုးဖြစ်သော အာဇလာတော်ဆင်ကြောင့်、ကျန်းမာရေးကို
ထိုးနှောက်စွက်ဖိုက်စေပါသည်။

「အရသာရှိတယ်」 ဆိုတာ ဘယ်လိုမျိုးလဲ...

ဂျပန်ဘက်မှ နှမ်းစပါးပွဲမှိန်တွင် အဓိကကြည့်သည့်အချက်များ

အကြောင်းအရာ	သတ်မှတ်ချက်များ
အရောင်	အရောင်၊အရောင်မညီညာခြင်း၊ အရောအနှောများ
အရွယ်	အရွယ်မညီညာခြင်း၊ အဖျင်းပါဂင်မှု၊ နှမ်းစေ့တထောင်အလေးချိန်
အနံ့အရသာ	သတ်မှတ်ချက် ၁၃ ချက် + အားလုံးခြုံရုံစစ်ဆေးခြင်း

★အနံ့အရသာစုစုပေါင်းရမှတ်(၆)မှတ်ကျော်ရင်အဆင်ပြေသည်။

2018နှစ်3လ

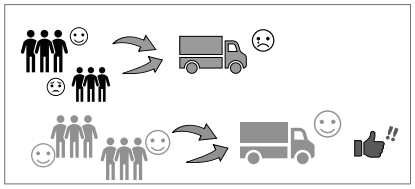
နှမ်းနက် နဲ့ ဆက်သွယ်
မြန်မာ မှ ဂျပန်ကွယ်

ကျန်းမာသန့်ရှင်း ရောဂါကင်းစင် အရသာမြိန်သောနှမ်းနက်ဖြင့်
မြန်မာမှ ဂျပန် ရောက်ရှိပို့ဆောင်ကြပါစို့

နှမ်းအကောင်းနှင့် မကောင်းတာများရောနှောသိုလှောင်မိပါက
နှမ်းအားလုံးရောနှော၍ ပျက်ဆီးစေနိုင်သည်။
အရည်အသွေးကောင်းသောနှမ်းများကိုတောင်သူမှကြိုစားထားသော်လဲ
ကုန်သည်များမှဆက်လက်မထိန်းသိမ်းနိုင်လျှင်လဲပျက်ဆီးစေနိုင်ပါသည်။

⬇

တောင်သူ၊ပိုးသတ်ဆေးဆိုင်ငံကုန်သည်များနှင့်နှမ်းလောက
လာကသားများအားလုံးတက်ညီလက်ညီပူးပေါင်းမှသည်အ
သည်အလွန်အရေးကြီးလှသည်။



ဘယ်လိုလူတွေ ဘယ်နေရာတွေဆီသို့
လူကြီးမင်းတို့ရဲ့နှမ်းများအရောက်ပို့ချင်ပါသလဲ?

JAICAF ジェイカフ

ယခုစာစောင်အားဂျပန်အပြည်ပြည်ဆိုင်ရာလယ်ယာစိုက်ပျိုးရေးနှင့်သစ်တောရေးရာအခွံအစည်းမှ
အစည်းမှုဖြစ်ရေးသားသည်။

လူကြီးမင်းတို့ရဲ့ အရသာရှိလှတဲ့နှမ်းများကို
ကမ္ဘာကြီးထဲမှစောင့်မျှော်နေသူတွေရှိနေပါတယ်။

～အက်ဆစ်ပါဂင်မှုနှင့်ဈေးကွက်တောင်းဆိုမှု～

အစားအစာ(စီးပွားဖြစ်သီးနှံ)တွင်အဓိကကျသောအရာ

- စိတ်ချယုံကြည်စွာစားလို့ခြင်း=ယုံကြည်စိတ်ချမှု
- စားသုံးသူများက"စားချင်လိုက်တာ"လို့ဖြစ်စေတဲ့အရာ
  =\"အရသာရှိမှု"

နှမ်းအားသတ်မှတ်ထားသည့်စံနှုန်းများသည်
ဈေးကွက်ပေါ်မူတည်၍ပြောင်းလဲမှုများ
ရှိတတ်သည်။

လူကြီးမင်းတို့နှမ်းဈေးကွက်က
ဘယ်နေရာမှာပါလဲ?

နောက်ဆုံးရဈေးကွက်သတင်းများလဲစုဆောင်းကြပါဦို့!!

မြန်မာနိုင်ငံ၏ နှမ်းပုံချိန် နှမ်းထောင်ချိန်ရှိ ပိုးမွှားများ

၂၀၁၉ နှစ် ဇန်နဝါရီလ JAICAF

အကြောင်းအရာ

၁။ နိဒါန်း

- မြန်မာနိုင်ငံတွင် နှမ်းရိတ်သိမ်းပြီးနောက် နှမ်းပုံခြင်း နှမ်းထောင်ခြင်း ဖြင့် အခြောက်ခံလေ့ရှိကြသည်။
- နှမ်းပုံချိန် နှင့် နှမ်းထောင်ချိန်တွင် ပိုးမွှားများကျရောက်လေ့ ရှိသော ကြောင့် အထွက်နှုန်းလျော့နဲစေသည်။ ပိုးမွှားအန္တရာယ် ကာကွယ် ရန် နည်းလမ်းများ ရှာဖွေရန် လိုအပ်လှပေသည်။

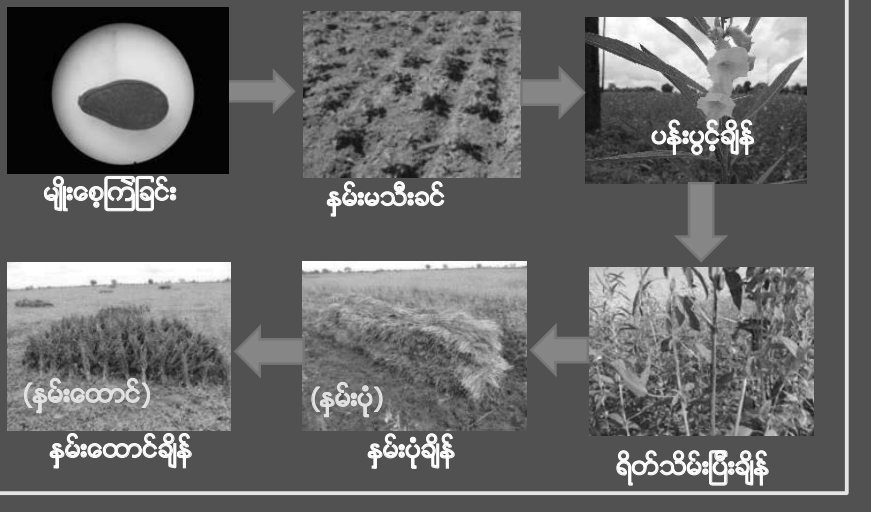
ယခုရေးသားသော လက်စွဲစာအုပ်သည် တောင်သူများနှင့် ကွင်းဆင်းဝန်ထမ်းများအတွက် ရည်ရွယ်ပါသည်။

၂။ ပိုးမွှား နှင့် ပျက်ဆီးမှု စမ်းသပ်လေ့လာနည်းများ

စမ်းသပ်မှုနည်းလမ်းများ

စမ်းသပ်မှုအမည်	စမ်းသပ်မှုနည်းလမ်း
ပိုးမွှားစစ်တမ်း	
(၁) အမြင်ဖြင့်သုံးသပ်နည်း	◎**နှမ်းပုံ နှမ်းထောင်ချိန် ကျရောက်သော ပိုးမွှားအား အမြင်ဖြင့် သုံးသပ်ခြင်း။** 
(၂) ဖမ်းတံဖြင့်ကြည့်နည်း	◎ နှမ်းခင်းများထဲ ဖမ်းတံ (အချင်း ၃၆cm) ဖြင့် အကြိမ်၄၀ ဝှေ့ရမ်းဖမ်းခြင်း။ 
(၃) အဝါရောင်ကဒ်ဖြင့်ဖမ်းနည်း	◎**အဝါရောင်ကဒ် (20cm×10cm) ဖြင့် ၃ကဒ် ချိတ်၍ ဖမ်းခြင်း** 
ပျက်ဆီးမှုစစ်တမ်း	◎နှမ်းပုံနှမ်းထောင်ချိန်တွင်နှမ်းရွက်နှင့် နှမ်းသီးများပျက်ဆီးမှု ရှိ မရှိ စစ်ခြင်း ◎မှန်ပြောင်းဖြင့် ကြည့်၍ (နှမ်းဖျင်း)များအားစစ်ခြင်း

နှမ်းစိုက်ပျိုးခြင်းအဆင့်ဆင့်



၃။ နှမ်းပုံချိန် နှမ်းထောင်ချိန် ကြုံရသော ပိုးမွှားနှင့် ပျက်ဆီးမှု

နှမ်း၏ အဓိကကျသော ပိုးမွှားများနှင့် ပျက်ဆီးဆုံးရှုံးမှုများ

ပိုးမွှားများ	Aphids (Vector)	Leafhoppers (နှမ်းဖြတ်ညို့)	Bugs (နှမ်းစေ့စုပ်ကျိုး)	Scarabs (နှမ်းကျိုင်းနက်)	Pyralid moths (နှမ်းရွက်လိပ်ပိုး)	Sphinx moths (နှမ်းဗလဲ)	Tiger moths (ရွက်စုံစားသူတါ)	Owlet moths (နှမ်းသီးလုံးဖောက်ပိုး)	Termites(ခြင်္ကျား)
နှမ်းပုံ · နှမ်းထောင်ချိန်			ရိတ်သိမ်းပြီး						
(၁) ပိုးမွှား	○	○	●	○	×	○	○	○	○
(၂)ပျက်ဆီးမှု	×	×	●	×	×	×	○	×	×
မစိုက်ခင်မှ စိုက်ပြီး		စိုက်ပျိုးစဉ်							
(၁) ပိုးမွှား	○	●	○	○	○	○	○	○	○
(၂) ပျက်ဆီးမှု	○	●	○	○	○	○	○	○	○

သတိ : ပိုးမွှားနှင့် ပျက်ဆီးမှုဖြစ်ပွားမှုအဖြေအနေ : ×=သိပ်မဖြစ်、○=ဖြစ်ပွား、●=အများကြီးဖြစ်ပွား

၂။ အထူးသတိပြုရန်မှာ နှမ်းဖြတ်ညို့ နှင့် နှမ်းစေ့စုပ်ကျိုး တို့ပင်ဖြစ်သည်
အထွက်နှုန်းလျော့၍ အရည်အသွေး ကျဆင်းစေသောကြောင့် ဖြစ်သည်။

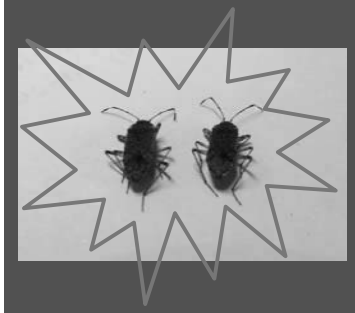
၃။ ပျ၊ ခြ၊ ကြွက်များ၏ အန္တရာယ်လဲ ရှိတတ်ပေသည်။

- နှမ်းပုံ နှမ်းထောင်ချိန်တွင် ကျရောက်သော ပိုးမွှားများစွာရှိသည်။ သို့သော် စိုက်ပျိုးစဉ် ကျရောက်လေ့ရှိသော ဖျက်ပိုးများရှိသော်လဲ ရိတ်သိမ်းပြီးချိန်အထိ ကျရောက်သော ဖျက်ပိုးမှာ နံပါးလှသည်။
- အမှန်မှာ နှမ်းစေ့စုပ်ကျိုးကဲ့သို့သော ဖျက်ပိုးများသည် နှမ်းသီးချိန်မှ ရိတ်သိမ်းချေလှေ့ချိန်ထိ ကျရောက်ဖျက်ဆီးတတ်သည်။

နှမ်းပုံချိန် နှမ်းထောင်ချိန်တွင်
နှမ်းစေ့စုပ်ကျိုးကြောင့် ပျက်ဆီးမှုပိုများနိုင် !

ကျိုးများ (နှမ်းစေ့စုပ်ကျိုး)

နှမ်းစေ့စုပ်ကျိုး
Elasmolomus sordidus
Lygaeoidea



အထူးသဖြင့်အန္တရာယ်ပေးသောဖျက်ပိုး
နှမ်းစေ့စုပ်ကျိုး
အဖြစ်များ !

ဘာ့ကြောင့်အန္တရာယ်များလဲ ?
「အရည်အသွေးကျစေပြီး ထွက်နှုန်းလျော့စေလို့」

အထွက်နှုန်းလျော့ခြင်း (နှမ်းဖျင်းများကြောင့်)

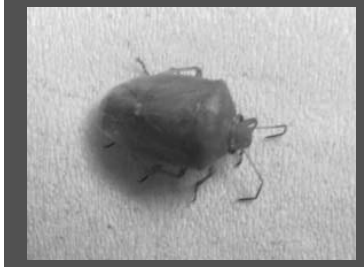
အရည်အသွေးကျဆင်းခြင်း (အက်ဆစ်မာတ်မြင့်မားခြင်း)

နှမ်းစေ့စုပ်ကျိုး စုပ်စားသောကြောင့်
အက်ဆစ်မာတ် ပိုမိုမြင့်မားလာ
(အက်ဆစ်မာတ်မြင့်မားခြင်း)

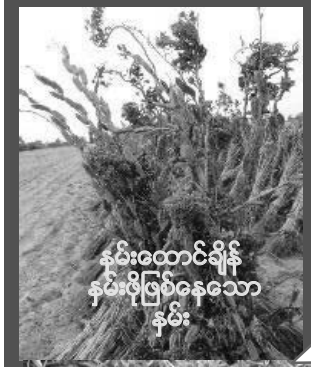
နှမ်းစေ့စုပ်ကျိုး၏ မိတ်ဆွေပိုး

* နှမ်းပုံ နှမ်းထောင်ချိန်တွင် ထိုကဲ့သို့သော မိတ်ဆွေပိုးများကြောင့်လဲ ပျက်ဆီးစေနိုင်
(အရှည်- 9.0±0.5mm ရင်အကျယ်- 3.3±0.3mm ကဲ့သို့သော ပိုးများလဲရှိ)။

အမျိုးမျိုးသော ပိုးမွှားများ



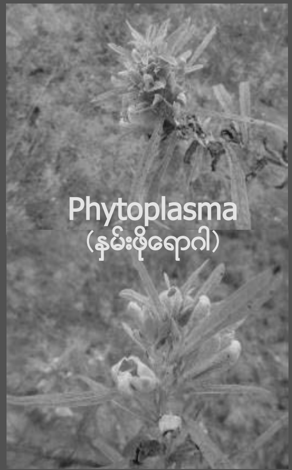
* နှမ်းစိုက်ချိန်တွင် ထိုကဲ့သို့သော ပိုးမွှားများစွာ တွေ့နိုင်သည်။
နှမ်းပုံ နှမ်းထောင်ချိန်တွင် ထိုပိုးမွှားများအား များစွာ မတွေ့ရှိနိုင်ပေ။



Leafhoppers (Jassid) နှမ်းဖြူတ်ညို နှင့်
Phytoplasma နှမ်းဖိုရောဂါ

စိုက်ပျိုးချိန်
ဖြစ်ပွားနေသော
နှမ်းဖို

* Sesame jassid (*Orosius albicinctus*) နှမ်းဖြူတ်ညိုသည် တခုတည်းသော ကူးစက်ရောဂါ သယ်ဆောင်လာသော ပိုးမွှားဖြစ်ပြီး မြန်မာနိုင်ငံတွင် မြောက်မြားစွာ ထိုရောဂါကျရောက်နေသည်ကို တွေ့ရသည်။



* ကိုင်းကူးနည်းဖြင့် ရောဂါကူးစက်ကာ ရောဂါဖြစ်နေသောကိုင်းတွင် နှမ်းစေ့မအောင်ပေ။ နှမ်းပုံ နှမ်းထောင်ချိန်တွင် ရောဂါဖြစ်ပွားမှု မများနိုင်။

ပျပိုး နှင့် ဗိုင်းရပ်စ်ရောဂါ

* ပျပိုးသည်လဲ စိုက်ပျိုးစဉ် ရောဂါသယ်ဆောင်၍ ရောဂါကူးစက်ကာ ရောဂါဖြစ်နေသောကိုင်းတွင် နှမ်းစေ့မအောင်ပေ။ နှမ်းပုံ နှမ်းထောင်ချိန်တွင် ရောဂါဖြစ်ပွားမှု မများနိုင်။

ရောဂါဖြစ်နေသော
(လက္ခဏာထင်ရှားမှုမရှိ)

Scarabs
(နှမ်းကျိုင်းနက်)

* ပိုးလောင်းကောင်များသည် နှမ်းပင်အမြစ်ကိုစားသည်။ နှမ်းပုံ နှမ်းထောင်ချိန်တွင် ထိုအကောင်များ မဖျက်ဆီးပါ။

Sphinx moths
(နှမ်းဖလံများ)

* စိုက်ပျိုးစဉ် ပိုးလောက်ကောင်များသည် အရွက်များကို ကိုက်ဖြတ်သည်။ နှမ်းပုံ နှမ်းထောင်ချိန်တွင် ထိုအကောင်များ မဖျက်ဆီးပါ။

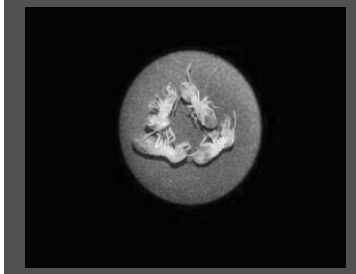
Tiger moths
(ရွက်စုံစားခုဝါ)

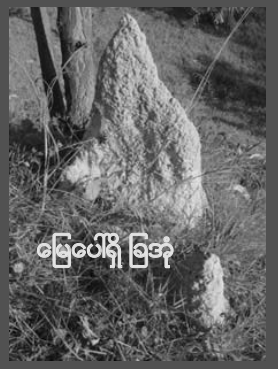
အခြား ရွက်စုံစားခုဝါများ

သီးတောင့်များပျက်ဆီးခြင်း

* စိုက်ပျိုးရိုန်တွင် ပိုးလောက်ကောင်သည် အရွက်နှင့် နှမ်းသီးတောင့်များကို ဖျက်ဆီး။
နှမ်းပုံ နှမ်းထောင်ရိုန်တွင်လဲ သီးတောင့်ကို ဆက်လက် ဖျက်ဆီးနိုင်သည်။

Termites
(ခြများ)





မြေပေါ်ရှိ ခြအုံ

ပင်စည်ပေါ်ရှိ ခြအုံ

* စိုက်ပျိုးပြီးနောက် မြေပေါ်ရှိ အပင်များ ပင်စည်၏ အတွင်းပိုင်းကို ဖျက်ဆီးသည်။
နှမ်းပုံ နှမ်းထောင်ရိုန်တွင် ထိုအကောင်များ မဖျက်ဆီးပါ။

အခြား

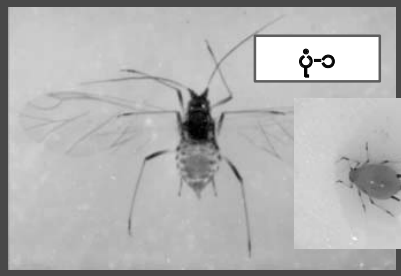
* နှမ်းပုံ နှမ်းထောင်ရိုန်တွင် Cotton bollworm နှမ်းသီးလုံးဖောက်ပိုး၏
မိတ်ဆွေပိုးများဖြစ်သော Mealybugs၊ Flatid planthoppers၊ Ratsကြွက်များ၏
ဖျက်ဆီးမှုများလဲ ရှိပေသည်။ သို့သော် အတိအကျကြီး မဟုတ်ပါ။

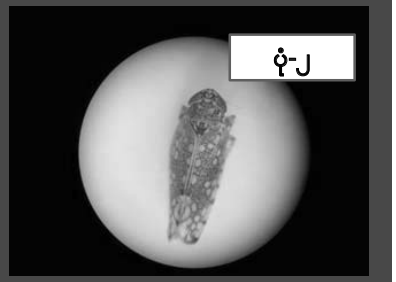
၄။ ပိုးမွှားများ ခွဲခြားနည်း

နှမ်းတွင်တွေ့ရသော ပိုးမွှားများ ခွဲခြားနည်း(၁)

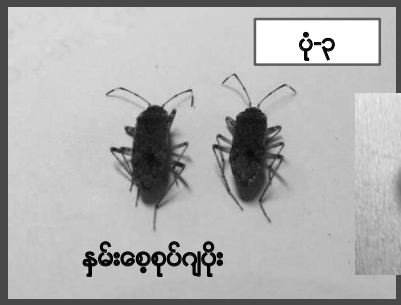
ပိုးမွှားအမည်	လက္ခဏာ	ပုံအမှတ်
Aphids (ပျဉ်ပိုး)	• သေးလွန်း၍ တွေ့ရန်ခက်ခဲ • တောင်ပံရှိသောပိုး နှင့် တောင်ပံမရှိသောပိုး • ဝမ်းပိုက်တွင် အခုံးပုံ ဖြန်လေးနှစ်ခုပါ	ပုံ-၁
Leafhoppers (နှမ်းဖြုတ်ညို)	• သေးလွန်း၍ တွေ့ရန်ခက်ခဲ • မီးခိုးဖျော့ရောင်ရှိပြီး သေးငယ်သောအစက်များရှိ	ပုံ-၂
Bugs (နှမ်းစေ့စုပ်ကျိုး)	• အကောင်အသေးမှ အကြီးအထိရှိ • အရွယ်သေးပြီး အခဲရောင်ရှိသဖြင့် တွေ့ရန်ခက်ခဲ	ပုံ-၃

ပုံအမှတ် (ပုံ ၁~၃)


ပုံ-၁


ပုံ-၂

နှမ်းဖြုတ်ညို


ပုံ-၃

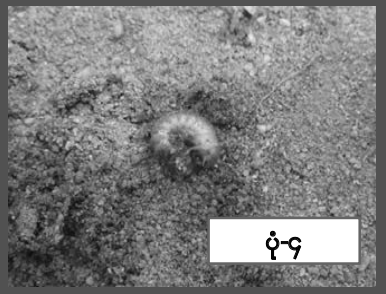
နှမ်းစေ့စုပ်ကျိုး


အခြား ပိုးများ

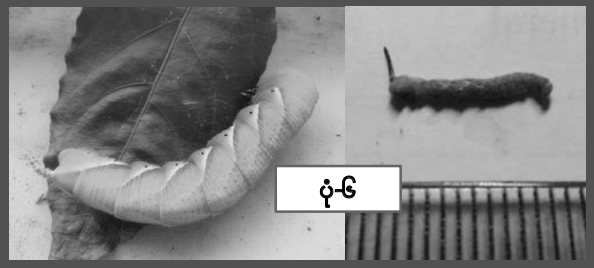
နှမ်းတွင်တွေ့ရသော ပိုးမွှားများ ခွဲခြားနည်း(၂)

ပိုးမွှားအမည်	လက္ခဏာ	ပုံအမှတ်
Scarabs (နှမ်းကျိုင်းနက်)	• အကောင်ကြီးသောကြောင့် မြင်တွေ့ရန် လွယ်ကူ • ပိုးလောင်းကောင်မှာ ဖြူပြီး အရွယ်ရောက် အကောင်များမှာ အရောင်အမျိုးမျိုးရှိ	ပုံ-၄
Pyralid moths (နှမ်းရွက်လိပ်ပိုး)	• လောက်ကောင်သည် အပင်ထိပ်ရှိ အရွက်နုများကို စားသည်။	ပုံ-၅
Sphinx moths (နှမ်းဖလံ)	• ပိုးလောက်ကောင်မှအရွယ်ရောက်သည်အထိ အရွက်များကိုက်ဖြတ်ကာအကောင်ကြီး၍ မြင်သာသည်။ • ပိုးလောက်ကောင်ဘဝတွင်အမြီးပိုင်းတွင် ဦးချိုကဲ့သို့သော အချွန်လေးများပါသည်။	ပုံ-၆

ပုံအမှတ် (ပုံ ၄~၆)


ပုံ-၄

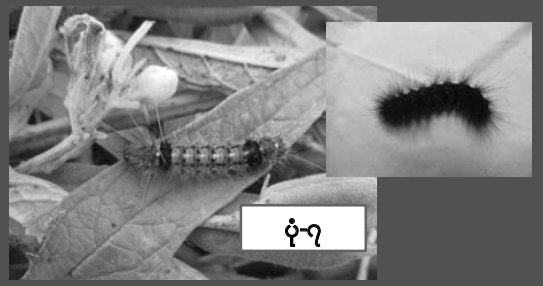

ပုံ-၅

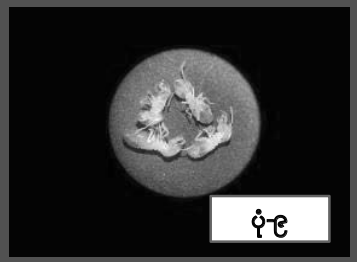

ပုံ-၆

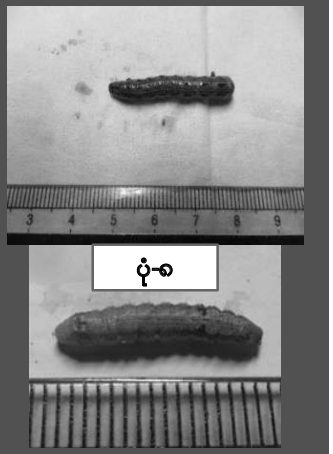
နှမ်းတွင်တွေ့ရသော ပိုးမွှားများ ခွဲခြားနည်း(၃)

ပိုးမွှားအမည်	လက္ခဏာ	ပုံအမှတ်
Tiger moths (ရွက်စုံစားခူဝါ)	• သားလောင်းသည် အညိုရောင်ရှိပြီး အမွေးရှည်များ ရှိသဖြင့် မြင်သာသည်။	ပုံ-၇
Owlet moths (နှမ်းသီးလုံးဖောက်ပိုး)	• Caterpillarလိုမျိုး ဖြစ်၍ပုံသဏ္ဌာန်အမျိုးမျိုးရှိ။ • အကောင်ကြီးပြီး တုတ်ခိုင်သော်လဲ ဓနုလည်တွင် တွေ့ရန်ခက်ခဲသည်။	ပုံ-၈
Termites (ခြမျှား)	• ပုရွက်ဆိတ်နှင့် အလွန်တူသည်။ • ဦးခေါင်းမှာ ညိုပြီး၊ ဝမ်းဗိုက် ဖြူသည်။	ပုံ-၉

ပုံအမှတ် (ပုံ ၇~၉)







၅။ ပိုးမွှားပြဿနာနှင့်နှမ်းပုံ·နှမ်းထောင်ခြင်း
=အနှစ်ချုပ်=

(၁) နှမ်းပုံ နှမ်းထောင်ချိန်တွင် တွေ့ရသော ဖျက်ပိုး

ဖျက်ပိုးအမျိုးမျိုးတွေ့ရသော်လဲ အများစုမှာ စိုက်ပျိုးပြီးနောက် တွေ့ပြီး ရိတ်သိမ်းချိန်ထိ ထိုဖျက်ပိုးများ ဆက်လက်ဖျက်ဆီးနေခြင်းပင် ဖြစ်သည်။

(၂) Sesame seed bug (နှမ်းစေ့စုပ်ဂျပိုး)

နှမ်းပုံ နှမ်းထောင်ချိန်တွင် ကူးလူးပျံသန်းပြီး ပိုးလောင်းကောင်မှ အကောင်ကြီးထိ နှမ်းစေ့များအား စုပ်စားဖျက်ဆီးသောကြောင့် အလွန် အန္တရာယ်ရှိသော ဖျက်ပိုးဖြစ်သည်။

ထိုဂျပိုး၏ စုပ်စားဖျက်ဆီးမှုကြောင့် နှမ်းအရည်အသွေးကျဆင်းခြင်း (အက်ဆစ် ဓာတ် မြင့်မားသောကြောင့်) နှင့် အထွက်နှုန်းလျော့ကျခြင်း (နှမ်းဖျင်းများကြောင့်) တို့ကို ဖြစ်ပေါ်စေသည်။

(၃) နှမ်းပုံခြင်းနှင့် နှမ်းထောင်ခြင်း

နှမ်းပုံရိုးရိုးတွင် အက်ဆစ်ဓါတ်မြင့်မားပါက နှမ်းအရည်အသွေးကျဆင်းခြင်း ရှုပ်ပိုင်းဆိုင်ရာ အကြောင်းရျက်များ (အစိုဓာတ် အပူရိန်) ကြောင့်လဲ ဖြစ်ပွားစေနိုင်သလို နှမ်းစေ့စုပ်ဂျိုးကြောင့်လဲ အရည်အသွေး ကျဆင်းစေနိုင်သည်။

နှမ်းထောင်ခြင်းဖြင့် အက်ဆစ်ဓာတ် မြင့်မားမှုအား လျော့ကျစေနိုင်သည်။

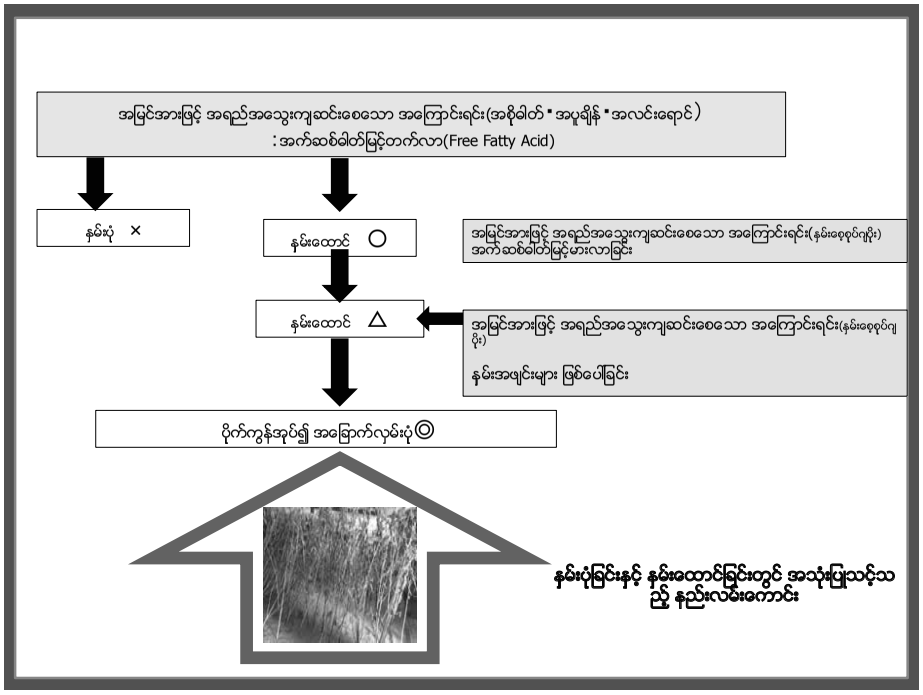
သို့သော်လဲ ဇီဝဖေဒ အရျက်များကြောင့် နှမ်းစေ့စုပ်ဂျိုး ရိခဲ့ပါက နှမ်းစေ့အား စုပ်စားဖျက်ဆီးသောကြောင့် ထိုဖျက်ပိုးအား အထူးသတိပြုရန် လိုအပ်ပေသည်။

(၄) ခြောက်သွေ့နည်းလမ်းအား ပြန်လည်ဆန်းစစ်ခြင်း

အခြောက်ခံသောနည်းများအား ပြန်လည်ဆန်းစစ်စေလိုသည်။ နှမ်းမပုံပဲ တန်းၭ နှမ်းထောင်စေလိုသည်။

သို့သော် ပိုးများပါက တန်းၭ နှမ်းထောင်မှုသည် မလွယ်ကူလှပေ။ အကယ်၍ နှမ်းစေ့စုပ်ဂျိုး ကျနေပါကလဲ အရည်အသွေး ကျဆင်းကာ အထွက်နှုန်း လျော့စေနိုင်ပေသည်။

အရည်အသွေး မြင့်မားသော မြန်မာ့နှမ်း အဖြစ်ဖြင့် တင်ပို့ရောင်းချမှုကို ရှေးရှု၍ အခြောက်ခံနည်း ⇒ အခန်းတွင်းအခြောက်လှန်းနည်း



နှမ်းပုံခြင်းနှင့် နှမ်းထောင်ခြင်းတွင် အသုံးပြုသင့်သည့် နည်းလမ်းကောင်း

၆။ နှမ်းစေ့စုပ်ဂျိုးအား စမ်းသပ်လေ့လာခြင်းနှင့် အကြံပြုခြင်း

=ကွင်းဝန်ထမ်းများအားလုံးသို့=

(၁)နှမ်းစေ့စုပ်ကျိုးအား လေ့လာခြင်း !

ဧန္ဒနှမ်း ပိုးနှမ်း ဆောင်းနှမ်း အသီးသီးအား နှမ်းပုံ နှမ်းထောင်ချိန်တွင် ကျရောက်လေ့ရှိသော နှမ်းစေ့စုပ်ကျိုးများအား နှိုင်းယှဉ်မှတ်သားထားစေလိုသည်။

(၂)နှမ်းဖျင်းများအား လေ့လာခြင်း !

ဧန္ဒနှမ်း ပိုးနှမ်း ဆောင်းနှမ်း အသီးသီးအား နှမ်းသီးအား ခြေ၍ ရုံးသို့ သယ်လာပြီး လေ့လာစေလိုသည်။ နှမ်းဖျင်းမည်မျှ ထွက်သည်ကို ရေတွက်၍ မှတ်တမ်းထားစေလိုသည်။(နှမ်းစေ့တထောင် စစ်တမ်း)

(၃)နှမ်းစေ့စုပ်ကျိုးအား ကာကွယ်နိမ်နင်းကြပါစို့ !

နှမ်းထောင်ပုံပေါ် ပိုက်အုပ်ခြင်းသည် ပိုးမွှားရန်ကို ထိရောက်စွာ ကာကွယ်နိုင်သည်။ အရှည် 9.0±0.5mm၊ ရင်အကျယ် 3.3±0.3mmအတွက်၊ ပိုက်အပေါက်အရွယ် (1~2mm)ဖြင့်ဖမ်းရန် လိုအပ်သည်။ တဖန် ပိုက်အုပ်ခြင်းဖြင့် အရည်အသွေးကျဆင်းခြင်း အထွက်နှုန်းလျော့ခြင်းများကိုလဲ လျော့နဲစေနိုင်သည်။

စမ်းသပ်မှုတခုအနေဖြင့် နှမ်းထောင်စဉ် ပိုက်အုပ်ထားသော ရလဒ်နှင့် ပိုက်မအုပ်ထားသော ရလဒ်များကို နှိုင်းယှဉ်၍ နှမ်းစေ့စုပ်ကျိုး၊ နှမ်းအဖျင်း၊ အက်ဆစ်တန်ဖိုး မည်မျှရှိသည်ကို နှိုင်းယှဉ်လေ့လာကာ အကျိုးသက်ရောက်မှုနှင့် မည်သည့် အခက်အခဲ ရှိသည်ကို တိကျစွာ စမ်းသပ်စေလိုသည်။

မြန်မာနိုင်ငံ၏

နှမ်းစိုက်ပျိုးခြင်းဖွံ့ဖြိုးတိုးတက်မှုဆီသို့ရည်ရွယ်၍

ယခု လက်စွဲစာအုပ်အား မြန်မာနိုင်ငံစိုက်ပျိုးရေး မွေးမြူရေးနှင့် ဆည်မြောင်းဝန်ကြီးဌာန လက်အောက်ရှိ စိုက်ပျိုးရေးဦးစီးဌာန (DOA) နှင့် စိုက်ပျိုးရေးသုတေသန ဦးစီးဌာန (DAR) များ၏ လမ်းညွှန်မှုဖြင့် ဂျပန်နိုင်ငံ စိုက်ပျိုးရေးသစ်တော နှင့် ရေလုပ်ငန်းဝန်ကြီးဌာနမှ (MAFF) အလုပ်အား ဂျပန်အပြည်ပြည်ဆိုင်ရာ လယ်ယာစိုက်ပျိုးရေးနှင့် သစ်တောရေးရာအဖွဲ့အစည်းမှ ပါဝင် ဆောင်ရွက်သည်။