Content List Available at ThaiJo

Khon Kaen Agriculture Journal

Journal Home Page : https://li01.tci-thaijo.org/index.php/agkasetkaj

Effects of composts made from different residues on growth and quality of Khao Dawk Mali 105 (*Oryza sativa* L.) in Chumphon Buri series

Paweena Saleethong[1]*, Supatra Khabuanchalad[1], Laddawan Kammapana[1] and Auemporn Junsongduang[2]

[1] *Faculty of Agriculture and Technology, Rajamangala University of Technology Isan Surin Campus, Surin Province*
[2] *Liberal of Arts and Science Faculty, Roi Et Rajabhat University, Roi Et Province*

ABSTRACT: This study compared the effects of composts made from various materials combined with the leaves of *Samanea saman* (rain tree) and *Mimosa pudica* (shy plant) on Khao Dawk Mali 105 rice's growth and quality in Surin province, Thailand. The nine treatments include: T1-Rain tree, T2-Rain tree+Indian mulberry, T3-Rain tree +shellfish, T4-Rain tree+Wildbetal leafbush+Vietnamese mint, T5-Shy plant, T6-Shy plant+Indian mulberry, T7-Shy plant+shellfish, T8-Shy plant+Wildbetal leafbush+Vietnamese mint and T9-chemical fertilizers. Post-harvest soil analysis showed higher organic matter, P and Ca in compost-treated soils compared to soil that received chemical fertilizer. Rice yield was highest with composts containing Vietnamese mint and Wildbetal leafbush leaves. The 2-AP content in rice treated with *Samanea saman* and *Morinda pudica* L. (Indian mulberry) leaves compost was similar to chemically fertilized rice. All treatments had similar antioxidant content (Total phenolic, DPPH, FRAP). Nutrient analysis of the rice grains showed that N and Fe were highest in rice treated with chemical fertilizer, while Ca level was highest in rice treated with *Samanea saman* and *Mimosa pudica* leaves composts. P, K and Mn levels were similar across all treatments. The study concluded that compost made from leguminous plants provides crop quality that is comparable to chemical fertilizers in some aspects.
Keywords: compost; grain quality; *Mimosa pudica*, *Samanea saman*; rice

Introduction

Khao Dawk Mali 105, a premium fragrant rice variety with excellent cooking qualities and a pleasant aroma due to 2-Acetyl-1-Pyrroline (2-AP), is a significant export commodity for Thailand. The primary growing area is in the northeastern region, covering approximately 15 million rai, but yields remain relatively low. Fertilizer, either chemical or organic, plays a crucial role in rice cultivation. Chemical fertilizers often result in higher yields. However, extended use of chemical fertilizers may result in soil hardening and loss of soil structure. In contrast, organic fertilizers improve soil quality. Rice growers are encouraged to use compost made from local weeds such as water hyacinth, *Samanea saman* leaves, *Mimosa pudica* leaves, and Lead tree leaves, which contain essential nutrients for plant growth. Micronutrients and trace elements also promote rice grain quality. Researchers have studied the effects of various nutrient concentrations on Khao Dawk Mali 105 rice. According to the study conducted by In-nok and Poomipan (2016) comparing chemical and organic fertilizer applications on Khao Dawk Mali 105 rice quality in Surin Province,

* Corresponding author: paweena.sl@rmuti.ac.th
Received: date; March 17, 2025 Revised: date; August 31, 2025
Accepted: date; September 3, 2025 Published: date; February 6, 2026

the results showed that organically fertilized rice exhibited softer, more glutinous texture and superior nutritional content compared to chemically fertilized rice. Likewise, Sukyankij et al. (2024) conducted a comparative study of water hyacinth compost and vermicompost quality in Pathum Thani fragrant rice, finding that seed weight yield was similar to that achieved with chemical fertilizers, and additionally resulted in enhanced soil organic matter and potassium content.

This experiment aimed to investigate the utilization of local weeds including *Samanea saman* leaves, *Mimosa pudica* leaves, and water hyacinth plants and weeds that are abundantly present in the locality along with examining their synergistic effects when combined with other plants and materials such as Indian mulberry, Vietnamese mint and Wildbetal leafbush and shellfish on the physical, chemical, and nutritional quality of Khao Dawk Mali 105 rice grain production through different organic compost formulas.

Materials and methods

Study method

A field experiment was conducted using a Randomized Complete Block Design (RCBD) with nine treatments and four replications. The study was carried out in Prai Khla subdistrict, Chumphon Buri district, Surin province. The experimental site was located in Chumphon Buri soil series with soil classification Coarse-loamy, mixed, active, isohyperthermic Typic Dystrustepts at Latitude 15.345951802537229 and Longitude 103.54467302348898. To determine the initial soil properties and nutrient status, composite soil samples were collected from the experimental site prior to the commencement of the study. Soil properties prior to conducting the experiment are presented in **Table 1**.

Table 1 Chemical properties and nutrient content of the soil before the application of composts prepared from various materials combined with *Samanea saman* and *Mimosa pudica* leaves

Chemical Properties and Nutrient Content:	Result
pH	6.31
Organic Matter (g/kg)	0.40
Electrical Conductivity (EC) (dS/m)	2.70
Total Nitrogen (mg/kg)	0.15
Available Phosphorus (mg/kg)	7.39
Exchangeable Potassium (mg/kg)	0.04
Exchangeable Calcium (mg/kg)	259.08

pH using soil-water suspension method (ISO 10390: 2005); electrical conductivity (EC) using soil-water suspension method (ISO 11265: 1994); organic matter (OM) content using the Walkley-Black method (Walkley and Black, 1934); total Nitrogen (TN) using the Kjeldahl method (AOACc, 2019); Phosphorus (P) using the vanadomolybdophosphoric acid colorimetric method (AOACb, 2019); Potassium (K), Calcium (Ca), Magnesium (Mg), Iron (Fe), Manganese (Mn), Zinc (Zn), and Copper (Cu) using exchangeable cation method (AOACd, 2019); and Sulfur (S) using the barium chloride method (USDA, 2014). The results are presented in **Table 2**.

The compost formulas were as follows:

T1- *Samanea saman* leaves/rice husk charcoal/rice bran/water hyacinth at a ratio of 1:1:1:2.

T2- *Samanea saman* leaves/rice husk charcoal/rice bran/water hyacinth/Indian mulberry leaves at a ratio of 1:1:1:1:1.

T3- *Samanea saman* leaves/rice husk charcoal/rice bran/water hyacinth/shellfish waste at a ratio of 1:1:1:1:1.

T4- *Samanea saman* leaves/rice husk charcoal/rice bran/water hyacinth/ Vietnamese mint and Wildbetal leafbush leaves at a ratio of 1:1:1:1:1.

T5- *Mimosa pudica* leaves/rice husk charcoal/rice bran/water hyacinth at a ratio of 1:1:1:2.

T6- *Mimosa pudica* leaves/rice husk charcoal/rice bran/water hyacinth/Indian mulberry leaves at a ratio of 1:1:1:1:1.

T7- *Mimosa pudica* leaves/rice husk charcoal/rice bran/water hyacinth/shellfish waste at a ratio of 1:1:1:1:1.

T8- *Mimosa pudica* leaves/rice husk charcoal/rice bran/water hyacinth/ Vietnamese mint and Wildbetal leafbush leaves at a ratio of 1:1:1:1:1.

In the plot treated with chemical fertilizers: T9, the application rate was determined based on the analysis of soil chemical properties and nutrient content. The plot received an NPK fertilizer (15-15-15) (commercial grade) at the rate of 30 kg/rai as a basal application 10 days after transplanting, and a 46-0-0 fertilizer (commercial grade) at the rate of 15 kg/rai as a top dressing during the booting stage.

In the plots treated with compost, organic fertilizers were applied as a basal application before rice transplanting at a rate of 500 kg/rai. The composted materials included water hyacinth, *Samanea saman* leaves, *Mimosa pudica* leaves, rice husk charcoal, rice bran, and a microbial inoculant (Super PD). The compost piles were turned every 7 days, and moisture content was maintained at 60% during the 60-day composting process before application. Chemical properties and nutrient contents of the composts were analyzed as follows:

Khao Dawk Mali 105 rice was transplanted using 30-day-old seedling, with a spacing of 25 × 25 cm between plants. The rice was harvested 135 days after transplanting (DAT).

Data collection

Experimental data on rice growth components and yield were collected by randomly sampling 10 hills per subplot. The rice samples were analyzed as follows:

1. Yield quality: Number of panicles per hill, number of spikelets per panicle, number of filled grains, number of unfilled grains, 1,000-grain weight of paddy, and 1,000-grain weight of brown rice.

2. Physical quality: Width and length of brown rice grains using a Vernier caliper.

3. Chemical quality of brown rice grains: 2-Acetyl-1-pyrroline (2-AP) content using Automated Headspace Gas Chromatography-Nitrogen Phosphorus Detector (GC-NPD) technique (AOACa, 2019).

4. Nutritional quality: Total phenolic compounds using the Folin-Ciocalteu phenol test (Folin and Ciocalteu, 1927); DPPH (1,1-Diphenyl-2-picrylhydrazyl) radical scavenging activity (Brand-Williams et al., 1995); and Ferric Reducing Antioxidant Power (FRAP) assay (Benzie and Strain, 1999).

5. Nutrient content in rice plants at the booting stage and in rice grains after harvest: Total nitrogen (TN) using the Kjeldahl method (AOACc, 2019); phosphorus (P) using the vanadomolybdophosphoric acid colorimetric method (AOACb, 2019); and potassium (K), calcium (Ca), magnesium (Mg), iron (Fe) using Atomic Absorption Spectrophotometry (AOACe, 2019).

Statistical Analysis

All data were analyzed using SPSS version 22 software. Analysis of variance (ANOVA) was performed to determine the differences among treatments. The treatment means were compared using Duncan's multiple range tests (DMRT) at a 95% level of confidence.

Results and discussion

Nutrient analysis of composts prepared from various materials combined with *Samanea saman* and *Mimosa pudica* leaves

The nutrient analysis of composts prepared from various materials combined with *Samanea saman* and *Mimosa pudica* leaves **(Table 2)** showed that all experimental treatments met the quality standards for non-liquid organic fertilizers set by the Department of Agriculture (2012). Water hyacinth, a weed containing essential plant nutrients, was used as the main raw material for compost production. Yasaeng et al. (2020) similarly found that organic fertilizer produced from water hyacinth with a specific ratio of leonardite, volcanic rock, pig manure, and chicken manure met the organic fertilizer standards. Sukyanki et al. (2021) reported that water hyacinth compost had higher pH, electrical conductivity, and potassium content than vermicompost, while Gosal et al. (2022) found that water hyacinth compost at 200 g/plant maximized maize growth.

Leaves from leguminous plants like *Samanea saman* and *Mimosa pudica* are also commonly used in compost production due to their high nitrogen content. Thongboonrit et al. (2018) and Thongthanee (2018) found that composts made from rain tree leaves had high nitrogen and organic matter content. Another raw material used was thornless mimosa (*Mimosa invisa*), which can be used as green manure. Anna et al. (2007) found that intercropping thornless mimosa between rows of sweet corn increased yield from the 3rd cropping season onwards, possibly due to the accumulation of organic matter and nitrogen.

The chemical properties and nutrient content of organic fertilizers vary according to the materials used. Composts from *Samanea saman* and *Mimosa pudica* leaves provided similar results, indicating their potential interchangeability as compost materials.

Table 2 Chemical property of composts prepared from various materials combined with *Samanea saman* and *Mimosa pudica* leaves

	T1	T2	T3	T4	T5	T6	T7	T8
Moisture (%)	10.71	11.91	6.17	12.22	10.14	12.24	6.58	12.71
pH	7.50	7.70	7.99	7.66	7.33	7.67	7.84	7.33
Electrical Conductivity (EC) (dS/m)	1.26	1.42	0.72	1.56	1.22	1.13	0.72	1.57
Organic Matter (g/kg)	41.26	45.66	21.45	48.79	39.23	49.48	22.74	41.17
Total Nitrogen (mg/kg)	1.81	2.25	1.18	2.71	1.52	1.96	1.05	2.24
Phosphorus (mg/kg)	0.45	0.86	0.60	0.74	0.48	0.43	0.49	0.51
Potassium (mg/kg)	1.11	0.90	1.27	0.87	1.55	1.49	0.60	0.50
Calcium (mg/kg)	2.12	2.34	21.75	2.41	1.51	2.05	25.17	1.77
Magnesium (mg/kg)	0.62	0.56	0.32	0.51	0.59	0.57	0.41	0.65
Iron (mg/kg)	0.29	0.49	0.22	0.43	0.33	0.40	0.12	0.59
Manganese (mg/kg)	599.33	1,380.50	222.50	726.00	615.50	1,225.83	174.17	798.33
Zinc (mg/kg)	39.70	43.77	26.48	40.48	59.22	48.15	67.38	49.80
Copper (mg/kg)	3.61	5.48	<1.00	3.93	5.34	5.44	<1.00	4.42
Sulfur (mg/kg)	660.38	974.81	<1.50	1,918.24	660.38	1,289.31	<1.50	1,918.24

Analysis of soil properties after harvesting with the application of composts prepared from various materials combined with *Samanea saman* and *Mimosa pudica* leaves

Analysis of soil properties after the application of composts revealed that some compost-amended treatments had higher organic matter content than the soil treated with chemical fertilizers **(Table 3)**. This is consistent with Rajbunmi et al. (2020), who investigated the effects of organic fertilizer and chemical fertilizer on the yield of RD43 rice variety; they found that organic fertilizer application resulted in 20% higher soil organic matter compared to chemical fertilizer treatment. Similarly, Jaipunya (2019) studied the effects of combined chemical and bio-organic fertilizer application on growth and yield of Sanpatong 1 glutinous rice. The results indicated that soil organic matter in plots treated with bio-organic fertilizer was significantly higher than in plots receiving the recommended chemical fertilizer rate or chemical fertilizer based on soil analysis. Furthermore, soil treated with bio-organic fertilizers exhibited higher phosphorus content than chemical fertilized soil. However, nitrogen content and electrical conductivity did not differ significantly between treatments, mirroring the results in **Table 3**. The slow-release nature of organic fertilizers leads to greater residual nutrients levels in the soil compared to chemical fertilizer. These retained nutrients provide long-term benefits for crop production in subsequent growing seasons. (Sukyankij et al., 2019).

Table 3 Soil properties after compost treatment prepared from various materials combined with *Samanea saman* and *Mimosa pudica* leaves

Treatment	pH	Organic Matter (g/kg)	Electrical Conductivity EC (dS/m)	Total Nitrogen (mg/kg)	Phosphorus (mg/kg)	Potassium (mg/kg)	Calcium (mg/kg)
T1	6.01±0.14	0.54±0.06[ab]	3.15±0.75[b]	0.18±0.03	71.39±4.35[ab]	0.04±0.01[b]	334.92±90.21[b]
T2	6.11±0.25	0.54±0.01[ab]	4.79±0.42[a]	0.18±0.03	49.35±9.85[ab]	25.97±1.36[a]	391.20±180.31[b]
T3	6.43±0.20	0.69±0.06[a]	3.96±0.47[ab]	0.17±0.02	77.52±8.66[a]	6.23±8.24[b]	411.83±128.16[b]
T4	6.61±0.47	0.64±0.06[a]	3.63±0.49[ab]	0.20±0.01	43.15±5.17[b]	0.82±0.59[b]	903.08±116.85[a]
T5	6.13±0.17	0.59±0.11[ab]	3.02±0.60[b]	0.16±0.01	60.40±1.88[ab]	1.19±1.12[b]	393.34±62.85[b]
T6	6.45±0.51	0.69±0.11[a]	4.01±0.03[ab]	0.19±0.01	65.05±14.55[ab]	8.75±11.80[b]	335.38±135.68[b]
T7	6.24±0.90	0.55±0.02[ab]	3.89±0.18[ab]	0.18±0.04	66.52±29.42[ab]	6.04±2.59[b]	410.88±284.56[b]
T8	5.95±0.78	0.66±0.17[a]	3.76±0.45[ab]	0.19±0.01	49.10±6.78[ab]	7.21±3.17[b]	869.97±153.26[a]
T9	5.90±0.25	0.41±0.04[b]	3.56±0.66[ab]	0.17±0.02	6.27±2.86[c]	0.4±0.00[b]	245.01±9.11[b]
C.V. (%)	6.57	11.62	12.65	11.61	19.83	21.41	29.35

Remark: Means with the same column followed by the same letters indicate no significant differences among treatment used by DMRT

Yield and yield components of Khao Dawk Mali 105 rice under compost treatment prepared from various materials combined with *Samanea saman* and *Mimosa pudica* leaves

Based on the comparison of Khao Dawk Mali 105 rice yield treated with compost prepared from various materials combined with *Samanea saman* and *Mimosa pudica* leaves in **Table 4**, it was found that the *Samanea saman* leaf compost supplemented with Vietnamese mint and Wildbetal leafbush showed significantly higher number of panicles per hill (9.80 panicles), number of spikelets per panicle (90.10 spikelets), 1000-unmilled grain weight (33.66 g), and 1000-grain weight of brown rice (30.40 g) compared to other experimental treatments. Similarly, the number of panicles per hill and spikelets per panicle in the *Mimosa pudica* leaf compost supplemented with Vietnamese mint and Wildbetal leafbush also showed significantly improved yield quality. When comparing the nutrient analysis results of bio-compost in **Table 2**, it was found that the *Mimosa pudica* and *Samanea saman* leaf composts supplemented with Vietnamese mint and Wildbetal leafbush contained higher total nitrogen content compared to other experimental treatments. This high nitrogen content affected the yield quality in rice grains, consistent with the study of Poomipan et al. (2017), who found that organic fertilizer application with high nitrogen content significantly increased the number of panicles per hill in Suphanburi 1 rice, as well as the number of filled grains and 100-grain weight of paddy rice, which were relatively high compared to other experimental treatments.

This finding aligns with the study of Yoojaroenkti et al. (2021), who investigated the effects of nitrogen content in organic fertilizer on growth and seed storage life of organic Pathum Thani 1 rice. They found that higher nitrogen content in organic fertilizer (14 kg N/rai) resulted in the highest number of panicles per hill. Similarly, the study on the effects of nitrogen fertilizer on growth and yield of RD 6 rice under transplanting and direct seeding methods (Meesumlee et al., 2021) found that rice receiving high nitrogen rates (40 kg/rai) produced the highest number of panicles per hill in transplanted rice. Nitrogen is an essential nutrient that plants require in large quantities for growth and yield production. It plays a role in stimulating cell division, promoting tillering, and consequently affecting the number of panicles and grains per panicle (Gewaily et al., 2018).

Table 4 Yield and yield components of Khao Dawk Mali 105 rice treated with composts prepared from various materials combined with *Samanea saman* and *Mimosa pudica* leaves

Treatment	Number of panicles (hill/plant)	Number of spikelet (panicles/plant)	Filled grains (%)	1000-unmilled grain weight (g)	1000-grain weight of brown rice (g)
T1	8.20±2.10^{bc}	75.70±15.13^{bcd}	86.53±3.69^{abc}	30.08±4.08^{b}	24.72±4.46^{b}
T2	6.40±1.17^{d}	58.00±11.28^{d}	89.06±4.70^{a}	26.97±1.49^{b}	20.98±1.53^{c}
T3	7.10±2.13^{cd}	62.20±17.89^{cd}	84.46±6.04^{abc}	27.61±1.22^{b}	22.65±1.53^{bc}
T4	9.80±1.03^{a}	90.10±14.93^{a}	84.09±6.27^{bc}	33.66±5.03^{a}	30.40±3.27^{a}
T5	9.60±0.84^{ab}	88.80±14.43^{a}	83.26±5.82^{c}	28.98±3.35^{b}	21.74±1.43^{bc}
T6	8.10±1.66^{bc}	80.50±15.32^{ab}	87.07±3.77^{abc}	27.27±1.31^{b}	21.62±0.59^{bc}
T7	7.40±1.17^{cd}	70.20±12.08^{bcd}	88.56±3.29^{ab}	29.89±2.98^{b}	22.90±2.14^{bc}
T8	10.10±1.37^{a}	87.90±13.24^{a}	88.47±2.49^{ab}	28.16±3.13^{b}	22.30±0.94^{bc}
T9	9.20±2.15^{ab}	63.60±21.24^{cd}	74.85±5.61^{d}	30.06±3.98^{b}	23.36±2.90^{bc}
C.V. (%)	18.51	20.64	5.50	9.90	8.59

Remark: Means with the same column followed by the same letters indicate no significant differences among treatment used by DMRT

Effects of composts prepared from various materials combined with *Samanea saman* and *Mimosa pudica* leaves on rice grain morphological characteristics of Khao Dawk Mali 105

The results of Khao Dawk Mali 105 rice grain shape comparison treated with compost prepared from various materials combined with *Samanea saman* and *Mimosa pudica* leaves in **Table 5** showed that in terms of grain width, rice treated with *Mimosa pudica* leaf compost combined with Indian mulberry leaves and fruits exhibited the greatest grain width compared to other experimental treatments. This finding is consistent with the study of Sukkasame (2015), who investigated the efficiency of high-quality organic fertilizer on rice yield and quality in Ongkharak and Rangsit soil series using Hom Suphanburi rice variety. The study found that when measuring the width and length of brown rice grains of Hom Suphanburi variety, rice receiving high-quality organic fertilizer had greater grain width than rice receiving chemical fertilizer. However, the study on the effects of compost application combined with chemical fertilizer based on soil analysis on the productivity of Pathum Thani 1 rice grown in Sanphaya soil series by Isuwan (2018) found that different fertilizer applications had no significant effect on the grain length and width of milled rice of Pathum Thani 1 variety grown in Sanphaya soil series. Similarly, the study by Chiwapreecha et al. (2018), which compared certain properties of rice from organic and chemical farming systems, found that the average length, width, and proportion of milled rice grains from organic and chemical rice farming were not statistically different.

Table 5 Rice grain morphological characteristics of Khao Dawk Mali 105 rice treated with composts prepared from various materials combined with *Samanea saman* and *Mimosa pudica* leaves

Treatment	Seed width (mm)	Seed length (mm)
T1	2.08 ± 0.09^{ab}	7.31±0.22
T2	2.06 ± 0.14^{b}	7.29±0.29
T3	2.04 ± 0.20^{b}	7.34±0.46
T4	2.05 ± 0.22^{b}	7.37±0.37
T5	1.90 ± 0.18^{c}	7.27±0.36
T6	2.16 ± 0.16^{a}	7.31±0.38
T7	2.05 ± 0.17^{b}	7.31±0.30
T8	2.09 ± 0.19^{ab}	7.18±0.57
T9	2.07 ± 0.18^{ab}	7.37±0.34
C.V. (%)	8.33	5.00

Remark: Means with the same column followed by the same letters indicate no significant differences among treatment used by DMRT

Analysis of chemical and nutritional quality in the grains of Khao Dawk Mali 105 Rice treated with composts prepared from various materials combined with *Samanea saman* and *Mimosa pudica* leaves.

Based on the nutrient analysis results of compost prepared from various materials combined with *Samanea saman* and *Mimosa pudica* leaves in **Table 2**, it was found that manganese content in compost using *Mimosa pudica* and *Samanea saman* leaves combined with Indian mulberry leaves and fruits showed the highest levels (1,226 and 1,381 mg/kg, respectively) compared to other experimental treatments. This may have resulted in rice grains treated with *Samanea saman* leaf compost combined with Indian mulberry leaves and fruits having 2-AP aromatic compound content (3.29 mg/kg) that was similar to rice treated with chemical fertilizer (3.27 mg/kg), as shown in **Table 6**. Li et al. (2016) found that fragrant rice treated with 250 mg $MnSO_4$ pot-1 had significantly higher 2-AP content. Changsri et al. (2015) reported that rice treated with primary nutrients and Mn had very high 2-AP content. However, the effects of S, Ca, Mg, and Mn on 2-AP content varied depending on soil properties, nutrient contents, pH, and moisture.

The nutritional quality analysis showed no significant differences in total phenolic content, DPPH, and FRAP antioxidant activities between rice grains treated with compost and chemical fertilizers. This is consistent with studies on black glutinous rice (Prajuntasan et al., 2022) and upland rice (Sittichoktham et al., 2017), where organic and chemical fertilizers resulted in similar antioxidant content. Multiple factors, including rice bran, may influence the total phenolic compound content.

Table 6 Comparison of chemical and nutritional quality of Khao Dawk Mali 105 rice treated with composts prepared from various materials combined with *Samanea saman* and *Mimosa pudica* leaves

Treatment	2-AP (mg/kg)	Total phenolic content (mg/L)	DPPH (%)	FRAP (mg/L)
T1	2.69±0.48^{ab}	574.29±94.14	76.18±6.12	546.91±11.28
T2	3.29±0.49^{a}	730.25±615.01	61.80±17.62	765.09±42.25
T3	3.14±0.38^{ab}	702.86±230.83	71.81±1.51	599.95±95.20
T4	2.75±0.16^{ab}	621.83±172.82	67.22±8.01	561.83±167.79
T5	2.62±0.79^{ab}	706.90±284.93	74.22±4.00	515.31±103.31
T6	2.68±0.52^{ab}	919.52±308.45	71.42±1.21	555.67±341.19
T7	2.68±0.48^{ab}	775.08±399.96	68.05±2.92	790.87±142.10
T8	2.16±0.01^{b}	842.76±576.99	65.09±8.02	667.94±219.91
T9	3.27±0.03^{a}	574.65±186.80	74.05±6.16	622.86±94.55
C.V. (%)	13.27	22.96	9.17	22.35

Remark: Means with the same column followed by the same letters indicate no significant differences among treatment used by DMRT

Analysis of nutrient content in the grains of Khao Dawk Mali 105 Rice treated with composts prepared from various materials combined with *Samanea saman* and *Mimosa pudica* leaves

The analysis of nutrient content in rice grains **(Table 7)** showed that the N content in the rice treated with chemical fertilizers was the highest. This is consistent with the study by In-nok and Poomipan (2016), who compared the quality of Khao Dawk Mali 105 rice grown using chemical and organic fertilizers in Surin province. They found that the N content in the rice grains treated with chemical fertilizers was higher than that in the rice treated with organic fertilizers, whereas the analyzed phosphorus and potassium contents showed no differences among all experimental treatments. Which corresponds to the analysis results in **Table 7**, where phosphorus, potassium, and magnesium contents were not significantly different across all experimental treatments. While rice grains treated with *Samanea saman* leaf compost showed the highest calcium content noticeably, iron content in rice grains was found to be highest in grains treated with chemical fertilizer. Nutrient release from compost occurs more slowly than chemical fertilizer, and compost application provides lower nutrient rates compared to chemical fertilizer. This can be observed from the nitrogen content in rice grains grown using chemical fertilizer being higher than those using compost **(Table 7)**. This is consistent with the study of In-nok and Poomipan (2016), who compared the quality of Khao Dawk Mali 105 rice grown using chemical and organic fertilizers in Surin province. They found that nitrogen content in rice grains treated with chemical fertilizer was higher than in rice treated with organic fertilizer, resulting in better yield quality. In contrast, the experimental results showed that rice yield grown using chemical fertilizer was lower than rice grown using compost in almost all parameters, as shown in **Table 4**. This may be attributed to the rice treated with chemical fertilizer accumulating relatively high iron content in grains, as shown in **Table 7**, which may reduce rice growth and yield in the chemical fertilizer treatment because plant roots may not be able to absorb and utilize nutrients adequately to meet rice requirements (Fageria, 2014).

Table 7 Comparison of nutrient content in the grains of Khao Dawk Mali 105 rice treated with composts prepared from various materials combined with *Samanea saman* and *Mimosa pudica* leaves

Treatment	Nitrogen (mg/kg)	Phosphorus (mg/kg)	Potassium (mg/kg)	Calcium (mg/kg)	Magnesium (mg/kg)	Iron (mg/kg)
T1	1.03±0.09[d]	0.23±0.00	0.23±0.01	68.00±36.77[a]	921.00±26.87	122.43±19.59[ab]
T2	1.24±1.10[abc]	0.23±0.01	0.19±0.01	1.13±0.18[b]	947.50±24.75	111.83±3.18[ab]
T3	1.06±0.04[cd]	0.25±0.02	0.29±0.02	16.76±22.62[ab]	990.00±130.81	130.58±4.81[ab]
T4	1.14±0.02[bcd]	0.23±0.03	0.26±0.06	18.13±24.22[ab]	1,007.50±229.81	141.03±20.58[ab]
T5	1.03±0.01[d]	0.22±0.04	0.20±0.11	37.25±51.27[ab]	810.50±248.19	96.80±35.47[b]
T6	1.18±0.07[ab]	0.22±0.02	0.27±0.04	6.25±7.42[b]	816.25±178.54	124.38±5.94[ab]
T7	1.06±0.01[cd]	0.21±0.01	0.23±0.00	3.45±4.67[b]	750.00±49.50	105.63±46.60[ab]
T8	1.16±0.05[bcd]	0.25±0.03	0.24±0.08	1.00±0.00[b]	1,140.00±275.77	119.53±4.74[ab]
T9	1.31±0.03[a]	0.24±0.00	0.22±0.03	26.50±5.30[ab]	1,030.00±10.61	159.38±26.73[a]
C.V. (%)	4.07	7.94	17.30	83.37	13.99	15.93

Remark: Means with the same column followed by the same letters indicate no significant differences among treatment used by DMRT

Conclusion

Based on the nutrient analysis results of compost prepared from various materials combined with *Samanea saman* and *Mimosa pudica* leaves, all experimental compost treatments met the quality standards according to the Department of Agriculture's organic fertilizer specifications. Soil properties after harvest from almost all compost formulations were considerably better than soils treated with chemical fertilizer. Yield and yield components including number of panicles per hill, spikelets per panicle, and 1000-grain weight of paddy and brown rice in the *Samanea saman* compost combined with Vietnamese mint and Wildbetal leafbush treatment produced the highest yield. The greatest grain width was found in the *Mimosa pudica* compost combined with Indian mulberry leaves and fruits treatment. The 2-AP content in rice grains treated with *Samanea saman* compost combined with Indian mulberry leaves and fruits was similar to that of chemical fertilizer treatment. Total phenolic, DPPH, and FRAP contents showed no differences among treatments. Nutrient content in rice grains treated with chemical fertilizer showed relatively high N and Fe levels, while Ca content was highest in rice grains treated with *Samanea saman* compost. The experimental results demonstrate that using *Samanea saman* or *Mimosa pudica* compost combined with various materials provides certain qualities comparable to chemical fertilizer application. Therefore, the use of local materials for compost production should be promoted for rice cultivation to achieve better yield and soil quality in the future.

Acknowledgements

The authors would like to express their gratitude to the Faculty of Agriculture and Technology at Rajamangala University of Technology Isan Surin Campus, Surin Province, for providing the experimental greenhouse used for compost preparation.

References

AOACa. 2019. Official Methods of Analysis. 21st Eidition, Methods 925.10, 934.01). Association of Official Analytical Chemists International.

AOACb. 2019. Method 958.01: Phosphorus in fertilizers Vanadomolybdophosphoric acid colorimetric method. In: Official Methods of Analysis of AOAC International. 21st Edition. AOAC International.

AOACc. 2019. Method 978.04: Protein (crude) in animal feeds. In: Official Methods of Analysis of AOAC International. 21st Edition. AOAC International.

AOACd. 2019. Method 985.01: Metals and other elements in plants and pet foods. In: Official Methods of Analysis of AOAC International. 21st Edition. AOAC International.

AOACe. 2019. Method 2007.01: Pesticide residues in foods by acetonitrile extraction and partitioning with magnesium sulfate (QuEChERS). In: Official Methods of Analysis of AOAC International. 21st Edition. AOAC International.

Benzie, I. F. F., and J. J. Strain. 1999. Ferric reducing/antioxidant power assay: Direct measure of total antioxidant activity of biological fluids and modified version for simultaneous measurement of total antioxidant power and ascorbic acid concentration. Methods in Enzymology. 299: 15-27.

Brand-Williams, W., M. E. Cuvelier, and C. Berset. 1995. Use of a free radical method to evaluate antioxidant activity. LWT - Food Science and Technology. 28: 25-30.

Changsri, R., G. Sudtasarn, P. Khongsuwan, P. Rakchum, D. Suriyaarunroj, T. Chuenban, and W. Wongboon. 2015. Factors affecting the quality of Thai Hom Mali rice. In: Proceedings of the Rice and Winter Cereal Crops Conference, Northeastern Rice Research Center Group 11-13 March 2015. Ubon Ratchathani, Thailand.

Chiwapreecha, B., N. Tangtreiammit, and K. Janprasert. 2018. A comparison of some rice properties from organic and conventional rice paddy fields. Faculty of Science, Burapha University.

Department of Agriculture. 2012. Registration, issuance of registration certificates, request for amendment of registration items, and amendment of organic fertilizer registration items. B.E. 2012. Ministry of Agriculture and Cooperatives, Bangkok.

Fageria, N. K. 2014. Mineral Nutrition of Rice. CRC Press.

Folin, O., and V. Ciocalteu. 1927. On tyrosine and tryptophane determinations in proteins. Journal of Biological Chemistry. 73: 627-650.

Gewaily, E. E., A. M. Ghoneim, and M. M. A. Osman. 2018. Effect of Nitrogen levels on growth, yield and Nitrogen use efficiency of some newly released Egyptian rice genotypes. Open Agriculture. 3: 310-318.

Gosal, M., D. Rayer, and S. Gedoan. 2022. The effect of water hyacinth (*Eichhornia crassipes*) organic fertilizer on the vegetative growth of Manado strain yellow maize (*Zea mays* L.). World Journal of Advanced Research and Reviews. 15: 450-454.

In-nok, A., and P. Poomipan. 2016. Comparison on quality of rice var. Khao Dawk Mali 105 planted by using chemical and organic fertilizers in Surin province. Journal of Science and Technology [Special Issue]. 24: 766-776.

Jaipunya, K. 2019. Effect of chemical fertilizer and organic bio fertilizer on the growth and yield of San-Pah-Tawng 1 sticky rice. Journal of Agricultural Research and Extension. 37: 10-19.

International Organization for Standardization. 1994. ISO 11265:1994. Soil quality — Determination of the specific electrical conductivity.

International Organization for Standardization. 2005. ISO 10390:2005. Soil quality — Determination of pH.

Isuwan, A. 2018. Effect of combined application of composts and chemical fertilizers based on site-specific fertilizer management on productivity of Pathum-Thani 1 rice grown in Sappaya soil series. Khon Kaen Agriculture Journal. 46: 1057-1066.

Li, M., U. Ashraf, H. Tian, Z. Mo, S. Pan, S. A. Anjum, M. Duan, and X. Tang. 2016. Manganese-induced regulations in growth, yield formation, quality characters, rice aroma and enzyme involved in 2-acetyl-1-pyrroline biosynthesis in fragrant rice. Plant Physiology and Biochemistry. 103: 167-175.

Meesumlee, J., N. Damrongwattanakool, and J. Kaweewong. 2021. Effect of nitrogen fertilizer on growth and yield of RD6 rice variety grown under transplanting and broadcasting methods. Khon Kaen Agriculture Journal. 49: 830-841.

Phiwatkunwarut, N., T. Songboonketkul, W. Chaona, P. Kaewtaphan, and P. Maniin. 2021. Effect of nitrogen inorganic fertilizer on growth, storage time of Pathumthani 1 rice organic seed. Khon Kaen Agriculture Journal. 1: 963-967.

Poomipan, P., S. Chakatrakan, V. Latkanathinnawong, C. Pliumchareorn, and P. Chomphuphiw. 2016. Comparison between chemical fertilizer and high quality organic fertilizer on quality of rice variety Suphan Buri 1. Journal of Science and Technology. 24: 753-765.

Poomipan, P., V. Latkanathinnawong, C. Pliumchareorn, and P. Chomphuphiw. 2017. Effect of high quality organic fertilizer on production of Suphan Buri 1 rice. Journal of Science and Technology. 25: 248-259.

Prajuntasan, R., K. Ratanannikom, and P. Nitisuk. 2022. Effect of organic and chemical fertilizer on growth, yield, and antioxidant in black glutinous rice. Khon Kaen Agriculture Journal. 50: 1033-1042.

Rajbunmi, S., C. Handee, and S. Sagulso. 2020. Effects of organic and chemical fertilizers on the yield of RD 43 rice: A case study of Chulachomklao Royal Military Academy. In: Proceedings of the Central and Western Rice Research Center and Eastern Rice Research Center Annual Conference. 10-12 March 2020. Chanthaburi, Thailand.

Saimaneerat, A., S. Chotchuangmaneerat, and S. Ngamprasit. 2007. An experiment on intercropping giant sensitive plant between rows of sweet corn variety Intri 2 for fresh cob production. Intri Chantrasathit Institute for Cereal Crops Research and Development, National Corn and Sorghum Research Center, Kasetsart University.

Sittichoktham, S., T. Techakriengkrai, P. Na Chiangmai, P. Paengkoum, M. Kanjanamaneesathian, S. Kaiangam, C. Chanthasa, Y. Pootaeng-on, A. Jamphol, P. Pasukamonset, and K. Wunjuntuk. 2017. Effect of Soil Amendment by Organic Fertilizer on Physical Properties and Antioxidant Activity in Upland Rice. In: Proceeding of the 55th Kasetsart University Annual Conference 31 January-3 February 2017. Kasetsart University, Bangkok, Thailand.

Sukkasame, N. 2015. Effect of high quality organic fertilizer on yield and grain quality of rice in Ongkharak and Rungsit soil series. M.S. Thesis. Thammasat University, Thailand.

Sukyankij, S., T. Pluemphuak, and T. Panich-pat. 2019. Effects of green manures and fertilizer management on yield, nutrient uptake and economic return of rice cv. RD47 grown in Ayutthaya soil series. Agricultural Journal. 35: 61-73.

Sukyankij, S., S. Jewprasert, W. Pangjai, and T. Panich-pat. 2021. Comparison of the quality of two organic fertilizers on yield of Hom Pathum rice and soil properties. Khon Kaen Agriculture Journal. 49: 37-48.

Thongboonrith, K., S. Hengtrakoonwenich, W. Hhuapo, and P. Jantima. 2018. Study on nutrient content in compost of raintree and azolla. Sakthong Journal of Science and Technology (SJST). 5: 47-54.

United States Department of Agriculture. 2014. Method 5A8a: Extractable Ca, Mg, Na, K $BaCl_2$-TEA, pH 8.1. In: Soil Survey Laboratory Methods Manual (Version 5.0, pp. 248-250). United States Department of Agriculture, Natural Resources Conservation Service.

Walkley, A., and I. A. Black. 1934. An examination of the Degtjareff method for determining soil organic matter, and a proposed modification of the chromic acid titration method. Soil Science. 37: 29-38.

Yasaeng, N., B. Khidka, and W. Nuangmek. 2020 Comparing the quality of factory organic fertilizer and organic fertilizer from water hyacinth. Khon Kaen Agriculture Journal. 48: 1047-1052.

Yoojaroenkti, N., S. Thanachit, and S. Anusontpornperm. 2021. Effect of iron and manganese on Khao Dawk Mali 105 rice grown in different paddy soils. Khon Kaen Agriculture Journal. 49: 12-24.