Events
Dear Readers – Please note that the following events will be organized in 2017 and 2018. The details will be posted on the APNAN website or else.

1) The next International Workshop on basic EM Technology in 2017
The next international workshop on basic EM Technology is scheduled on September 18 to 21, 2017 at Saraburi Kyusei Nature Farming Center, Thailand. This will be a workshop with emphasis on EM Technology for all the field including EM related materials, animal husbandry, mushroom cultivation, environmental treatment, aquaculture etc.
http://www.apnan.org/Next_Workshop_Information.htm

2) The 7th International Workshop on Nature Farming in 2018
The next international workshop on Nature Farming is scheduled in March 2018 at Saraburi Kyusei Nature Farming Center, Thailand. This will be a workshop with emphasis on Nature Farming using EM Technology. The details will be announced later.

3) The 6th APNAN Meeting in 2018
The next APNAN Meeting is planned in 2018. The details will be announced once decided.

Saraburi Kyusei Nature Farming Center, Saraburi, Thailand

Please send your article regarding Nature Farming or EM Technology to APNAN
Email: apnanmail@yahoo.co.jp

APNAN NEWS is sponsored by INFRC
ASIA PACIFIC NATURAL AGRICULTURE NETWORK………

APNAN was first established in Thailand in 1989 with 13 member nations, and funded by International Nature Farming Research Center (INFRC), Matsumoto, Japan, through the generous support of Sekai Kyusei Kyo, Japan and Thailand. The mandate given at its inception was to elucidate the scientific basis and validity of Nature Farming and the technology of Effective Microorganisms (EM), which has been integrated into the concepts of Nature Farming.

From small beginnings, the network has moved on to facilitate research, information collection, EM production and technical advice to all interested in Nature Farming and training for people from all walks of life. The network helped organize major conferences on Kyusei Nature Farming in four continents and was instrumental in presenting the identity of Nature Farming at international forums such as the IFOAM conferences. The network is also responsible for planting seeds of interest in the technology of Effective Microorganisms in all continents of the world and today EM is being blended into even chemical systems to reduce pollution to help preserve the environment for future generations, as advocated by Mokichi Okada, the founder of Nature Farming principles.

The network also provides training on Nature Farming and EM Technology to interested groups, using the excellent facilities offered at Saraburi Kyusei Nature Farming Center, managed by Sekai Kyusei Kyo of Thailand. Information is disseminated, and the Newsletter is developed and circulated among a readership spanning all continents.

The network is run by a very few staff and has been very efficient in its management of resources. Today, it is sponsored by EM Research Organization of Okinawa, INFRC of Japan and is supported by Sekai Kyusei Kyo of Japan and Thailand.

All interested in the work of the network – please contact us at

APNAN

Email: apnanmail@yahoo.co.jp
Website: www.apnan.org
MADA Opening Ceremony in August 2015 at Last!

In Myanmar, there is a very active and wonderful NGO, MADA, who is spreading Nature Farming actively in this Buddhist country through various activities. Their core idea is that some Myanmar people can help other poor Myanmar people and develop their nation by themselves, so they come together to develop their country by true natural way.

INFRC has supported their real thoughtful idea, because it is well known already that just focusing on developing economy only will be lack of the balance of people’s life, so they should focus on healthy, rich and peaceful way hand in hand with each other.

The NGO, MADA had an opening ceremony with conclusion of the agreement on 22nd August. Mr. Ito, the chairman of INFRC was very happy to join that event with Mr. Okubo, Manager of International Section and another INFRC staff. In that morning, the board members of MADA including Mr. Hnin Oo, Patron of MADA, Mr. Nyan Lwin, Vice Chairman and other 8 executives, with 3 INFRC representatives held an opening ceremony with conclusion of the agreement between MADA and INFRC. It is affirmed that they will make sure to cooperate to extend Nature Farming activities for developing their true healthy nation with farmers.

In that afternoon, over 150 people mainly from Yangon but also from other Districts and some other foreign countries such as Nepal, France and of course Japan too came together at Central Hotel to join a seminar “Nature Farming Activities for Sustainable Agriculture” hosted by MADA and INFRC. Opening address was
conducted by Presidential Advisor, Dr. Sein Hla Bo who had supported Nature Farming activities and EM Technology in this nation after meeting with the late Dr. UR Sangakkara, APNAN Advisor. The presenters from Myanmar, Nepal and Japan introduced and discussed important issues and how to solve them, such as ‘Nature Farming with Ecosystem’ by Mr. Hidehiko Okubo, ‘Nature Farming Resilient to Climate Change Risk and Nutritional Problem’ by Dr. Myint Lwin, Advisor of MADA, ‘Sustainable Nature Farming Practices in Nepal’ by Mr. Charles Pradhan, Rural Reconstruction Nepal and ‘How to make EMAS & EM Bokashi’ demonstrated by APNAN staff.

We organized a surprising event too after these presentations. We called EM mother in Myanmar, Dr. Cho Cho Myint, ex-Pro-Rector of Yezin Agricultural University to gift her our letter of appreciation, because she devoted her time to promote Nature Farming and EM Technology in this nation to help poor farmers as one of the founding APNAN members since 1989 over 25 years.

All participants were keen to develop Myanmar as a really healthy, rich and happy country with affordable economic situation. They realize also that they must reserve their beautiful environment and healthy food for the next generation….

We are looking for the real happiness way beyond borders, races and religions through Nature Farming principles.

You can find some other photos related to these events as the following MADA HP too.

**MADA HP:** [www.naturefarmingmada.org](http://www.naturefarmingmada.org)

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**INFRC Visits Dr. Sangakkara’s Home in Kandy, Sri Lanka to Express Condolence**

Our respected advisor, the late Dr. U. R. Sangakkara passed away on 29 August 2014. The representatives of INFRC visited his family and prayed for his soul in August 2015 when it took around 1 year after he passed away. EMRO visited in the same season as well. We would like to call him as ‘Ravi san’ instead of Dr. UR Sangakkara, because that nick name is more familiar with us and easier to remind us of his smile too.
The chairman of INFRC, Mr. Akio Ito with 2 staff visited one of the most important temples, Sri Dalada Maligawa, where the Sacred Tooth Relic is enshrined in Kandy on 17th August before visiting Ravi san’s home. Ravi san knew one of the monks who held the highest position there. Ravi san’s elder brother and niece welcomed the party with delicious snacks at Ravi san’s home. Mr. Ito expressed our gratitude to them with our memorial plaque for Ravi san because INFRC and APNAN had got great supports from Ravi san such as editing all APNAN newsletters, nurturing abilities of all young APNAN staff, organizing many international events and advising to develop APNAN around 25 years. APNAN could achieve big development by his generous supports. We would like to send our gratitude to him, who never requested his own profit.

We visited Peradeniya University near Kandy, where the late Dr. Sangakkara had worked. We met and discussed with Dr. Janak K. Vidanarachchi, the assistant professor of Animal Faculty. He was very interested in EM Technology, because some professors had used EM as one of materials for their research in many years ago. In last year, he presented his research paper, "Evaluation of Effective Microorganisms on performance, carcass quality; gut microbial population and nutrient utilization in broiler chicken". It showed the effect of EM on broiler chicken as bio-tick.

We talked about one of the great professors from this university, the late Dr. Ravi Sangakkara, who had promoted organic farming and presented many meaningful researches.

INFRC would like to express their gratitude to Mr. Lakshman Piyasena, Chairman of SSEEDS who arranged his car and made his staff Mr. Asanka Nayanajith accompany the party.
MADA Is Actively Developing Nature Farming & Organic Agriculture in Myanmar!

Now MADA, Multi-Agri Development Association has spread Nature Farming surely in this Buddhist country through various activities especially since the opening ceremony in 2015. We would like to introduce 2 case-studies from their activities. These places were visited by INFRC staff every year and by the INFRC chairman in 2015 too.

**Sain Lan Fresh & Green Project in Hmawbi Township**

This is one of the important projects to spread Nature Farming and safe foods in Myanmar. The founder of this project, Ms. Lai Lai Oo, who is the vice chairman of MADA has started it since April 2013. The concept of this project is to supply the city people in Yangon with Nature Farming products cultivated by the farmers as chemical free foods. Ms. Lai Lai Oo prepared the land with all basic equipment including irrigation systems, electric facilities and simple houses for farmers with their families. Then she invited local farmers, who were interested to join this project. The total scale of this farm land achieved 150 acres and over 70 families joined in 2016.

The soil condition has been improved step by step after changing quality of compost from offensive odor one to fermented smell one. Now they are using blackish matured compost, which is made from chicken dung and rice husk charcoal sprayed with EMAS. In 2015, they opened their own organic shop “Go Green”, located at opposite side of Japanese Embassy in Yangon. The people prefer to purchase that shop’s safe vegetables, fruits and some processed foods, like yogurts, Jams, pickles etc.

Facebook: https://www.facebook.com/GoGreenMyanmar/?pnref=lhc

Discussion with farmers in the Sain Lan project

The banner for the farmer training
**Myanmar Eco Village Farm School in Hmawbi Township**

NEED standing for “Network for Environment & Economic Development” is one of NGOs to spread sustainable organic agriculture and other life skills through school activities for especially rural people in Myanmar. Most students came from rural states such as Mon, Shan, Kathin and others. Many of them had suffered under very poor conditions. That school is called Eco Village Farm School. They have 9 curriculums in 6 months for youths from each rural area.

Mr. Khaing Dhu Wan is the founder of this NGO to help and develop the situation of rural area people in Myanmar. This country is formed by many kind of ethnic people, who have stayed at especially around mountain area. He had practiced organic agriculture in Chiang Mai, Thailand over 10 years and established this NGO in 2006 in there. He contributed his time and property to this school with 2 ha land for organic farming activities because he believes that organic farming is the real way to help people who are suffering the problem of poverty.

The age of students is younger than thirty around 16-25 years old young guys and ladies. They are learning this organic...
program as future leaders in each region. Many NGOs and volunteers from Myanmar or overseas countries have come to teach at or to donate to the NEED in order to support future leaders in rural area. All the students are very active to study not only organic farming but also English and other technical curriculums to develop their life and return to their hometown for the development of each area with natural way.

“NEED” Facebook : https://www.facebook.com/need.organics/

*Eco village farm school’s activities which is conducted by NEED*

*The chairman of INFRC provided speech regarding Nature Farming for the student and their group photo*
Organic Farmer Groups in Vientiane Capital, Laos is Very Active!

Vientiane capital, Lao PDR is a very famous city nowadays through successful promotion of organic markets. The organic market started under DAF, which stands for Department of Agriculture and Forestry Vientiane Capital and supported by HELVETAS Swiss Intercooperation from 2004. At first, they have started with only 16 farmers as organic members, but now they have over 850 organic farmers jointing without special sponsors and the details are as follows.

<table>
<thead>
<tr>
<th>2014</th>
<th>Number of farmers</th>
<th>Total area (ha)</th>
<th>Annual produce amount (ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upland crops</td>
<td>316</td>
<td>176</td>
<td>NA</td>
</tr>
<tr>
<td>Lowland rice</td>
<td>538</td>
<td>870</td>
<td>3,875</td>
</tr>
</tbody>
</table>

As you can guess who have supported the technical part for this project, all organic farmers in this project learned how to manage their farms by EM Technology and Nature Farming principles from EM center staff of DAF as APNAN partner. This is one of the important points how they can achieve such a big success. APNAN and INFRC have provided technical information and EM through our partners, then they have managed and developed each local organic farmer group. This is a really happy circulation to develop a healthy society in this nation.

In this time, we would like to introduce two organic groups. One group is a just started organic farm as a new group at Toman village, Xaythany District and the other is one of the most successful groups at Tasan village, Parkngun District.

New Organic Group at Toman Village

This is a new organic vegetable farmer group in Xaythany District, Vientiane Capital and established at the beginning of July 2015. 10 vegetable farmers and 9 mushroom farmers have jointed as organic farmers. They used chemicals in a very limited amount before they started to join the organic group. Therefore, the land is suitable for Nature Farming or organic farming.

In this Toman village there is a specific thing. The interested people are not only farmers but also a Regional Agriculture Extension Manager of local government, Mr. Banelom. He told us that this organic activity was very important to improve this farmer’s life as one of the government policies of a clean agriculture project.

They divided new land to start organic farm, and they established irrigation systems and
specific type of greenhouses with plastic sheets covered on the roof only to avoid damage by direct heavy rain. But these greenhouses are not covered with the plastic sheets on sidewalls so as to avoid heating up. Color of the soil in the field outside the specific greenhouse looks very poor, white and red-brown. However, color of the soil under such a specific type of greenhouse is better and more blackish than outside.

APNAN staff discussed with them so that soil will be able to develop, if they can continue cultivation by applying organic matter with EM. Their products had a damage problem by harmful worms, so we advised to make a trap to catch moths as a countermeasure until soil became developed. We hope their passion for the activity will make a big fruit soon.

The First Organic Village in Laos Born 2016!!!
At last, the biggest organic vegetable farm group at Tasan village, Parkngum District achieved their goal!!! That means they became the first organic village in Lao PDR with all the village people. They have 144 farmer members and their representative is Mr. Chan What and his deputy is Mr. Somboon. In 2016, they established their additional area of 16 ha for their vegetable field with a workshop building for their organic village activity. They could get good yield by their many
contrivance fitting their field condition with nature.

During APNAN visit, deputy representative, Mr. Somboon introduced his Nature Farming activities. He has managed 7 rai organic farm, which are 4 rai for upland crops and 3 rai for lowland rice between June to October every year. As the local area unit 1 rai equals 0.16 ha.

The staple food in Laos is called *Khao Niao*, which means a sticky rice. Mr. Soomboon cultivates one popular variety ‘*Khao Hom*’ which is Jasmine sticky rice! His sticky rice yield was about 4.2 ton / ha in 2015.

His vegetable field has been produced many kind of vegetables, such as lettuce, small red onion, pumpkin, carrot, broccoli, brinjal, cauliflower etc. His selling amount of various organic vegetables is totally 600 kg in January 2016. One problem is that if his products remained unsold, he must send it to ordinarily markets though income goes down.

He has cultivation problem too in that Family Brassicaceae get insect damage very easily. Then APNAN advised the cause of the problem is not enough matured compost. He will improve his compost by spraying EM soon after getting the organic materials.

This organic village faces a serious problem about marketing. Their total amount of products increased year by year, but consumers hit the ceiling peak because there is limited population in Vientiane Capital. Therefore, their production volume has remarkably exceeded over consumer needs. Therefore, their new target is extension of organic distribution to many more people including restaurants, citizens in Vientiane and also visitors from other countries. They have been trying to develop organic farming activities following the nature law.

APNAN would like to continue support to their activities to achieve their new target.
Organic crops at the organic village, Tasan village

Organic market at the Vientiane Capital
Fifth International Workshop on Nature Farming

The Specific International Workshop focused on Nature Farming was held at Saraburi Kyusei Nature Farming Center in Thailand March 2016. It counted the 5th time in the year from 2011 and invited special speakers from INFRC Japan as a feature of this specific workshop.

In this time, there were 34 participants from 9 countries, which are Malaysia, Myanmar, Laos, Philippines, Bhutan, Vietnam, Brunei, New Zealand and England. The country with largest number of participants was Malaysia as usual. One lady from England, which is very far away from Thailand, took part in the workshop to learn how to get successful in her Nature Farming garden though it takes over 12 hours on a direct flight from London to BKK.

Main speaker of this workshop was Mr. Kentaro Sakakibara who is a famous person spreading Nature Farming in domestic area in Japan, but now he is also well known to spread it in the tropical area too beyond his territory as a Manager of Technical Extension Section, INFRC.

There were many important principles and ideas to get the successful way of Nature Farming with EM Technology in this workshop.

“Respect Nature and conform to its law.”

“Allow the living soil to exhibit its great potential.” Nature Farmers can learn all of the methods from nature. Any phenomena in the field is a message from nature…so we don’t need a fight against anything even though insects and diseases… You may understand after joining this workshop, what we would like to tell you.

In our life, we face sometimes good things or sometimes bad things. We feel normally just lucky or unlucky at that time. But your way of thinking will be probably changed that…because all of events are special messages from nature to make a better condition!?

There are not only many kinds of vegetables and fruits field, but also fish ponds, chicken houses, piggeries, mushroom sheds and flower gardens in this farm. However, one of

Explanation of soil profile at poor condition land

Practice of soil preparation
the most important idea of Nature Farming is soil treatment. Participants learned soil treatment ‘Ikudo’ and ‘Kuratsuki’ to prepare healthy soil. The successful model farm at Saraburi Kyusei Nature Farming Center has not applied any agro-chemicals including chemical fertilizer since 1988 when they started cultivation. Therefore you can enjoy really healthy & delicious food during the workshop. That is one of the results to realize how to find our healthy life with Nature Farming.

We have a site-visit of Nature Farming in Thailand too. The farm ‘Harmony Life Organic Farm’ is nowadays very famous as a successful organic farm on TV, magazines etc. in Thailand. They have around 12 ha organic farm with mainly vegetables and herbs field. The owner of this farm, Mr. Oga is a Japanese and has conducted this farm since 1999. He gave us the latest information about his activities including his organic farm.

Now 2 types of International workshops are organized by APNAN, one is focused on Nature Farming around every March mentioned above in this article, and the other is focused on EM Technology covering most fields including animal husbandry, environment and housekeeping around every August. Please contact APNAN partner in your nation, if you have an interest.
Visiting NCST Institute of Industrial Research & Training and Terra Verde Organic Farm, Philippines

Mr. Atanocio, who owns NCST and TVOF, obligingly guided Mr. Fukugauchi at the facilities. He has participated in Saraburi workshops and he plans to install EM with the help of EMRPI (EM Research Philippines). NCST is a vocational school where over 2000 students graduated. The internships are cooperated and designed with YAZAKI, an automobile wiring circuits maker, so that NCST students can learn the business and Japanese culture such as 5S (Seiri: sorting, Seiton: organizing, Seiketsu: cleanliness, Seisou: cleaning, and Shitsuke: discipline). The school also has a business relationship with Samsung, so trained students with the corporation have business skills upon graduation. For example, more than 2000 graduates got jobs from Japanese based and foreign owned companies. Mr. Atanocio plans to provide vocational training in agricultural version at Terra Verde Organic farm. Aiming at this, construction has begun for 2 ha farms, a training center and accommodation. If the training involves natural farming with EM, the training center will be valuable. Mr. Fukugauchi believes
that the training center will be a greater facility when EM Research Organization and International Natural Farming Research Center concurrently provide agricultural education.

NCST HP: http://ncst.edu.ph/


Inside NCST there was the same facility as YAZAKI factory for vocational training.

These are pictures of the training facility at Terra Verde Organic farm. Across from and near the facility are several farms where they grow vegetables such as pumpkins, eggplants, corns, and okras.

Purification of Pampanga Fish Pond

Mr. Vistan has been farming fish at 80-hr farm ponds while working as a photographer for advertisement at TV production. For the last few years his farming business wasn’t profitable because fish got ill and grew poorly. Recently he heard that EM mud-balls
could purify water. Thus, he asked about how to use EM for improving his farm pond. Vast farm ponds cover lands Mr. Vistan’s neighborhood. Each of the ponds is a few hectares large, and they have replaced water and dried bottom mud under the sun. However, they haven’t taken care of sludge. In Mr. Fukugauchi’s experience, pouring lots of EM is not effective on the bottom mud when the pond is filled with water. Thus he suggested that, when drying the sediment, they sprinkle EM on the culvert and pour Activated EM-1 after filling water within the depth of 30 cm to spread EM all the way. Also, EM treated sediment can be one of the best agricultural fertilizers. So he invited local farmers to take such sediment for free, and Mr. Vistan was able to reduce bottom mud in his farm ponds.

Visiting Rivers with Ms. Rina Papio

Mr. Fukugauchi met with Ms. Papio for the first time and visited rivers in Manila City where her NGO purifies the water using EM mud-balls. Her activities include production of animation videos featuring EM mud-balls and her appearance on CNN Philippines. However, it seemed challenging to find her sponsor to continue her NGO operation. It is learnt that EMRPI has been supportive; for example, it has supplied the NGO with EM-1 for free. Ms. Papio is so good at broadcasting her NGO, and Mr. Fukugauchi thinks positively about providing technical information to assist her activity.

Facebook of Earthventure Inc: https://www.facebook.com/EarthventureInc/

The river treated by EM mud-balls a few times. No odor. Small fish on the surface
Lecture Meeting at Ministry of Agriculture and Forests, Bhutan

The EM lecture meeting for the new employees was held in late July after restructure of Ministry of Agriculture and Forests (MoAF).

First of all, Mr. BB Rai presented its background, activities, and future schedule. Then Mr. Koshoji taught basics of EM and introduced case studies of EM use. At the meeting Mr. Ugyen Dorji was invited as a guest who used to be our APNAN counterpart and now assists us in spreading EM use. Other guests included officers from Thimphu. They showed interests in EM use for waste management and sewage treatment.

During the visit Mr. Koshoji has brought from Bangkok a newly manufactured trophy to the winner of School Agricultural Program (Junior high division).

Lecture Meeting in Southern Gelephu

The meeting was held mainly for poultry farmers (producing eggs). Two farmers who had participated in International Training Workshop in Saraburi in February of 2015 and March of 2016 were invited. The farmers presented how to use EM (including EM Bokashi) for their layers through demonstration and they reported the effects. Among them, Mr. PL Mongar and Mr. Rumbas were inspired by the workshop in Saraburi and began to use EM at home and to introduce EM to other farmers. Since then, forty of local farmers have used EM. APNAN would like to express our gratitude to INFRC for their support to Mr. PL Mongar and Mr. Rumbas’s attendance of the workshop.
City Gelephu, Visiting Nursery and Poultry Farmers

City Gelephu is a town bordering India. Nursery is popular in the town because of the subtropical climate and EM use has spread. EM is almost solely used to manufacture composts, so APNAN shared with them other usage such as seed treatment and cutting.

Also, Mr. Koshoji visited six poultry farmers to check out the condition of Activated EM and the usage. He took surveys of the effectiveness. Every farmer has been using EM for more than three months and expressed a stable production of eggs. The average rate of their egg production is between 70 and 80 %. All the farmers reported the number of eggs precisely, which indicated that they had been cultivating almost the same amount of eggs every day. This was great news. During the visit, the farmers told him that there was no stock of EM anymore in Gelephu; thus, they had not used EM for two months. He requested EM partner in Gelephu to inform APNAN of EM storage status early.

Lastly Mr. Koshoji visited three farmers: the
current president of a poultry farmers group ‘Sarpang Layer Cooperative’, the former president, and his friend. This group consists of 96 members who bridged farmers and the market. Mr. Rumbas from the group participated in International Workshop in Saraburi last March. Since his return, he has been using EM and promoting to his fellow members. The current president shows his willingness to use EM, which let APNAN expect EM to spread among the members. The former president who is also the founder of the group shared with APNAN his story; it used to be impossible to suppress foul odors from pit in which they put dead chickens and no employee wanted to deal with it. However, the odor disappeared after pouring EM which was presented by Mr. Rumbas and then employees said that they could even sleep on the pit!!

This farmer has decided to use EM once the inventory is stored. His poultry farm has the largest number of chickens, that is, 11000. Since the average in the area is 1500-2000, it is crystal clear how large his farm is. Recently, the farm distributes their eggs to the capital, airport town Paro and Hoa. The demand for the eggs has been high.
Visiting School Agriculture Program

Driving down from the Capital Thimphu toward southern City Gelephu, Mr. Koshoji visited two schools: Dekiling (the student body is 331) which participated in School Agriculture Program (SAP) and Tsitang Dzongkhag (the number of students are 470). At Dekiling they grow Moringa trees and manufacture Moringa Tea. Mr. Koshoji asked them to bring the tea for sales at APNAN Meeting in Bali. It is encouraged that the school uses partially the profit from sales to run their organization.

Regarding Tsitang Dzongkha school, EM was used only for composts because the trained teachers had to transfer. This is why he provided a lecture meeting to the current corresponding teacher and those who were in charge of animal farming.

Visiting the Ministry of Education

Mr. Desang Dorji from School Health & Nutrition Division and Mr. Koshoji had a fruitful meeting. Mr. Dorji has been to Saraburi and now is one of supporters for
SAP. As his title states, he cooperates with SAP which manufactures various food that contains quality of protein and vitamin to maintain his students’ health. For example, they cultivate Moringa and manufacture second products (e.g., tea, spice for rice curry). Mr. Desang Dorji expressed his continuous support for SAP activities and his hope that school teachers keep participating in Saraburi workshop sessions.

**Visiting the Mayor in Thimphu**

Mr. Koshoji visited the Mayor of Thimphu with officials in environment division who participated in the lecture meeting at the Ministry of Agriculture and Forest. They agreed on using EM to suppress odors from raw garbage at compost fields and sewage treatment facility. APNAN plans to collaborate occasionally; for instance, participation to the lecture meetings in Saraburi. This time sewage water was sampled to survey the quality again before pouring EM. After the sampling, we plan to manufacture EM mud-balls and throw into sewage treatment plant. Also, Mr. Koshoji went to the site of garbage treatment and explained about EM use to effectively solve problems such as foul odors at raw garbage compost fields, appearance of fly, and wastewater treatment.

![Situation of compost fields](image1.jpg)  ![Sampling sewage (Before pouring)](image2.jpg)

<Lastly…>

Princess Sirindhorn of Thailand visited Bhutan. This was when Mr. BB Rai showed his School Agriculture Program. The official card as the certificate is shown in the picture.


Contributions

A Member of MADA First Trip to INFRC Farm!!!

I had been ex-Pro-Rector of Yezin Agricultural University, therefore I got a chance to have been working as a visiting professor at the Center for Southeast Asian Studies, Kyoto University, Japan. On 10th October 2015, I and my husband visited Chita-Kusagi farm in Aichi prefecture. We were warmly welcomed by Mr. Sano and Mr. Daisuke Abe (Extension Department, INFRC) and they explained their agricultural methods and experimental plots. The farm was established in 2011, with an area of 1.7 ha. The followings were noted:

(1) Rice and vegetables have been grown since 2011 with the use of mainly EM Bokashi. Variety yield tests (e.g. local varieties, a variety from Kyushu and own varieties of INFRC) are performed. Crop rotation system is being conducted with rice for two-three years and soybean for two-three years. Rice straw, as well as rice husks are incorporated into the soil. Application of EM Bokashi: In autumn (after the rice harvest), the chopped rice straws are distributed on the plot and Bokashi (1.5 - 2 t/ha) is applied on them. Then they are incorporated into the soil by ploughing. In spring as the second time application, after transplanting Bokashi is applied 0.6 - 0.8 t/ha. (No chemical fertilizers are in this field! Nature Farmer never use any agrochemicals including chemical fertilizers).

This method gives an average rice yield of about 4.5 t/ha (the average rice yield of Aichi, Japan is 5 t/ha) in 2014. It is noted that the yield is not so different from the yield with the application of chemical fertilizers alone.
(2) Underground irrigation system has been set up in some fields. That construction conducted by themselves. It makes better control of weeds and more vigorous root systems. Not only the irrigation pipes, but also drainage pipes are installed to control the moisture content of the soil. The soils were originally muddy, not suitable for soybean, but it gradually improved under this system. The underground irrigation system was innovated by one of the famous Nature Farmers in Japan – Mr. Fukushi in Aomori Prefecture.

(3) Sorghum is grown for use as green manure. Sorghum plants were seen with radish and pumpkin crops. Sorghum has a deep root system and large biomass. It was noted that by using sorghum as green manure, it can reduce the amount of EM Bokashi. The resulted yields were almost the same.

(4) In the home garden plots, use of companion crops, such as basil (Pin-sein) and leek (Kyet-thon), as repellent of pests were observed.

(5) Anaerobic EM Bokashi has been made using large drums, which only needs protection from rains. The well-formed structures with sweet smell of EM Bokashi were observed.

(6) A hand weeder, special hand tool, “Hattandori” in Japanese for rice field and a weeding machine (weeding equipment for paddy field). It was innovated for moving out the weeds not only in between rows, but also for the weeds in inter-rows.
Visit Korin Agricultural Producers' Cooperative Corporation, Chita District, Aichi Prefecture Too

Mr. Shinohara from Korin farm welcomed and showed their Nature Farm.

Korin Farm is a large scale commercial farm producing vegetables (red lettuce, green lettuce, radish, cabbage etc.) by Nature Farming. The total farm size is 20 ha, situated in separate places. It was established about 20 years ago.

(1) The soils were formerly stony and they have been improving by applying with mainly compost (cow dung fermented with EM). The farmers in this area usually use a huge amount of composts and break out the stones by tillage machine. However, this farm maintains the stones which will provide minerals for the development of the microbes.

(2) One significant thing is that the farm applies the “solarization” for weeding. The cow dung compost were spread and EM solution was applied before ploughing. Then the field was left for 3 months (in summer) or 6 months (in winter) for fermenting. The weeds came out and they were ploughed into the field again. In general, 100 t/ha (10 ton/ tan: Japanese 1 tan equals to 0.1 ha). These days the application of compost is done 2-3 years intervals. As for the other conventional farmers in this area, they use 4-5 times of compost from the Korin farm.

(3) In winter, weeds are kept for cover crops on soil surface.

(4) Irrigation is done by spraying, adding with EM (Several EM products) at 10 day- intervals. The fields were certified by Organic JAS (Japanese Agricultural Standard).
(5) The healthy seedlings of radish plants were observed that the cotyledon leaves are large and thick and keeping longer period. It was a time of weeding with an inter-cultivator, and we could witness the very friable soils (good soil structure).

(6) The plastic - mulching was done with the machine, “mulcher in Japanese” for the last stage of land preparation. The lettuce seedlings will be transplanted by inserting the plants in the holes of the plastic mulch in the following day.

(7) Two nursery facilities were seen with “green lettuce and “red lettuce” seedlings ready to transplant.

(8) Sowing time is carefully adjusted based on the temperature, to reduce the pest occurrence. There was no serious outbreak of pests and diseases now.

(9) The damage occurred only by the severe typhoon. When it happens at the time of transplanting, a big damage can occur. The fact was noted that the recovery of the plants of Nature Farm were found to be faster than those of the ordinary farming.

(10) The sale price is 10 – 30% higher than the normal price. Most are transported to Tokyo area.

MADA Website: [http://naturefarmingmada.org/](http://naturefarmingmada.org/)
Dr. Khin Lay Swe, Member of Multi-Agri Development Association (MADA)
Successful Fish Farm with EM by Saraburi Training Alumni

Mr. Ajay Kumar Chaudhary participated in Kyusei Nature Farming/EM training in Saraburi, Thailand in August 2000 just after he completed his Bachelor’s degree in Agriculture. Afterwards, he worked as an Agriculture Officer, Program Officer, District Facilitator and Trainer with different organizations both in Government and NGO sectors in Nepal.

In early 2014, he started his own fish farm initially with 1 hectare pond in western part (Rupandehi district) of Nepal. The farm is known as "A Cube Aquatic Fish Farm". This farm has been expanded having several ponds with total of 3.5 hectare water surface area. At present, the farm is having several varieties of fish including carp (Common carp, Grass carp, Silver carp), very common and popular Indian (Rohu/Naini) varieties and Tilapia as well.

There were several unknown problems observed in early 2015 like the filthy smell of pond water, very slippery surface of fishes, poor growth and bad odor of fish. Then the farm has started using EM in early 2015 when the above problems were becoming serious.

The fish farm has started using Activated EM (AEM) at the rate of 1 liter for every 10 thousand liter water of the pond. Positive results were observed within 2 weeks. The initial observations were the cleanliness of pond water and reduction in bad odor. Now, the farm has been using AEM at the ratio of 1 liter per 10 thousand liter water continuously at 7 days interval. The impact was marvelous having no filthy smell in the ponds area, better growth of fishes and the more interesting feedback by the consumers was regarding the taste of fish which was much better and very different compared than the fishes from elsewhere.

The fish farm has been developed as Agro-Tourism and Village Resort. The farm area is near to Lumbini (the tourist hub in western Nepal) where there has great potentiality of its development. At present, there are a few boats where the visitors can enjoy boating in fish ponds. Interested individuals are allowed fishing. Fish cooking facilities are also available on the farm area where visitors can enjoy cooked items of fish.

Mr. SP Yadav, EMCO-Nepal, Email : spcwds@gmail.com
Nature Farming Case-Study in New Zealand

We here in NZ have had a summer with an El Nino weather pattern threaten many farmers with a 2nd straight drought. Fortuitously there was an unusual amount of January rain which broke the drought and set up many crops. This has helped alleviate at least one pressure on our customers in a market which currently has uncharacteristically low milk and lamb prices. This however has not stopped many of our customers experience great results using EM.

We popped out to see one of our local clients at the beginning of February and were very impressed with the results. He uses EM across his entire property alongside a sustainable fertilizer program. The maize is irrigated and was standing close to 10 feet tall with a strong stalk and large cobs. This paddock had a straw and manure blend spread around pre-sowing which no doubt gives this crop a sizable advantage over others in the area with a terrific source of organic matter and Nitrogen being added to the ground alongside the quality nutrient program and EM, which would thrive with this type of organic matter in the soil. It will be interesting to see what the yield is at maturity given we still have plenty of growing to do yet. EM was sprayed onto the soil and organic matter pre-sowing at 10L / ha.

The next crop we looked at was on the clay downs. This was a dryland fodder beet crop and also looked excellent. This crop had the benefit of some great rain in Canterbury during January and it looks like it has utilized every bit of that water. With great canopy cover this crop is set up for a huge yield. This crop had EM sprayed on at 10L per ha post emergence.

Mr. Paul Daly
EMNZ Website: www.emnz.com
Research

Conservations of Natural Enemies in Open Field and Soil–based Greenhouses

Abstract

Many practices of the alternative integrated pest management have been tried at International Nature Farming Research Center and the related farms. The practical examples are introduced in this article as 1) cabbage intercropped into crimson clover that is attractive to ladybirds and favours other predators such as frogs and 2) Biodiversity enrichment for pests control in soil-based greenhouses by mulching plant residuals along the walls. In the two cases, pest insects were effectively controlled without pesticides used.

1. Introduction

In conventional or chemical agriculture, pesticides are used effectively to control pest organisms. However, excessive uses of pesticides have caused many problems such as food and environmental pollution and risks to animals, human and other organisms in the environment. The so-called pesticide is a chemical used to control, to repel, to attract or to kill pest, such as insects, weeds, birds, mammals, or microbes that are considered a nuisance. Pesticides are usually of high poison, which causes injury or illness or death of a living organism. Chemical engineers continually develop new pesticides to produce enhancements over previous generations of products. DDT, a typical insecticide that is also toxic to animals and humans, has been banned in Japan and other countries since 1970s. DDT is one of the once heavily used pesticides and the adverse effects exist till now, for example, affecting baby by the milk containing DDT that was deposited in the mother's body several decades ago. Most of new generations of pesticides present dangers to humans when used to control weeds or insects on food crops. Food crops, such as many fruits and vegetables, contain residual pesticides even after being washed or peeled. However, they may still meet government limits. Besides human health risks, pesticides also pose dangers to the environment. Non-target organisms can be severely impacted. Therefore, alternative integrated pest management should be developed for Nature Farming or organic crop production.

IPM was introduced as a concept in the United States in the late 1950s and developed to harmonize chemical control and biological control (Bartlett, 1956; Smith and Allen, 1954; Stern et al., 1959). Smith and Allen (1954) first established IPM as a new trend in economic entomology. The early concept was based on the premise that pesticides could have a minimum impact on the natural enemies. "Economic threshold" was introduced at the same time, based on the knowledge that pest populations fluctuate naturally. "Economic injury level" was defined as the lowest density that will cause economic damage. These concepts remained the major theme of IPM throughout the 1970s. There are 64 definitions of integrated pest control or integrated pest management (IPM) that have
been made since the early 1930s. In simple terms, IPM can be a procedure to manage pest populations by harmonizing control methods such as natural enemies, pesticides and cultural practices, in purpose of minimizing economic damage and harmful environmental side-effects by managing pest populations instead of eradicating or removing the pest. The theory and principles of IPM have been developed over the last 40 years. Prior to World War II, pest control was accomplished primarily through cultivation practices such as tillage and rotation as well as mechanical removal of pests. After World War II, DDT and other organic insecticides came into use worldwide to control insect pests. The regular use of pesticides was started in industrialized countries in the early 1950s. By the 1970s, farmers in industrialized countries had relied on pesticides without other methods considered. Pest adapted to the chemicals and no pesticide could control the pests on some farms. Some farmers increased the application of highly toxic pesticides to 60 applications during the growing season. Under these conditions, the cost of pest control made the production of cotton profitless. IPM began to shift to non-pesticidal tactics in the 1980s with expanded use of cultural and biological controls and introduction of resistant crop cultivars. In the 1990s, extension techniques and policy have been emphasized strongly in the development of IPM. Many practices of the alternative integrated pest management have been tried at International Nature Farming Research Center and the related farms. The practical examples are introduced as in next paragraphs.

2. Study Cases

2.1. Cabbage intercropped into crimson clover

2.1.1. Implementation of the cabbage-clover intercropping

Crimson clover (Trifolium incarnatum L.) is sown in two paralleled rows as a band with inter-row space of 25 cm and a 60 cm space for cabbage transplanting is left between the two clover band. When the red clover is established, seedlings of cabbage are transplanted with an inter-space of 30 cm. The soil was fertilized with a biofertilizer (oil mill sludge, rice bran and fish meal as materials and fermented with a microbial inoculant called EM as the starter) at a rate of 8 g N per m².

2.1.2. Impact on biodiversity of cabbage-clover intercropping

Crimson clover is usually used as forage crop or intercropped into orchards or turfgrass as a cover plant. Recently, crimson clover is used as a cover crop in crop fields to conserve the field biodiversity. Flowers of crimson clover are attractive to or harboured bees, ladybirds and other beneficial insects and animals, especially the minute pirate bug (Orius tristicolor) that preys on various agricultural pests and ladybird that preys on aphids. Frogs also thrive in the canopy of crimson clover. Soil arthropods are more diverse in the intercropping fields than in the clean-tilled fields.

Fig. 1. Cabbage intercropped into Crimson clover.
2.1.3. Previous cases
Bugg et al. (1990) has also reported that convergent lady beetle (Hippodamia convergens) and seven-spotted lady beetle (Coccinella septempunctata) are found in substantial numbers in canopy of crimson clover. Crimson clover is more tolerant of Meloidogyne spp. than are red, white, or arrowleaf clovers and a good host for Meloidogyne hapla and other Meloidogyne spp. It is reported by Tillman et al. (2004) that Densities of Geocoris punctipes and lady beetles are high in cotton fields previously planted in crimson clover. Intercropping cotton in live strips of cover crop was probably responsible for the relay of G. punctipes onto cotton in these crimson clover fields. Density of O. insidiosus was not significantly different between cover crop and control cotton fields. Lady beetles seemed to relay from cover crops into cotton. Conservation of the habitat of fire ants during planting probably was responsible for the higher density of red imported fire ants observed in all conservation tillage cotton fields relative to control cotton fields. Reduction in the number of times in which economic thresholds for heliothines were exceeded in crimson clover and rye compared with control fields indicated that the buildup of predaceous fire ants and G. punctipes in these cover crops subsequently resulted in reduction in the level of heliothines in conservation tillage cotton with these cover crops compared with conventional tillage cotton without cover crops.
Crimson clover is also resistant to viral diseases. Crimson clover is tolerant of weeds. As shown in the picture, any other kinds of weeds or plants are suppressed in the canopy of the crimson clover. Other cases of weeds suppressed by crimson clover are also reported.
In addition to the improvement in biodiversity, crimson clover improves soil nitrogen nutrition with a yield of about 50 kg N/ha from the above-ground biomass and additional N release into the soil. As shown in the picture (crimson-cabbage intercropping) in the present article, crimson helps absorb the N at the young stage of cabbage and avoid the excess in N in the soil and it may release N into the soil or transfer N to cabbage through mycorrhizae or root inter-cross. Therefore, crimson buffers the N nutrition in the soil and avoid diseases related with N excess. Other research has also found the N is transferred from crimson to the intercropped cereals. In terms of total N content, crimson clover tended to be superior to other leguminous cover crops due to its large dry matter production. The mean N content of crimson clover was significantly greater than that of subterranean clover and common vetch. Soil organic carbon and organic nitrogen concentrations are increased in no-till crimson clover winter cover crop plots, as reported by Hargrove (1982).

2.2. Biodiversity enrichment for pests control in soil-based greenhouses
2.2.1. Implementation of the biodiversity enrichment
Along the walls of the soil-based greenhouse, organic materials such as crop residues, hays, twigs and rotten wood were placed and piled up to 50 cm high and 50 cm wide, where thriving of predators such as spiders (Lycosa pseudoannulata), frogs (Hyla arborea japonica) and Carabidae beetles (Anthia spp.) were expected.
2.2.2. Impact on biodiversity of the biodiversity enrichment

Biodiversity enrichment is one system of practices in integrated pest management (IPM). IPM is an approach to pest control that uses regular monitoring to determine if and when treatments are needed and employs physical, mechanical, cultural, biological, and educational tactics to keep pest numbers low enough to prevent unacceptable damage or annoyance. In IPM programs in conventional agriculture, pesticide treatments are made only when and where monitoring has indicated that the pest will cause unacceptable economic, medical, or aesthetic damage. Treatments are chosen and timed to be most effective and least-hazardous to non-target organisms and the general environment. However, no chemical pesticide is allowed in organic agriculture. One of pest control measures in organic agriculture is to enrich populations of natural enemies to pest insects. The process of finding and introducing natural enemies from its place of origin is a challenge. The introduced pest predator or parasite must undergo exhaustive testing before being released to be sure it will not harm non-target organisms. Failure can also be related to problems such as climate differences, prior or current pesticide use, disturbances of the habitat by other agricultural operations, and/or the removal of weeds that might otherwise offer food and shelter to the natural enemies. Intercropping with attractive plants, nectar-producing plants and alternate host plants in and around fields, and intercropping different crops to provide habitat diversity are all management techniques that lead to the build-up of natural enemy populations and result in enhanced biological control of pests in organic crop production (Nentwig, 1988; Nentwig et al., 1998).

2.2.3. Case study/example of the biodiversity enrichment

A brassica leafy vegetable (*Brassica campestris* L. cv. Seitei) were sown in an Andosol in a polyethylene greenhouses at the end of April. Each greenhouse was separated in middle with a net spreading from the roof to the soil surface. The conditions were maintained the same in both separated compartments of the greenhouse. Along the walls of one part of the greenhouse, organic materials such as crop residues, hays, twigs and rotten wood were placed and piled up to 50 cm high and 50 cm wide, where thriving of some predators such as spiders (*Lycosa pseudoannulata* (BOESENBERG et STRAND)), frogs (*Hyla arborea japonica* Gunther) and Carabidae beetles (*Anthia spp.*) were expected. As the control plot, in another compartment of the greenhouse, a black polyethylene sheet was mulched onto the soil surface along the walls. In each part of the greenhouse, plots were separated as chemical fertilization and organic fertilization treatments. As treatment replications, three identical greenhouses were used to this experiment. The applied organic fertilizer is a biofertilizer anaerobically fermented using organic materials such as rice bran, oil mill sludge, and fish meal in the proportions of 3:2:1 in a closed container. A microbial material, which mainly contains lactic acid bacteria, yeast and photosynthetic bacteria, was inoculated to the organic materials before fermentation. The concentration of N, P and K of this organic fertilizer was 51, 18 and 19 gkg$^{-1}$, respectively. This organic
fertilizer was applied at a rate of 300 g m\(^{-2}\). A compound chemical fertilizer (N-P-K: 15:15:15) was applied in the chemical fertilizer plots. Since it was considered that 30% of N in the organic fertilizer could not be used the present cropping season, in the chemical fertilization plots, the quantity of chemical fertilizer was applied with the total nitrogen equivalent to 70% of the total nitrogen in the organic fertilizer applied to the organic fertilization plots. The brassica leafy vegetables were harvested in a thinning manner four times at an interval of 5 day from 45 days after sowing. Populations of pest insects and predators were examined before the third harvest.

As shown in Table 1, populations of natural predators, spiders (*Lycosa pseudoannulata* (BOESENBERG et STRAND)) and Carabidae beetles (*Anthia spp.*) were enriched by placing organic materials along the walls of a soil-based greenhouse. These two groups of predators thrived from the early spring in the mulched organic materials, where they predated the insects in the decomposing organic materials before the insects in the field plots reach the dense populations. Populations of frog (*Hyla arborea japonica* Gunther) and the parasite bee (*Eretmocerus nr. Californicus*) was not affected by organic mulching treatment because their origination was not related with the compiled organic materials. The spider population was also higher in the organic fertilization plot than in chemical plot (P≤0.05). This might be attributed to more soil fauna in the organic fertilized plots as indicated by other research. Populations of frog and parasite bee were slightly higher (P≤0.05) in chemical fertilization plot than in organic fertilization plots. This might be related to populations of predated pest insects, which were higher (P≤0.01) in chemical fertilization plots. Populations of all pest insects, including leaf miner (*Phytophymza nigricornis*), aphid (*Brevicoryne brassicae*) and semi looper (*Autographa nigrisigna* Walker), were lower in organic mulched plots than in cleaned plots. Results suggested that the practice of placing organic materials along the walls of a soil-based greenhouse to preserve natural predators effectively controlled pest insects of brassica leafy vegetables. Populations of pest insects were also lower in organic fertilization plots than in chemical fertilization plots. Similar observations were reported for other crops. The spiders predate the insects in the decomposed organic materials such as crop residuals before the insects reach the dense populations. This practice effectively controlled insects of brassica leafy vegetables in greenhouse. Many practices similar to the present one have been attempted using land margin spaces to enrich biodiversity and rear natural enemies (Baines et al., 1998; Sotherton, 1984).

### 2.2.4. Lessons to be learned from the biodiversity enrichment

The author and his colleague have tried several years of experiment to raise the predators using the waste organic materials along the walls of soil-based greenhouses. One year, spiders and beetles throve in winter time before the leafy brassica had not been established. When the leafy vegetable is established and pest insects appeared in the leafy vegetable field, the population peak of the predators disappeared. A sustainable population maintenance should be ensured
for the predator. The dynamic changes in predator population should be elucidated.

Fig. 2. Organic materials placed along the walls of greenhouse (Left) where growing is a brassica leafy vegetable.

Fig. 3. Natural enemies thriving in brassica plots (Left: a spider (*Lycosa pseudoannulata*) is fighting a green worm (*Autographa nigrisigna* Walker); Right: two frogs are patrolling on a brassica plant).

Table 1. Populations (per m²) of pest insects and natural enemies in Brassica vegetable plants of preserved plots in greenhouse.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Natural enemies</th>
<th>Pest insects</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Spiders</td>
<td>Frog</td>
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<td>Chemical-Preserved</td>
<td>11.6</td>
<td>4.6</td>
</tr>
<tr>
<td>Chemical-Cleaned</td>
<td>7.8</td>
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<tr>
<td>Preservation</td>
<td>**</td>
<td>NS</td>
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<td>Fertilization</td>
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<td>Preserv.*fertiliz.</td>
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* and ** mean significant difference at P≤0.05 and P≤0.01 respectively and NS means no significant difference according to ANOVA. The same is for tables below.
3. Discussion

In organic agriculture, benefits of crop diversity have been recognized, for example, planting mixtures or stripes of different crops in the field. Various types of living mulch including clovers and turfgrass are adopted in Nature Farming systems. Instead of demand for productivity, the technique of living turf mulch is expected to avoid diseases, whereby a reasonable yield is ensured in the organic production. As well known, excessive nitrogen nutrition, especially the accumulation of excessive intermetabolic nitrogen compounds such as amino acid in the tissues, would increase risks of diseases and insect pests (Xu 2004). The turfgrass absorbs the excessive nitrogen, if any, and excessive supply of nitrogen to tomato plants is avoided. This might be one reason for disease avoidance. Another reason for the disease avoidance is the microbial biodiversity in the rhizosphere that is maintained by the abundance of mycorrhizal colonization (Amaranthus 2001). Mycorrhizae colonize the clover or turfgrass root with high density and the density is much higher than in roots of tomato plants without intercropping. Mycorrhizal symbioses in rhizosphere ecosystems, the rootlets and root hairs are connected with the surrounding soil through an interface called the mycorrhizosphere (Johansson et al. 2004). In the present study case, the living mulch crop of clover can also fix nitrogen and share the nitrogen nutrition when the main crop of cabbage needs it at later growth stages. Moreover, the aboveground biodiversity is also improved because clover plants grow between cabbage rows. Ladybird, the natural enemy for aphids, is attracted by the red-purple flowers of clover and aphids are completely controlled.

In the second study case, crop residues and cut grasses are mulched onto the soil surface to improve the habitat conditions of natural enemies such as spiders and carabids beetles. In addition to the residual mulch, a biofertilizer, fermented with rice bran, oil mill sludge and fish meal as materials, is applied into the mulched residual materials. The purpose of mulching crop residues and supplying with the biofertilizer is to enrich the food and refuge for the soil fauna, which may in turn serve spiders and carabid larvae as preys before the populations of pest insects on cabbage form to a scale that can support the population of natural enemies. As expected, the relatively high density of natural enemies and low density of crop pests are observed under the habitat management systems enriched by residual mulching and organic biofertilizer additions. It is suggested that the population of crop pests is suppressed by the natural enemies whose population is enhanced by improvements in their habitat conditions. The higher density of natural enemies under habitat management systems confirm more favourable habitat conditions. Studies have been attempted by using field margin spaces to enhance biodiversity and enrich natural enemies in farmland ecosystems (Leyval and Berthelin 1993). The results in this study case have proved the effectiveness of habitat management for natural enemies by placing the plant residues and organic materials onto soil surface along the row space. Habitat management may improve habitats for natural enemies in two respects, diet and microclimate. As the plant residues
decomposed in the field, a new food web based on the plant detritus was constructed. Microorganisms decompose the plant residues and release the majority of energy fixed in plant residues to provide the primary energy base for detritus food web. A large number of detritivorous fauna including collembolan, diptera, nematodes and mites feed on the microorganisms and constitute the mainly fungivores. These fungivores can be as the diet of many arthropod predators, such as carabids and spiders, which usually act as natural enemies of pest insects in the farmland systems (Rygiewicz and Andersen 1994). Therefore, the density of predators can be favoured with improved food availability. In this study case, the population of spiders is enhanced to a relatively high level before the occurrence of pest insects on the cabbage crop, which is attributed to the enough energy resource from detritus food web. During the construction of such food web, the biodiversity of the field is also enriched. It is suggested that, as generalists, before the occurrence of crop pests, predators mainly feed on the organisms involved in the detritus food web and the density of predators can be maintained at a relatively high level. During the occurring period of pest insects, predators may transfer the preys from soil fauna to crop pests or forge on both of them, and so that population of pests was controlled at a relatively low level, and in turn the population size became larger due to the enlarged diet resource. The purpose of habitat management is to increase the density of natural enemies by enhancing the local biodiversity, with the expectation to suppress the pest insects in the cabbage field. After the occurrence period of pests and the harvest of crops, predators return to the detritus ecosystem and turn to prey on mainly detritivores again. Such pest control by natural enemies can be taken as a kind of feedback of biodiversity to crops (Linderman 1988). Plant residues also provided the necessary shelter for natural enemies. Half-decomposed plant residues have an excellent waterholding and sunshade capacity, dramatically improving the microclimate conditions and microhabitat structure for natural enemies. In the season with adverse weather such as heavy rain or strong sunlight, predators can get into the crevice of plant residues to seek for protection. In the present study plots, the upper part of weeds over cabbage plants is cut off but the lower part is reserved with the stubbles remaining lower than cabbage plants. The weeds can help to increase the moisture and lower the temperature on the soil surface. In the vigorous growth season, the crop leaves and weeds form a canopy over the row space in the field, vapour stream from the plant residues is hindered by the canopy and hence, the moisture of the crop space is enhanced and the temperature of the soil surface is reduced and the habitat of predators is improved. On sunny days in the summer season, the average temperature and relative humidity on the soil surface in day time are around 27°C and 75% in habitat management plots, and 40°C and 50% in control plots, respectively. Under the adverse weather conditions, spiders are found hiding inside the crop residues or under the weeds. Although crops themselves can provide shading for predators in non-mulch plots, the degree of such ‘comforting’ is much less than that in the improved habitat with plant residues. In the.
present study case, a multiple intercropping system is adopted with the main aim at improving field vegetation diversity. In the original landscape systems in nature without manmade disturbance, many species plants share the natural resources in harmony and balance. Today, in the organic crop production systems, it is important to design the field landscape as close to the natural origin although this is limited by the production objectives. From the present study cases, it is concluded that plant residual mulching and field vegetation conservation as habitat management practices in addition to intercropping are effective in improving field biodiversity, whereby insect pests are controlled to a lower level by natural enemies.

4. Recommended Readings


The terms EM, Effective Microorganisms and EM Technology refer to the specific technology developed by Dr. Teruo Higa of Okinawa, Japan. These trademarks are exclusively owned by EM Research Organization, Inc. of Okinawa, Japan.
International Nature Farming Research Center (INFRC), located at Matsumoto, Japan, was established in 1985 with the objectives of enhancing economic stability of farmers and producing nutritious and good quality food for humankind through the promotion of Nature Farming. Thus, INFRC undertakes research and extension programs on Nature Farming based on the principles of Nature Farming advocated by Mokichi Okada, who stated the importance of respecting nature and conforming to its laws. The importance of allowing soils to exhibit their inherent potential is also a key to the principles of Nature Farming, which is promoted by INFRC.

In April 2012, INFRC was reorganized and registered as a public benefit foundation, and the headquarters was shifted to Hata, Matsumoto, Nagano, where the research station is located. However, the International Section of INFRC is located at Atami, at 1F, Momoyama Bldg., 16-3, Momoyama, Atami, Shizuoka 413-0006, Japan.

Today, INFRC supports over 1900 Nature Farming units in Japan. It also has a research farm at Matsumoto, Nagano where scientists are diligently working towards the validation of Nature Farming. INFRC also promotes the use of EM Technology to stimulate the soil biota and enhance productivity.

The international activities of INFRC range from being associated with the International Federation of Organic Agriculture Movements (IFOAM), supporting the Asia Pacific Natural Agriculture Network (APNAN) and also research and development in many nations such as China, Laos and Myanmar.

In the recent past, INFRC has been accredited to certify organic agricultural products and organic agricultural processed food under the JAS organic certification scheme of the Ministry of Agriculture of Japan, which is now promoting organic agriculture. Thus, INFRC is a very dynamic organization working diligently to provide a sustainable system of producing food through Nature Farming, based on the principles of Mokichi Okada.

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EVENTS
Dear Readers – Please note that the following events will be organized in 2017 and 2018. The details will be posted on the APNAN website or else.

1) The next International Workshop on basic EM Technology in 2017
The next international workshop on basic EM Technology is scheduled on September 18 to 21, 2017 at Saraburi Kyusei Nature Farming Center, Thailand. This will be a workshop with emphasis on EM Technology for all the field including EM related materials, animal husbandry, mushroom cultivation, environmental treatment, aquaculture etc.
http://www.apnan.org/Next_Workshop_Information.htm

2) The 7th International Workshop on Nature Farming in 2018
The next international workshop on Nature Farming is scheduled in March 2018 at Saraburi Kyusei Nature Farming Center, Thailand. This will be a workshop with emphasis on Nature Farming using EM Technology. The details will be announced later.

3) The 6th APNAN Meeting in 2018
The next APNAN Meeting is planned in 2018. The details will be announced once decided.

Please send your article regarding Nature Farming or EM Technology to APNAN
Email: apnanmail@yahoo.co.jp

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