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# Study of Environmental Impacts Before and After Using the Organic-Chemical Fertilizer in Rice Paddy Fields

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## ABSTRACT

The environmental impact of an organic-chemical fertilizer developed by the Institute of National Science and Technology has been studied at Bansrangsabaeng Posai Ubonratchathani. The study revealed that the values of pH, EC, OC, total N, available P, and exchangeable K in soils from two varieties of rice tested Kor-Khor 10 and Kor-Khor 15 paddy fields are almost the same. The concentrations of VOC, $NH_3$, and $CH_4$ in the air from the rice paddy fields mentioned above are lower than 0.001 mg/m$^3$ indicating no air pollution problems. Analysis of the water supply (ground water) and surface water within the studied area before and after using organic-chemical fertilizer, found that most of the water supply parameters including pH, Total Hardness, TDS, SS, Fe, Mn, and $NO_3$-N were not significantly changed and all of them met water supply standards. In terms of surface water quality, slightly different values of pH, TDS, SS, $NO_3$-N, TKN, $PO_4$-P, BOD, COD, and DO were observed compared with a standard fertilizer. In conclusion, the organic-chemical fertilizer is a viable alternative to standard chemical fertilizer and may help to reduce the environmental impact of such chemicals upon the land.

**Keywords:** Organic-chemical fertilizer, rice paddy fields, air quality, water quality, soil quality, environmental impact

## INTRODUCTION

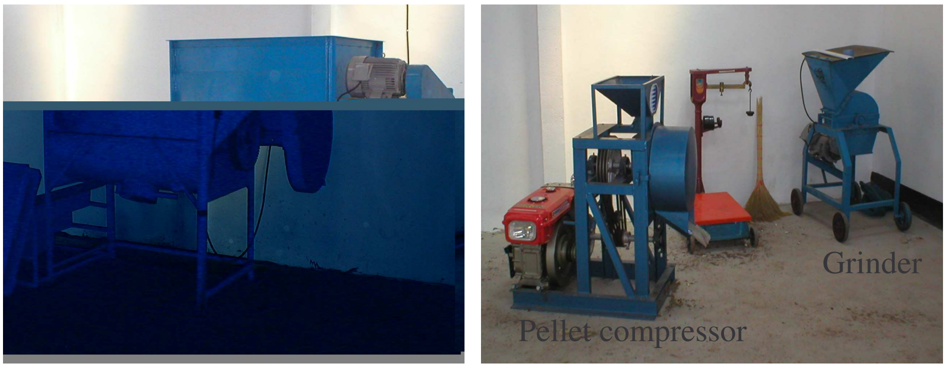
Thailand is an agricultural country, its economy is mostly dependent on agricultural products such as rice. There are approximately 53.24 million acres of farming [1], however, the efficiency of agricultural productions is relatively low due to the shortage of organic matter and nutrition in the soil. Between 1987 and 1992, the government passed national economic development policy number 6 in which agricultural production efficiency was to be enhanced [1]. The utilization of chemical fertilizer was one of the actions to respond to the policy because of its rapid enhancement of production rates. Since then, chemical fertilizers have been widely used in the entire country. Nevertheless, using chemical fertilizer can eventually affect the quality of the soil [1], for example, acidity, soil compression, and organic matter depletion. Furthermore, the manufacture of chemical fertilizer also impacts upon human health and the environment. Therefore, to resolve these problems, organic-chemical fertilizer with 12-8-4 (N-P-K) formula was proposed as an alternative to augment the organic matter and nutrition in soil while minimizing environmental impact. (This organic-chemical fertilizer is composed of 900 kilograms of cow maneuvers, 5 kilograms of urea fertilizer with 46-0-0 formula, 900 kilograms of bagasse, and 5 liters of EM solution. However, this organic-chemical fertilizer still may not have sufficient nutrition and addition of a chemical fertilizer of formula 15-15-15 along with it is recommended.) In addition, farmers can benefit financially by earning more income from the manufacture of organic-chemical fertilizer. Finally using organic materials to produce the fertilizer can decrease the problem of solid waste management in the local areas. However there is a lack of scientific evidence to verify the hypothesis that organic-chemical fertilizer would definitely diminish environment influence, thus this work will provide the results to examine this hypothesis.

## MATERIALS AND METHODS

### Organic-chemical fertilizer production

The Institute of Science and Technology Development in Thailand (WT.) has been researching and developing the process of manufacturing an organic-chemical fertilizer which can be simplified for local production by farmers. The production process and procedure, material supply and equipment needed were detailed documented by WT. The

Science and Technology Ministry provided technical and financial support to several areas to construct a model factory for the production of organic-chemical fertilizer. In Ubonratchathani, the factory was constructed in Bansrangsabaeng Posai in 2003. The organic-chemical fertilizer produced there is "formula 12-8-4" to accelerate the growth rate of crops. A set of instruments used in the manufacturer comprised of: 1) a horizontal fertilizer mixer (3-horse power), 2) an organic fertilizer grinder (2-horse power), and 3) a pellet compressor (10-horse power). **Figure 1** illustrates these instruments.




(a) (b)

**Figure 1** (a) the horizontal fertilizer mixer, (b) the organic fertilizer grinder and the pellet compressor.

## Case Study Area

The experiments were done at the three rice paddy fields of Mrs. Tieng Aangsin at number 59 Moo.10 Bansrangsabaeng Posai Ubonratchathani. These three rice paddy fields were: 1) Kor-Khor 10 field which is on high land, 2) Kor-Khor 15 field which is on flat land and 3) Kor-Khor 15 field in which only the chemical fertilizer was used. The soil and air samples from these fields were collected for the soil and air quality analysis which will be further elaborated in the following section. Water samples were collected at four different places: 1) the starting point of the water supply distribution system, 2) the end point of the water supply distribution system near the organic-chemical fertilizer factory, 3) the surface water in the reservoir near the organic-chemical fertilizer factory, and 4) the surface water in the Kanrai canal. **Figure 2** illustrates the various locations for the collection of soil, air, and water samples.

(a) (b)

(c) (d)

**Figure 2** (a) air and soil sampling location during planting season, (b) air and soil sampling location at the end of planting season, (c) water sampling location near the water supply distribution system, and (d) water sampling location for surface water at the Kanrai canal.

## Samples

*Soil samples*: Samples were collected at three different fields as depicted earlier at the two different levels, 0 - 15 cm from ground level and 15 - 30 cm from ground level. There were a total of sixteen samples from the three fields at two levels during the studied period. Shovels and bags were used to collect the samples.

*Air samples*: Samples were collected at 2 meters above surface using pump model 224-TCXR (SKC Inc.) and tedlar bags. Twelve samples from the three fields were collected during the study.

*Water samples*: Sixteen samples were collected at four different sites by the grab sampling method from the places mentioned previously. Water samples were kept in an ice box to maintain a constant temperature for subsequent analysis.

## Analyzed parameters

### *Soil*

Several parameters were analyzed from soil samples including the levels of nitrogen (N), phosphorus (P), potassium (K), acidity and salinity. Organic matter is a source of nitrogen in soil. Nitrogen which can be absorbed into crop roots must be in an inorganic form such as nitrate ($NO_3^-$) or ammonium ($NH_4^+$). Release of inorganic nitrogen into soil primarily proceeds through the degradation of microorganisms. The rate of release depends on several parameters such as temperature, soil moisture, soil ventilation and pH. The level of nitrogen is analyzed in two steps. First, degradation of organic matter with acid and second, distillation of ammonia. Nitrogen in soil is conventionally reported as percentage of organic matter (g of organic matter/100 g of soil). The higher the percentage of organic matter, the more available nitrogen in the soil. Typical values of nitrogen in mineral soil are 0.1 - 5.0 % [2,3].

Phosphorus absorbed by crops must be in a negative ion form. Available P can be analyzed based on the Bray II method by dissolving minerals in soil using a mixture of 0.1 N HCl and 0.03 N $NH_4F$ as an extracting agent. Available P can be extracted in various forms (Ca-P, A1-P, Fe-P), but is mostly present in the Ca-P form.

Potassium which is practical for crops is primarily in an exchangeable K form. Soluble K, though it is easily absorbed by crops, is a trivial fraction in soil. Thus, analysis was focuses on the level of exchangeable K. The analysis is performed by extracting K in the soil using ammonium acetate, then the K concentration measured by a flame spectrophotometer [2,3].

The level of acidity in soil is generally measured by a pH meter. The ratio of soil to solution (distilled water) in this study was 1:1. A pH ranging from 5.5 to 7.0 is appropriate for agricultural activity. At a pH lower than 4.0, lime will be used to decrease the acidity.

The level of salt in soil is important as too much salt can prohibit crop growth. Naturally, salty soil is found on the coast and in northeastern regions. The level of salt in the soil was determined by measurement of the conductivity using an EC meter with a soil to water ratio of 1:5. The higher the conductivity, the saltier the soil. Rice can grow well if the EC value is less than 700 μs/cm.

***Water***

The parameters examined for the water samples were pH, Biochemical Oxygen Demand (BOD) and Dissolved Oxygen (DO). The concentration of hydrogen ions is commonly expressed in terms of the pH scale. Low pH corresponds to high hydrogen ion concentration and vice versa. pH is generally referred to as an indicator to specify the acidity or alkalinity of substance. For surface water, regulation mandates that the pH is in the range 5 - 9 [4].

Biochemical Oxygen Demand is basically a measurement of the amount of oxygen that would be consumed if all the organics in one liter of water were oxidized by bacteria and protozoa. BOD usually reported is known as $BOB_5$ which is the difference between oxygen levels on the fifth day after incubation and on the first day before incubation. According to water quality regulations, the BOD of surface water should not exceed 2 mg/L [4].

**Table 1** Water quality standard appropriating for aquatic life [5].

| Parameter | Regulation | Note |
|---|---|---|
| DO | At least 3 mg/L and less than 110 % of the saturation level | Saturation level for different categories of water is reported in Water Chemistry textbooks. |
| $CO_2$ | Less than 30 mg/L with sufficient dissolved oxygen | |
| pH | Above 5 and below 9 with daily variation less than 2.0 | |
| Temperature | 23 - 32 $^oC$ | |
| Turbidity | Transparency range is 30 - 60 cm. Suspended solids less than 25 mg/L | Measured by Secchi disc |

Dissolved Oxygen is the amount or volume of oxygen that is contained in water. The amount of oxygen that can be held by the water depends on the water temperature, salinity, and pressure. DO is a very important indicator of a water body's ability to support aquatic life. Fish "breathe" by absorbing dissolved oxygen through their gills. Oxygen enters the water by absorption directly from the atmosphere or by aquatic plant and algae photosynthesis. Oxygen in water is removed through respiration and decomposition of organic matter. The regulation for DO in surface water is at least 4 mg/L [4]. Examples of water quality standards appropriate for aquatic life are tabulated in **Table 1**.

***Air***

Rice paddy fields greatly contribute to methane, volatile organic compound and ammonia emissions [6,7]. The emissions are produced by the degradation of microorganisms under anaerobic conditions. The parameters analyzed in the air samples were methane gas ($CH_4$), volatile organic compounds (VOCs) and ammonia ($NH_3$).

Rice agriculture is possibly the biggest source of anthropogenic methane gas emission. Approximately 50 to 100 million tons per year of methane gas are released from rice fields [8]. The warm, waterlogged soil of rice paddies provides ideal conditions for methanogenesis, and though some of the methane gas produced is usually oxidized by methanotrophs in the shallow overlying water, the vast majority is released into the atmosphere. Rates of methane gas emission may vary spatially and temporally depending on average temperature, water depth and the length of time that the rice paddy soil is waterlogged [9-11]. Emissions from rice paddies can vary largely during the course of a year [10]. On average, the rice paddy soil is only fully waterlogged for about 4 months each year. For the rest of the time methanogenesis is generally much reduced and, where the soil dries out sufficiently, rice paddy soil can become a temporary sink for atmospheric methane. Methane gas is one of the most significant greenhouse gases and is linked to global warming [12]. Methane gas contributes to approximately 20 % to the greenhouse effect globally and its life cycle is 8 years [13].

Volatile organic compounds are substances that have a high vapor pressure and low water solubility. VOCs can evaporate easily. They are colorless, odorless, and tasteless. VOCs constitute a very wide range of individual substances, such as hydrocarbons (for example benzene and toluene), halocarbons and oxygenates. VOCs are involved in the formation of ground level ozone and in the depletion of the ozone layer [14]. They also contribute to the greenhouse effect in that methane gas and photochemical oxidants produced from the use of VOCs are both greenhouse gases. Thus they have both local and regional effects.

Ammonia ($NH_3$): Ammonia is the dominant gaseous base in the atmosphere and a principal neutralizing agent for atmospheric acids. Therefore the availability of alkaline soil dust and gaseous $NH_3$ in the atmosphere may control the acidity of precipitation. $NH_3$ can evaporate and react to form ammonium nitrate or ammonium sulfate and thereby contribute to airborne particulate matter (PM). There are several constraint factors of $NH_3$ emissions from chemical fertilizers. High $NH_3$ volatilization is strongly associated with high soil pH (7-9) levels. The moisture of the soil can strongly influence $NH_3$ losses. Moist soils can emit more $NH_3$ than drier soils [15-18]. Moreover, temperatures and strong winds may interact with humidity and soil moisture to promote higher volatilization. In addition to chemical fertilizer sources, $NH_3$ volatilization losses from organic fertilizers can be substantial. Use of liquid manure may result in loss of up to >90 % of ammonium nitrogen from the organic mixture, depending on the intensity of sunlight during field application [19].

## Analyzing Methods

Analyzing methods used in this study to examine the properties of soil, air, and water samples are reported in **Table 2**.

**Table 2** Analyzing methods for soil, air, and water samples.

| Number | Parameter | Analyzing Method |
|---|---|---|
| Soil Samples (3) | | |
| 1 | pH (1:1) | pH meter |
| 2 | EC (1:5) µs/cm | EC meter |
| 3 | Organic matter (%) | Walkley and Black (1982) |
| 4 | Total Nitrogen (%) | Kjedalh Flask |
| 5 | Available Phosphorus (ppm) | Vonado-Molybdate |
| 6 | Exchangeable Potassium (ppm) | Atomic Absorption Spectrophotometer |
| Air Samples (20) | | |
| 7 | VOC | GC-MS |
| 8 | Ammonia gas | GC-MS |
| 9 | Methane gas | GC-MS |
| Water Samples (21) | | |
| 10 | pH | Electrometric Method |
| 11 | Biochemical oxygen demand (BOD, mg/L) | Azide Modification |
| 12 | Total dissolved solids (TDS, mg/L) | Drying at 103-105 $^{o}$C 1 hr |
| 13 | Suspended solids (SS, mg/L) | Drying at 103-105 $^{o}$C 1 hr |
| 14 | Iron (Fe, mg/L) | Phenanthroline Method |
| 15 | Manganese (Mn, mg/L) | Persulfate Method |
| 16 | Dissolve oxygen (DO, mg/L) | Membrane Electrode Method |
| 17 | Nitrate-nitrogen ($NO_3$-N, mg/L) | Cadmium Reduction Method |
| 18 | Hardness (mg/L as $CaCO_3$) | Indicator Method |
| 19 | Total Kjeldahl Nitrogen (TKN, mg/L) | Kjeldahl Method |
| 20 | Phosphate-Phosphorus ($PO_4$-P, mg/L) | Ascorbic Acid Method |

## RESULTS AND DISCUSSION

Soil, air, and water samples were analyzed to study their properties before and after first time usage of organic-chemical fertilizer. The soil quality parameters for the selected three fields are compared in **Table 3**. The results show that the values of pH for all soil samples were lower than 5. The values of EC, the soil salinity indicator, were very low and reduced further after application of the organic-chemical fertilizer. The soil samples contained relatively low amounts of organic matter (OM), total nitrogen (N), and exchangeable potassium (K). Most soil samples, however, had enough available phosphorus for rice to grow.

**Table 4** depicts the analytical results of air samples from the same fields as above. It was found that the concentrations of VOCs, $CH_4$ and $NH_3$ in all air samples from both before and after using the organic-chemical fertilizer were lower than 0.001 mg/m$^3$. Since the farmers in this study area have not used any pesticide for a long time levels of VOCs in the ambient air were extremely low. The very low concentrations of $NH_3$ and $CH_4$ gas, may possibly be due to the small amounts of nitrogen and organic matter left in the soil. The results also indicate that the amounts of the three parameters were not affected by use of the organic-chemical fertilizer.

**Table 3** Soil Characteristics for the three periods: 1) beginning of the planting season, 2) during the planting season, and 3) harvesting season.

| Parameter | Kor-Khor 15 field (Flat Land) At depth 0 - 15 cm | | | Kor-Khor 15 field (Flat Land) At depth 15 - 30 cm | | | Kor-Khor 10 field (High Land) At depth 0 - 15 cm | | | Kor-Khor 10 field (High Land) At depth 15 - 30 cm | | | Chemical fertilizer field At depth 0 - 15 cm | | Chemical fertilizer field At depth 15 - 30 cm | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1*** | **2*** | **3*** | **1*** | **2*** | **3*** | **1*** | **2*** | **3*** | **1*** | **2*** | **3*** | **2*** | **3*** | **2*** | **3*** |
| pH (1:1) | 4.31 | 5.11 | 4.15 | 4.89 | 4.71 | 4.22 | 4.56 | 4.64 | 4.23 | 4.27 | 4.71 | 4.63 | 4.63 | 4.63 | 4.77 | 4.72 |
| EC (1:5) μs/m | 36.50 | 31.00 | 31.50 | 27.00 | 13.00 | 12.00 | 31.00 | 13.50 | 23.00 | 39.50 | 11.00 | 11.00 | 50.00 | 71.00 | 18.75 | 17.50 |
| Organic matter (%) | 1.05 | 1.03 | 0.77 | 0.49 | 0.30 | 0.42 | 0.96 | 0.85 | 0.79 | 0.40 | 0.46 | 0.43 | 2.07 | 1.46 | 0.67 | 0.53 |
| Total N (%) | 0.07 | 0.08 | 0.05 | 0.05 | 0.03 | 0.03 | 0.06 | 0.06 | 0.06 | 0.04 | 0.04 | 0.03 | 0.11 | 0.08 | 0.06 | 0.04 |
| Available P (ppm) | 48.50 | 31.05 | 36.07 | 3.33 | 5.58 | 25.85 | 31.80 | 19.12 | 35.67 | 5.51 | 5.58 | 8.37 | 4.60 | 5.72 | 1.73 | 4.82 |
| Exchangeable K (ppm) | 41.08 | 24.41 | 14.11 | 38.23 | 16.68 | 14.84 | 62.77 | 42.76 | 45.04 | 13.62 | 42.16 | 43.18 | 140.30 | 163.55 | 87.41 | 96.41 |

1* = Beginning of planting season (June, 16, 2003)

2* = During planting season (October, 31, 2003)

3* = End of Planting Season (December, 26, 2003)

**Table 4** Air quality analysis results for four periods: 1) beginning of the planting season, 2) during the planting season 1 (September 17, 2003), 3) during the planting season 2 (October 31, 2003), and 4) end of the planting season.

| **Parameter** | **Kor-Khor 15 field (flat land)** | | | | **Kor-Khor 10 field (high land)** | | | | **Chemical fertilizer field** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1*** | **2.1*** | **2.2*** | **3*** | **1*** | **2.1*** | **2.2*** | **3*** | **1*** | **2.1*** | **2.2*** | **3*** |
| VOC | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| $NH_3$ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| $CH_4$ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |

ND = not detectable (< 0.001 $mg/m^3$)

1* = Beginning of planting season (June, 16, 2003)

2.1* = During planting season (September, 17, 2003)

2.2* = During planting season (October, 31, 2003)

3* = End of planting season (December, 26, 2003)

**Table 5** shows the results of water quality parameters for water supply (groundwater) and surface water. From the results, it is seen that the water quality parameters when using the organic-chemical fertilizer were almost the same as the ones when using the chemical fertilizer and these parameters did not exceed the water supply (groundwater) standards. The results also show that there were slight differences in water quality parameters compared with use of the organic-chemical fertilizer or the chemical fertilizer. Most of these parameters were well within the class 3 surface water standards except for the BOD concentration from the reservoir near the organic-chemical manufacturing factory at the end of the planting season. This effect may be caused by the shortage of water in the reservoir during summer resulting in the enhancement of algae growth which could be observed by the relatively high suspended solids concentration. Since the amount of algae cells in the water can directly influence the BOD concentration, the BOD of the reservoir would be expected to be fairly high (28.5 mg/L). However, the large number of suspended solids from the reservoir during the planting season may be the resulted of soil erosion. Therefore, this high suspended solid concentration had little impact on BOD concentration. The results also show a slight decrease in COD concentration after using the organic-chemical fertilizer. This reduction may be explained by the diminished amount of inorganic matter in the organic-chemical fertilizer.

**Table 5** Water quality analysis results for four periods: 1) beginning of the planting season, 2) during the planting season 1 (September 17, 2003), 3) during the planting season 2 (October 31, 2003), and 4) end of the planting season.

| **Parameter** | **Water supply from groundwater (the starting point of water supply distribution system)** | | | | **Water supply from groundwater (the ending point of water supply distribution system)** | | | | **Surface water (the reservoir near the organic-chemical manufacturing factory)** | | | | **Surface water (the Kanrai canal)** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1.0*** | **2.1*** | **2.2*** | **3.0*** | **1.0*** | **2.1*** | **2.2*** | **3.0*** | **1.0*** | **2.1*** | **2.2*** | **3.0*** | **1.0*** | **2.1*** | **2.2*** | **3.0*** |
| pH | 7.3 | 7.4 | 7.5 | 8.1 | 7.3 | 7.5 | 7.6 | 8.1 | 7.0 | 7.2 | 7.1 | 8.7 | 7.2 | 7.2 | 7.10 | 7.60 |
| Hardness (mg/L as $CaCO_3$) | 181.6 | 175.0 | 198.4 | 184.0 | 181.6 | 173.0 | 203.6 | 192.0 | - | - | - | - | - | - | - | - |
| Total dissolved solids, TDS (mg/L) | 450.0 | 444.0 | 404.0 | 260.0 | 450.0 | 464.0 | 444.0 | 255.0 | 426.0 | 324.0 | 284.0 | 43.0 | 300.0 | 196.0 | 236.0 | 28.0 |
| Suspended solids, SS (mg/L) | 8.0 | 1.0 | 4.0 | 4.0 | 8.0 | 12.0 | 12.0 | 32.0 | 12.0 | 16.0 | 296.0 | 76.0 | 10.0 | 60.0 | 60.00 | 8.00 |
| Iron, Fe (mg/L) | < 0.10 | < 0.10 | 0.13 | 0.14 | < 0.10 | < 0.10 | 0.11 | 0.11 | - | - | - | - | - | - | - | - |
| manganese, Mn (mg/L) | < 0.10 | < 0.10 | 0.30 | 0.28 | < 0.10 | < 0.10 | 0.20 | 0.20 | - | - | - | - | - | - | - | - |
| Nitrate-Nitrogen, $NO_3$-N (mg/L) | < 1.00 | 0.07 | 0.01 | 0.03 | < 1 | 0.04 | 0.06 | 0.03 | < 1.00 | 0.11 | 0.08 | 0.23 | < 1.00 | 0.16 | 0.02 | 0.04 |

1.0* = Beginning of planting season (June, 16, 2003)

2.1* = During planting season (September, 17, 2003)

2.2* = During planting season (October, 31, 2003)

3.0* = End of planting season (December, 26, 203)

- = Data not available

## CONCLUSIONS

The analytical results from the study show that the soil quality parameters after using the organic-chemical fertilizer were almost the same as the ones before using the organic-chemical fertilizer. The concentrations of VOC, $NH_3$, and $CH_4$ were lower than 0.001 mg/m$^3$. The analysis of the water supply (ground water) and surface water within the studied area before and after using organic-chemical fertilizer, showed that most of the water supply parameters including pH, Total Hardness, TDS, SS, Fe, Mn, and $NO_3$-N did not change significantly and all of them meet the water supply standards. Analysis of the surface water quality revealed the slightly different values of pH, TDS, SS, $NO_3$-N, TKN, $PO_4$-P, BOD, COD, and DO. However, there was a trend of COD reduction after the use of the organic-chemical fertilizer. Overall, these values meet the class 3 surface water standards. In conclusion, the utilization of the organic-chemical fertilizer or chemical fertilizer yields similar results for the quality of soil, water and air. However, use of the organic-chemical fertilizer appears to reduce environmental problems. Further long term studies will be needed to support this conclusion.

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## บทคัดย่อ

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**การศึกษาผลกระทบทางสิ่งแวดล้อม ก่อนและหลังการเปลี่ยนมาใช้ปุ๋ยอินทรีย์เคมีในแปลงนาข้าว**

สถาบันวิจัยวิทยาศาสตร์และเทคโนโลยีแห่งประเทศไทย ได้ดำเนินการวิจัยการผลิตปุ๋ยอินทรีย์เคมีสำหรับเกษตรกร และได้สนับสนุนการสร้างโรงงานผลิตปุ๋ยต้นแบบในหลายพื้นที่ รวมทั้งที่บ้านสร้างสะแบง อำเภอโพธิ์ไทร จังหวัดอุบลราชธานี ทั้งนี้ได้มีการคาดหวังว่าการเปลี่ยนมาใช้ปุ๋ยอินทรีย์เคมี จะช่วยลดปัญหาจากการใช้ปุ๋ยเคมี และผลกระทบต่อสิ่งแวดล้อม อย่างไรก็ตามความเชื่อที่ว่านี้ยังขาดหลักฐานยืนยันทางวิทยาศาสตร์ ดังนั้นการศึกษาและวิเคราะห์ผลกระทบทางสิ่งแวดล้อม ก่อนและหลังการเปลี่ยนมาใช้ปุ๋ยอินทรีย์เคมีในแปลงนาข้าวในช่วงต้นจนถึงปลายฤดูเพาะปลูกที่บ้านสร้างสะแบงจะเป็นแนวทางในการพิสูจน์สมมติฐานข้างต้น ผลจากการศึกษา พบว่าค่าพารามิเตอร์ต่างๆ ประกอบด้วย pH, EC, OC, Total N, Available P และ Exchangeable K ของตัวอย่างดินจากแปลงข้าว กข. 10 และ 15 มีค่าไม่แตกต่างกันมาก ทั้งก่อนและหลังการเปลี่ยนมาใช้ปุ๋ยอินทรีย์เคมี ค่าความเข้มข้นของ VOC, $NH_3$ และ $CH_4$ ในอากาศจากจุดเก็บตัวอย่างจากแปลงนาข้าวดังกล่าว มีค่าน้อยกว่า 0.001 มิลลิกรัมต่อลูกบาศก์เมตร ซึ่งไม่ก่อให้เกิดปัญหามลพิษทางอากาศ สำหรับผลจากการตรวจวิเคราะห์คุณภาพน้ำประปา (บาดาล) และน้ำผิวดินในเขตพื้นที่ทำการศึกษา ทั้งก่อนและหลังการเปลี่ยนมาใช้ปุ๋ยอินทรีย์เคมี พบว่าพารามิเตอร์ส่วนใหญ่ของน้ำประปา อันได้แก่ pH, Total Hardness, TDS, SS, Fe, Mn และ $NO_3$-N มีค่าใกล้เคียงกัน และอยู่ในเกณฑ์มาตรฐาน สำหรับน้ำผิวดิน พารามิเตอร์ที่ตรวจวิเคราะห์ประกอบด้วย pH, TDS, SS, $NO_3$-N, TKN, $PO_4$-P, BOD, COD และ DO พบว่ามีค่าแตกต่างกันเพียงเล็กน้อย โดยค่า COD ลดลงหลังการเปลี่ยนมาใช้ปุ๋ยอินทรีย์เคมี โดยรวมค่าพารามิเตอร์ต่างๆอยู่ในเกณฑ์มาตรฐานสำหรับน้ำผิวดินประเภท 3 สรุปแล้วการเปลี่ยนมาใช้ปุ๋ยอินทรีย์เคมีทำให้ค่าพารามิเตอร์ที่บ่งบอกคุณภาพของดิน น้ำ และอากาศไม่แตกต่างจากการใช้ปุ๋ยเคมีมากนัก แต่อย่างไรก็ตามผลจากการวิจัยมีแนวโน้มบ่งบอกว่าการใช้ปุ๋ยอินทรีย์เคมีช่วยลดผลกระทบต่อสิ่งแวดล้อม ทั้งนี้ควรมีการศึกษาเพิ่มเติมในระยะยาวเพื่อยืนยันแนวโน้มดังกล่าว

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