EVENT REPORT

1st-2021 Partnership Colloquium

on

Environmentally Friendly Agriculture

Organized by

TOKYO UNIVERSITY OF AGRICULTURE

and

HOCHSCHULE OSNABRÜCK
UNIVERSITY OF APPLIED SCIENCES

July 8, 2021 (online)

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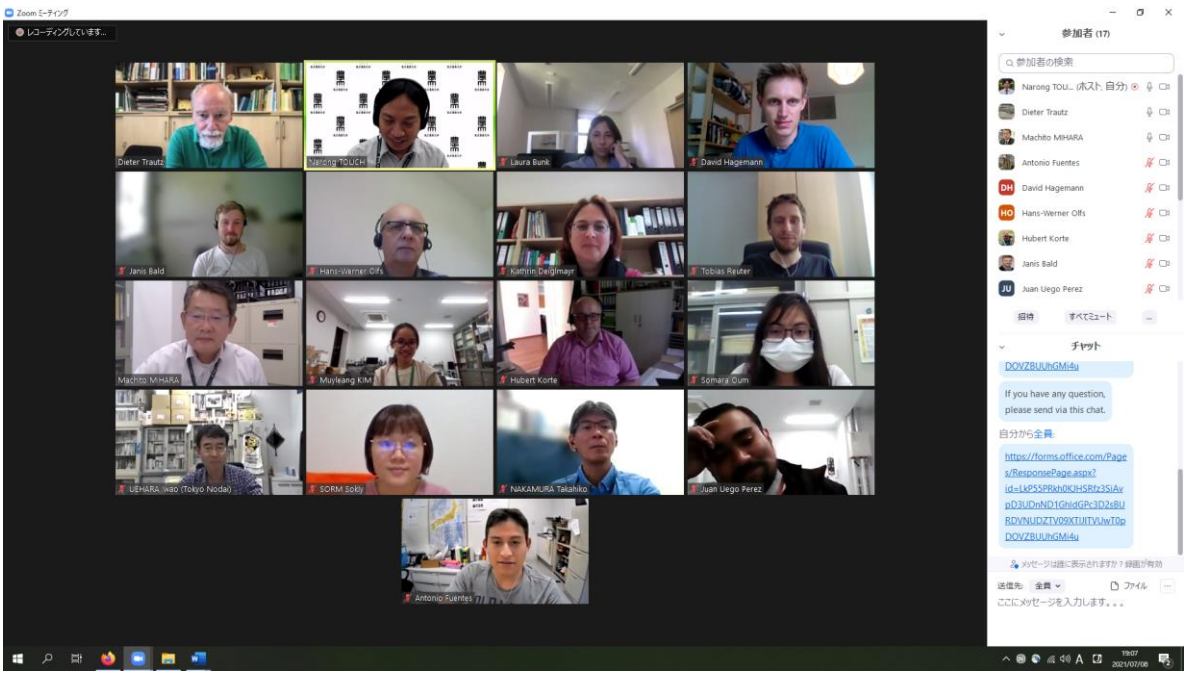

Meeting Program

From 10:00 in Osnabrück (17:00 in Tokyo)

(10:00-10:05) 1. Opening remarks by Assoc. Prof. Dr. Narong Touch

(10:05-10:45) 2. Presentations from Tokyo University of Agriculture

(10:05-10:25) 2-1 *Promotion of Organic Farming in Cambodia*
Miss Kim Muy Leang

(10:25-10:45) 2-2 *Water Environment Conservation by Water Morning Glory*
Miss Oum Somara

(10:45-11:25) 3. Presentations from Osnabrück University of Applied Sciences

(10:45-11:05) 3-1 *Resilient soils through stable macroaggregates and arbuscular mycorrhizal fungi*
Prof. Dr. Kathrin Deiglmayr

(11:05-11:25) 3-2 *Effect of land rolling on first pod height and other yield parameters in organic cultivation of soybeans (Glycine max (L.) Merill.)*
Mr. David Hagemann

(11:25-11:55) 4. Panel Discussion
Discussion on the issues relating to the presentations and Environmentally Friendly Agriculture

(11:55-12:00) 5. Closing remarks by Prof. Dr. Dieter Trautz

Till 12:00 in Osnabrück (19:00 in Tokyo)

Abstracts

HOCHSCHULE OSNABRÜCK
UNIVERSITY OF APPLIED SCIENCES

1st Partnership Colloquium on
Environmentally Friendly Agriculture
July 8, 2021 (online)

TOKYO UNIVERSITY OF AGRICULTURE

Promotion of Organic Farming in Kampong Cham Province, Cambodia

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Keywords: Organic farming; Organic fertilizer; Compost, Soil quality, Crop production

Summary of key findings

After the promotion of organic farming, farmers prefer to use organic fertilizers in combination with chemical, and only a few farmers applied only organic. The result of rice production in each farming practices showed that the rice production in organic fertilizer practice was high compared to other fertilization practices. When low chemical and more organic fertilizer has been applied for long times, the crop production was high, indicating high soil quality when using organic fertilizer. Even, farmers were trained on how to make compost from the project, the composts are still in low quality as the presence of coliform and *E. coli* bacteria was detected. The rates of coliform and *E. coli* was high compared to agriculture production safety standards for pathogenic bacteria. This ensures that the method used for making compost are not appropriate for producing safe and good quality of compost.

Background and relevance

Cambodia is located in Southeast Asia, has tropical climate which is affected by monsoon. Agriculture is shearing about 20.7% for the GDP growth (WB, 2019). Paddy rice is a main crop and cover 68% of total agricultural land in Cambodia. The farming system in Cambodia is normally based on the application of chemical fertilizers, chemical pesticide, fungicide, and herbicide (FAOSTAT, 2016). The use of high rates of chemical fertilizers continuously for several years, often lead to unsustainability in production and pose threat to the environment (Smith et al., 1990). Traditional farming in Cambodia was depending on the used if farmyard manures, farmyard manure is available year-round, but the amount produced was not enough. Recent year, with the support from the government and non-governmental organization (NGOs), many Cambodian farmers realized and looked for a better agricultural practice which could harmonize with natural environment and human health. Several practices were carried out to promote the use of organic fertilizers such as green manure, compost, and bio-liquid fertilizer in some provinces of Cambodia. The use of organic fertilizers, it can reduce the input of chemical fertilizer, as well as improve soil, water, and environmental quality. The purposes of this study were to discuss changes in farming practices before and after the promotion of organic farming, and to evaluate the compost quality and the effect of fertilization on crop production.

Results

Before the project implementation more than 90% of farmers were applied chemical fertilizers and less than 10% applied organic (Fig. 1). After the project on promotion of organic farming, farmers are likely use organic fertilizer in combination with chemical fertilizers (Fig.2). The amount of rice production in each farming practices was different, the production in organic fertilizer practice was high compared to other fertilization practices in Baray Commune (Fig.3). When low chemical and more organic fertilizer has been applied for long times, the crop production was high, indicating high soil quality when using organic fertilizer.

The survival rates of coliform and *E. coli* were detected in compost boxes which produced by local farmers in Samraong and Baray Commune, the rate of coliform contamination is 2.3×10^5 and 1.0×10^5 and *E. coli* is 0.9×10^5 and 0.1×10^5 in Samraong and Baray Communes, respectively. The rates of colonization found to be >1000 cfu/g (Briancesco et al., 2008).

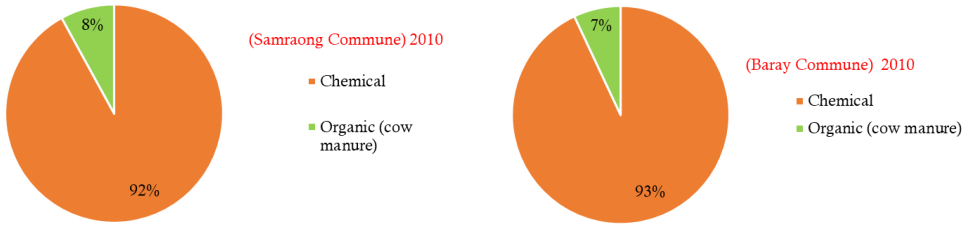

Fig.1 Farmer's fertilization practices before the project implementation in Samraong and Baray Communes 2010

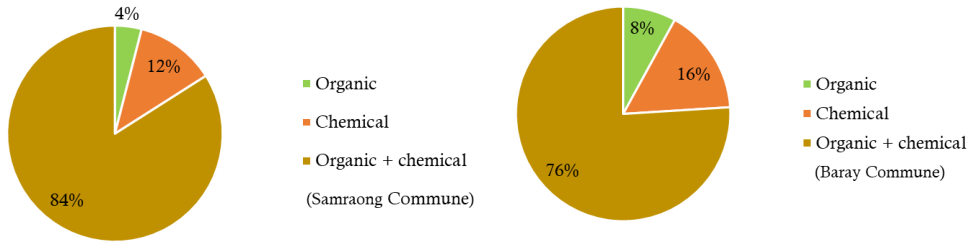

Fig. 2 Farmers' fertilization practices after the promotion of organic farming in Samraong and Baray Communes in 2019

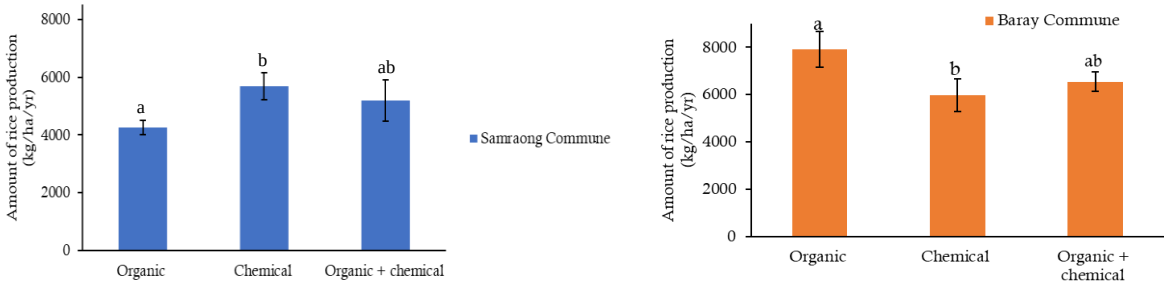

Fig. 3 Amount of rice production under different fertilization practices in Samraong and Baray Communes

Discussion

After the project implementation on the promotion of organic farming in Samraong and Baray Communes, farmers have changed their farming style by using organic fertilizer in combination with chemical. Also, less chemical fertilizer and more organic fertilizer has been applied for so many years in Baray Commune which effect to the soil quality and production. As the results, the rice production was higher in organic fertilizer practice. However, composts made by local farmers are still in low quality as there were coliform and *E. coli* bacteria inside the compost boxes. It considered that farmers are not following the methods from the project training, and the raw materials for composting was not in a good quality. Microbial safety of organic amendments or fertilizer used in agriculture is required to prevent colonization by food-borne illness pathogen like *E. coli* and Salmonella spp.

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Water Environment Conservation by Water Moring Glory

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Keywords: water quality; water morning glory, nutrient uptake, farmer income

Summary of key findings

Decreases in nutrient concentrations due to nutrient uptake by water morning glory (WG) were observed, indicating water purification by water morning glory. From economic analysis, the cultivating of water morning glory shows a profitable sign with economic efficiency of 1.80.

Background and relevance

Peri-urban lakes offer many valued ecosystem services, but their vulnerability to climate change and anthropogenic disturbances increases with the population growth. Cheung Ek Lake (Phnom Penh, Cambodia), the biggest wastewater lake located in the city, has been used for multiple purposes over the past decades. Apart from wastewater purification, the lake ecosystem also has an essential economic function, for example, local people use the lake to fish and cultivate aquatic plants, e.g., water morning glory (*Ipomoea aquatica*). However, 61% decreases of the lake area were found due to the expansion in the housing and satellite cities from 2003 to 2019 (Sahmakum Teang Tnaut, 2019). The purpose of this study is to investigate the potential of the Cheung Ek Lake in ecosystem services. Namely, (i) to investigate the concentration and load of nutrients derived from wastewater in the lake (ii) to calculate the nutrient uptake by morning glory *(Ipomoea aquatic)* and (iii) to discuss the benefit of water morning glory cultivation on the income of farmers

Methodology

The study was conducted on Cheung Ek Lake located at the south of Phnom Penh city (104°90'–104°94'E and 11°46'–11°53'N). The lake's surface area changes from approximately 1,300 to 3,000 ha from dry to rainy seasons, with an average depth of 0.5-1.5 m in the dry season and 7-9 m in the rainy season. The average annual rainfall is 1,440 mm and elevation is around 10 m above sea level (Nara et al., 2015). Water sampling were conducted during the rainy season of August 2019. The water samples were collected on three different days at the inlet, middle and outlet (Fig. 1). The sampled water was analyzed for determining pH, EC, Fe, DO, PO_4^{3-} and NO_3^-.

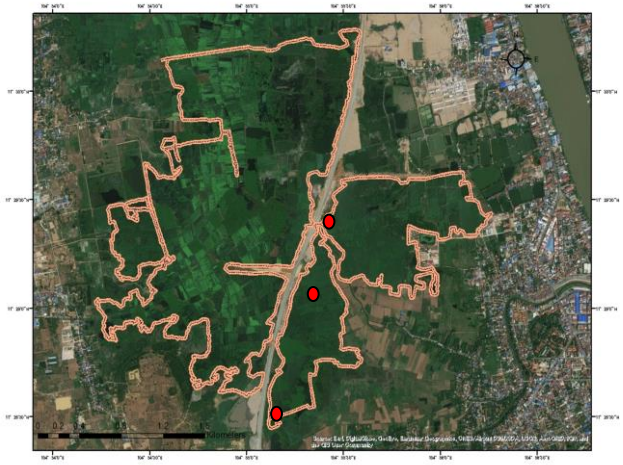

Figure 1 Map of Sampling point in Cheung Ek Lake

Load analysis was calculated by the following formula:

$L = Q \times C$

Where, L-load, Q-discharge (m^3/s), and C-concentration(mg/L)

Nutrient uptake by WG was calculated by using the following formula:

Amount of nutrient uptake = Total mass harvested of WG x Total nutrient absorbed in WG

Results

Table 1 Physical and chemical parameters at the inlet, middle and outlet of the lake

Discharge (m^3/s)	Sampling Location	pH	EC (mS/cm)	NO_3^- (mg/L)	PO_4^{3-} (mg/L)	Fe^{2+} (mg/L)	DO (mg/L)
42.12	Inlet	7.7±0.4	0.75±0.1	0.66±0.4	5.29±2.8 a*	0.03±0.0	5.14±2.7
-	Middle	7.7 ±0.3	0.72±0.0	0.11±0.2	1.42±0.7 b*	0.05±0.1	6.06±2.8
33.91	Outlet	7.6±0.5	0.66±0.0	0.55±0.2	1.90±0.6 b*	0.06±0.0	3.55±0.8

Note: values are mean ± SD (n=3), * p< 0.1

Table 2 Nutrient load of at the inlet and outlet of the lake

Parameter	Inlet	Outlet
NO_3^- (g/s)	28.08	18.65
PO_4^{3-} (g/s)	222.67	64.49
Fe^{2+} (g/s)	1.21	1.96
DO (g/s)	216.64	120.39

Table 3 Economic efficiency of water morning glory production (USD/ha/day)

Income	Total Expense	Net Profit	Economic Efficiency
53.35	29.58	23.77	1.80

Discussion

From Table 1, the decreased values NO_3^-, and PO_4^{3-} in the middle of the lake, indicating that the nutrient uptake by cultivating water morning glory in the lake. However, at the outlet point the nutrient increased, which could be due to the release of the nutrients from sediment where there is no plantation. The decreases of DO were observed at the outlet, indicating a high decomposition rate of organic matter in the lake. As the outlet's load was reduced compared to the inlet's load (Table 2)it can be said that the lake can remove inflow pollutants. According to Teang et al. (2010), the area for cultivating water morning glory is 429 ha which covers 43.2% of the lake area. In a hector area of cultivation amount of nitrate uptake by WG was 1.24 kg of NO_3^- and 5.53 kg of PO_4^{3-}, meaning that the water morning glory contribute to the nutrient removal from the lake, which were 65.22% for NO_3-N and 17.36% for PO_4^{3-}.

As for the economic benefit, the net profit from the production was 23.77 USD per day/ha (Table 3). Although the farmer spent a lot on labour, the income from the sale was good enough. The economic efficiency for the production was 1.80 (Table 3), suggesting that the business with this product is profitable. Moreover, cultivation in the lake gives economic benefits in terms of nutrient supply. The amount of fertilizer needed in land cultivation of WG production is around 200-300 kg in 1 hector, costing around 105-157 in one production cycle. Therefore, the farmers can earn more by not spend the extra cost on fertilizer application.

References

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Resilient soils through stable macroaggregates and arbuscular mycorrhizal fungi

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Summary of key findings

Resilient soils are of great importance for climate change adaptation. We focus on two key parameters that increase soil resilience: stable macroaggregates and arbuscular mycorrhizal fungi.

In incubation experiments, we demonstrated the effect of organic fertilisers on the formation of stable macroaggregates. The correlation between arbuscular mycorrhizal fungi and stable macroaggregates was investigated in a field experiment.

For a better understanding of the relevance of arbuscular mycorrhizal fungi, molecular techniques were established to quantify important genera of these fungi. At the same time, Next Generation Sequencing was used to describe the diversity of arbuscular mycorrhizal fungi in soils.

Effect of land rolling on first pod height and other yield parameters in organic cultivation of soybeans (Glycine max (L.) Merill.)

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Summary of key findings

Cultivation of genetically modified soybean cultivars increases when focusing on sustainability, regionality and demand for guaranteed non-GMO soybeans. Thus, local cultivation is of increasing interest. To meet the demand, the German government started an initiative to promote homegrown legumes. Because of the high protein value of soybeans, domestic legumes cannot fully replace soybeans.

In combination with climate warming and progressive breeding, soybean cultivation in Germany continues to rise. First pod height contributes significantly to harvest losses in soybean production. Therefore, land rolling has become a common treat to soybean fields in the USA and Canada to improve harvesting conditions by pushing rocks and root balls into the soil. Rolled fields can be harvested easier, faster and with a lower cutter bar, which allows those low pods to be harvested as well to avoid soil erosion and crusting, rolling could be postponed to post-emergence.

To evaluate the effect of post-emergence rolling, a trial was conducted at the organic trial farm of Osnabrück University of Applied Sciences in in 2018 and 2019. Rolling was conducted in plant development stage BBCH 11 and BBCH 12/13 with two different types of rollers on two cultivars of soybeans (maturity group 000).

Late rolling resulted in a curvature of the lowest internode leading to significantly lowered first pod heights compared to the control. However, this did not lead to a change in harvest losses, thus yield differences could only be explained by variety differences. Rolling soybeans can improve harvestability on stony soils. To reduce labour peaks, the risk of erosion and crusting rolling can be postponed to post-emergence. Though it should be done before BBCH 12 to prevent plant losses and lowered first pod heights.