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Do Not Throw Pet Faeces Away: Composted Manures Obtained from Dog and Cat Faeces Contain High Nutrients and Effectively Cultivate Plants

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Abstract: Dog and cat faeces are a globally neglected issue that demands proper management. The poor handling of pet waste not only impacts environmental health but also contributes to community conflicts due to insufficient waste management practices. The objectives were to investigate the properties of pet wastes compared to livestock wastes (pigs, hens, and cattle) with the intention of formulating an efficient compost product suitable for agricultural applications. Faeces from dogs and cats were collected from the community, while faeces from livestock (pigs, cattle, and hens) were collected from farms. Faeces were mixed with probiotics, rice bran, and rice husk to make compost and used to grow sweet corn plants. The nutrient content was compared between fresh and composted faeces. Composted manure from different animal sources was compared for its effectiveness in promoting sweet corn growth. The results showed that fresh and composted dog and cat manures contained higher levels of nutrients ($p < 0.05$) compared to livestock manures. Additionally, composted pet manure accelerated ($p < 0.05$) the growth of the plants compared to composted livestock manures and control groups. This is the first study to conclude that composted pet faeces surpass livestock manure in their higher nutrients and enhance plant growth. The findings could help reduce pet waste and transform it into a valuable recycled resource. However, the safety of composted manure, especially concerning toxoplasmosis from cat faeces, remains a significant concern and requires further investigation.

Keywords: compost; faeces; livestock; manure; pet; plant

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1. Introduction

Pet waste, specifically from dog and cat manure, is a globally overlooked issue. It is estimated that more than 2 million tons of pet faeces are produced annually, highlighting the need for effective management and sustainable solutions [1,2]. In 2023, the number of pets in our society increased, with an estimated total of around 900 million including approximately 471 million dogs, followed by 370 million cats [3]. The growing number of animals is leading to challenges in waste disposal, particularly with regard to animal faeces. This issue contributes to problems such as odours and the attraction of insects, which have a negative impact on environmental health and can cause conflicts within communities [4,5]. These problems are continuously increasing, particularly in countries with inadequate waste management systems and weak law enforcement [6].

In Thailand, the total population of dogs and cats is estimated to be 10 million; however, there remains a lack of proper management for pet faeces, resulting in numerous public health and environmental issues [7]. From our observation, pet faeces are mainly left in gardens or public areas and allowed to decompose naturally, leading to issues such as odour, contamination, and the spread of germs to others. Some pet owners dispose of pet faeces in plastic bags, further contributing to the growing problem of plastic waste [8]. Few owners combine faeces with leaves, attempting natural fertilisation without proper knowledge, potentially resulting in the spread of zoonotic diseases and also exerting negative effects on plant biodiversity and ecosystem functioning due to excessive salinity and nitrogen levels [9].

Although dog and cat faeces are produced in large quantities, proper protocols for recycling and waste management have rarely been explored. A few reports have demonstrated that dog waste has the potential to generate biogas, but it has a limited quantity and less gas production; therefore, it is recommended to be used with plant and other animal wastes to enhance its efficiency for biogas production [10,11].

Another possible method for recycling pet waste is composting, although most of the existing protocols are not based on scientific research [12]. One scientific study indicated that composting cat manure with spent coffee grounds produced a nutrient-rich mixture that supported the growth of spinach, showing superior results compared to composted chicken manure [13]. While composting and anaerobic digestion are viable treatments for managing dog faeces on both small and large scales, there is no scientific report on the ability to grow plants using the resulting products [14,15]. Given the current limited understanding of composting pet waste and its uncertain potential as a viable composting material, more studies are needed to investigate the properties of pet faeces, the proper composting process, and its effectiveness in promoting the growth of various plants.

The hypothesis of this study was that composted dog and cat faeces could be nutrient-rich and suitable for growing plants. The objectives of this study were to investigate the properties of pet (dog and cat) wastes compared to livestock (pig, chicken, and cattle) wastes with the intention of formulating an efficient compost product suitable for agricultural applications at the home scale. The goal of this study was also to develop a practical and effective protocol for composting dog and cat manure. The findings derived from this pioneering study could potentially contribute to the mitigation of pet waste and its transformation into a valuable recycled resource.

2. Results

2.1. Comparison of the Physical and Chemical Properties Among Different Types of Fresh Manure

The physical and chemical characteristics of fresh manures from various animals, rice husk, and rice bran are detailed in Table 1. The moisture content percentages were significantly higher ($p < 0.05$) in livestock, especially in hens, compared to pet manures. Meanwhile, cattle manure exhibited a significantly higher ($p < 0.05$) pH than other sources of manure. Cat manure contained significantly higher levels of phosphorus and calcium ($p < 0.05$) compared to other species, while dog manure had a notably higher nitrogen concentration ($p < 0.05$). The potassium levels in manure from hens, pigs, cats, and dogs were comparable, whereas those in cattle manure were significantly lower ($p < 0.05$). Cattle manure exhibited significantly higher magnesium levels compared to other types of manure ($p < 0.05$). Additionally, the sulphur levels in dog and cat manure were significantly higher ($p < 0.05$) than those in other manures.

2.2. Physical and Chemical Composition of Composted Manures Obtained from Pets and Livestock

The physical and chemical properties of composted manures from various animal sources are presented in Table 2. Cattle manure demonstrated a significantly higher moisture content percentage ($p < 0.05$). Cat manure contained a significantly greater proportion of organic matter compared to the other animal manures, while dog manure exhibited a significantly higher pH relative to the other manure types.

Table 1. Physical and chemical properties of fresh manures from different animals, rice bran, and rice husk (mean ± SD).

Source of Manure	MC (%)	OM (%)	pH	P (%)	N (%)	K (%)	Ca (%)	Mg (%)	S (%)	EC (mS/m)
Cat	40.91 ± 0.27 b	71.20 ± 0.42 c	7.33 ± 0.02 c	2.73 ± 0.00 f	2.23 ± 0.01 e	0.49 ± 0.00 b	1.57 ± 0.00 g	0.49 ± 0.00 f	0.27 ± 0.02 f	1.87 ± 0.00 f
Dog	42.80 ± 0.24 b	64.33 ± 0.30 b	8.64 ± 0.02 f	2.53 ± 0.01 e	3.06 ± 0.06 g	0.72 ± 0.00 e	0.89 ± 0.00 e	0.46 ± 0.00 e	0.25 ± 0.01 e	1.20 ± 0.00 c
Hen	84.40 ± 0.96 d	60.93 ± 0.68 a	8.08 ± 0.02 d	1.51 ± 0.01 c	2.61 ± 0.04 f	1.04 ± 0.00 g	0.91 ± 0.00 f	0.32 ± 0.00 d	0.25 ± 0.00 e	1.68 ± 0.00 e
Pig	73.11 ± 0.32 c	75.36 ± 1.02 d	8.29 ± 0.04 e	2.09 ± 1.32 d	1.92 ± 0.04 d	0.86 ± 0.01 f	0.65 ± 0.06 c	0.66 ± 0.00 g	0.24 ± 0.00 d	1.44 ± 0.00 d
Cattle	80.61 ± 1.56 d	64.59 ± 0.34 b	7.16 ± 0.03 b	1.26 ± 0.01 b	1.80 ± 0.03 c	0.67 ± 0.01 d	0.25 ± 0.00 b	0.29 ± 0.00 c	0.16 ± 0.00 c	1.20 ± 0.00 c
Rice husk	9.60 ± 0.06 a	89.74 ± 0.16 f	6.99 ± 0.03 b	1.21 ± 0.08 b	0.46 ± 0.01 a	0.57± 0.00 c	0.13 ± 0.00 a	0.25 ± 0.00 a	0.12± 0.00 b	0.09 ± 0.00 a
Rice bran	9.81 ± 0.08 a	85.47 ± 0.76 e	6.36 ± 0.12 a	0.44 ± 0.01 a	1.25 ± 0.01 b	0.44 ± 0.02 a	0.68 ± 0.14 d	0.28 ± 0.00 b	0.06 ± 0.00 a	0.11 ± 0.00 b

Abbreviations: MC = moisture content, OM = organic matter, N = nitrogen, P = phosphorus, K = potassium, Ca = calcium, Mg = magnesium, S = sulphur, and EC = electrical conductivity. Three replicates were performed. a–g represent a statistical difference ($p < 0.05$).

Table 2. Physical and chemical properties of composted manure derived from different animal sources in comparison to composted rice bran with husk and conventional soil (mean ± SD).

Source of Compost Manure	MC (%)	OM (%)	pH	P (%)	N (%)	K (%)	Ca (%)	Mg (%)	S (%)	EC (mS/m)
Cat	35.05 ± 0.03 c	30.61 ± 0.58 c	6.31 ± 0.11 c	1.95 ± 0.02 f	0.96 ± 0.01 c	0.20 ± 0.02 b	1.49 ± 0.04 g	0.18 ± 0.00 d	0.06 ± 0.00 d	0.02 ± 0.00 b
Dog	34.39 ± 0.23 c	20.94 ± 0.75 b	6.99 ± 0.16 d	0.54 ± 0.00 c	1.56 ± 0.03 d	0.20 ± 0.08 b	0.59 ± 0.00 e	0.15 ± 0.00 c	0.06 ± 0.00 d	0.02 ± 0.00 b
Hen	54.15 ± 0.06 e	29.71 ± 1.76 c	6.54 ± 0.03 c	0.44 ± 0.00 b	0.97 ± 0.06 c	0.26 ± 0.04 b	0.90 ± 0.02 f	0.11 ± 0.00 b	0.05 ± 0.00 c	0.04 ± 0.00 c
Pig	52.28 ± 0.52 d	28.40 ± 2.86 c	7.12 ± 0.10 e	0.72 ± 0.03 d	0.98 ± 0.01 c	0.22 ± 0.04 b	0.37 ± 0.00 d	0.23 ± 0.01 e	0.04 ± 0.00 b	0.02 ± 0.00 b
Cattle	59.94 ± 0.34 f	27.32 ± 4.73 c	7.51 ± 0.20 f	0.10 ± 0.00 a	0.87 ± 0.01 b	0.08 ± 0.01 a	0.14 ± 0.00 c	0.05 ± 0.00 a	0.05 ± 0.00 c	0.01 ± 0.00 a
Rice bran/husk	4.14 ± 0.46 a	19.11 ± 1.77 b	5.87 ± 0.01 b	0.14 ± 0.00 a	0.83± 0.00 b	0.28 ± 0.00 b	0.03 ± 0.00 a	0.04 ± 0.01 a	0.00 ± 0.00 a	0.09 ± 0.00 d
Soil	29.29 ± 0.12 b	4.89 ± 0.03 a	5.67 ± 0.01 a	1.13 ± 0.04 e	0.16 ± 0.03 a	0.44 ± 0.01 c	0.08 ± 0.01 b	0.23 ± 0.01 e	0.00 ± 0.00 a	0.14 ± 0.00 e

Abbreviations: MC = moisture content, OM = organic matter, N = nitrogen, P = phosphorus, K = potassium, Ca = calcium, Mg = magnesium, S = sulphur, and EC = electrical conductivity. Three replicates were performed. a–g represent a statistical difference, $p < 0.05$.

The composted cat manure exhibited significantly higher levels of calcium, phosphorus, and sulphur ($p < 0.05$) compared to the other composted manures. Composted dog manure contained a significantly higher nitrogen content ($p < 0.05$), while the potassium levels were notably higher ($p < 0.05$) in composted hen manure. Furthermore, the magnesium content was significantly higher ($p < 0.05$) in composted pig manure compared to the other composted animal manures.

2.3. Transition of Colour, Odour, and Temperature Change During Composting

On day 14, the compost manures were morphologically different from the fresh manure, resembling conventional compost manure (Figure 1). The colour of composts changed from a brown colour (day 0) to a black colour on day 14 (Figure 1). The odour and temperature of manures before (day 0) and after composting (day 14) are shown in Table 3. All manure odours were significantly reduced following composting. The temperature of the manure increased markedly ($p < 0.01$) during the transition from fresh to composted manure. The daily temperature measurements during the composting process are presented in Figure 2, with the highest temperature, approximately 40 °C, recorded on day 14.

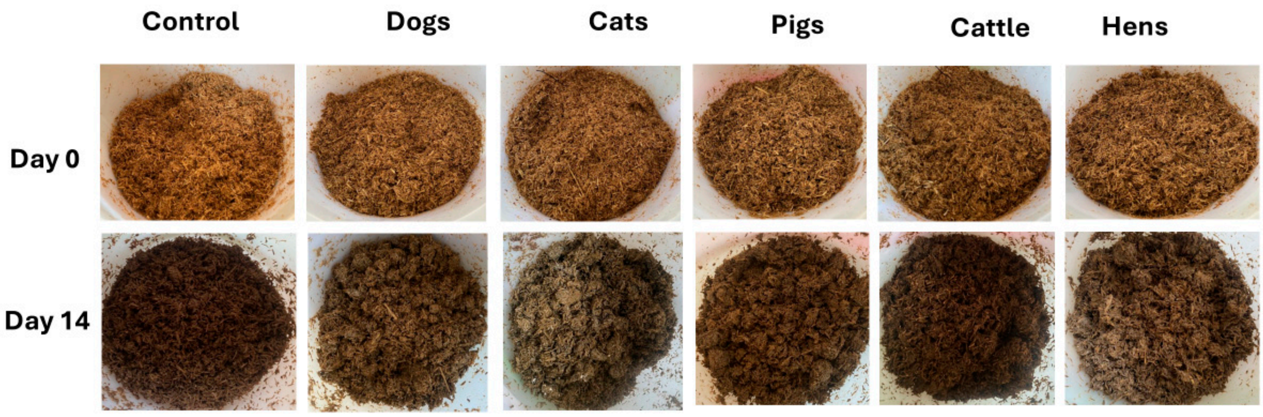

Figure 1. Colour of control (rice bran and rice husk), fresh manures from dogs, cats, pigs, cows, and hens mixed with rice bran and rice husk (day 0), and composted manure on day 14.

Table 3. Comparison of the odour and temperature of manures pre composting (day 0) and post composting (day 14). Three temperature measurements were taken from separate pots, and the temperature values are reported as the mean ± SD.

Source of Manure	Fresh Animal Manure		Composted Animal Manure	
	Odor	Temperature (°C)	Odor	Temperature (°C)
Cat	++	31.70 ± 1.15	+	40.30 ± 1.53 *
Dog	+++	31.30 ± 0.58	+	40.70 ± 1.15
Hen	++++	30.70 ± 0.58	+	37.70 ± 1.15 *
Pig	++	30.30 ± 1.53	+	39.30 ± 0.58
Cattle	++	28.30 ± 1.15 *	+	36.70 ± 1.53 *
Rice brand/husk	+	27.28 ± 0.58 *	+	34.30 ± 1.53 *

* represents statistical difference, $p < 0.01$. + represents the strength of odour (+ = very mild odour, ++++ = very strong odour).

2.4. Effect of the Animal Manures on Growth of Sweet Corn

In general, the soil without compost exhibited lower nutrient levels compared to all composts (Table 2). However, it was still able to partially support the growth of sweet corn, albeit at a lower level than soil with compost.

The sweet corn crop's height, number of leaves, leaf length, and root length at 3 weeks after sowing are detailed in Table 4 and Figure 3. The results indicate that the treatment with composted dog manure yielded the highest height of trunk (14.20 ± 1.10 cm), followed by composted hen manure (13.80 ± 2.27) and composted cat manure (13.60 ± 2.77). Notably, composted dog manure significantly promoted the growth of sweet corn compared to composted pig manure, composted cattle manure, and the control composts ($p < 0.05$). However, there was no statistical difference ($p > 0.05$) between composted dog, cat, and hen manures.

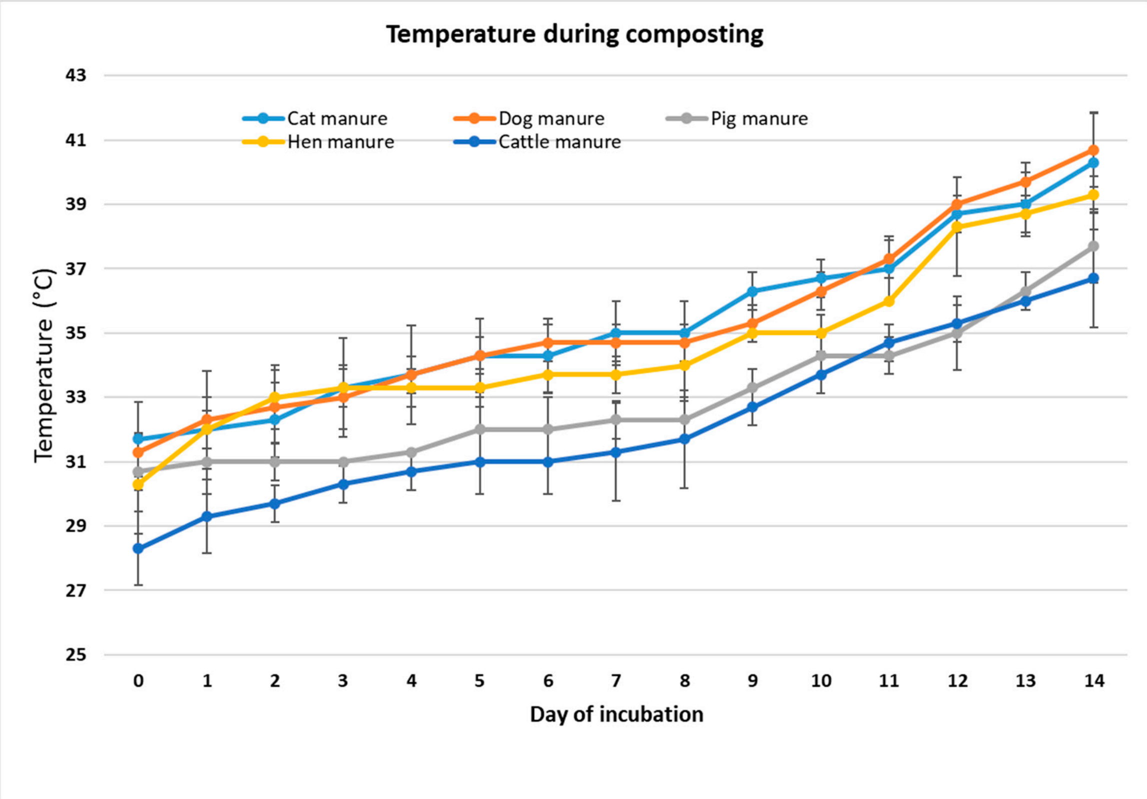

Figure 2. Temperature change during composting process.

Table 4. The effect of composted animal manures on the growth of sweet corn plants (on day 21). Each group consisted of five samples, with the growth data expressed as the mean ± SD.

Treatments	Height of Sweet Corn (cm)	Number of Leaves (per Plant)	Leaf Length (cm)	Root Length (cm)
Cat compost + soil	13.60 ± 2.77 [cd]	8.00 ± 1.00 [bc]	18.57 ± 1.29 [d]	24.7 ± 0.40 [d]
Dog compost + soil	14.20 ± 1.10 [d]	9.00 ± 1.00 [c]	18.87 ± 1.88 [d]	23.1 ± 0.35 [c]
Hen compost + soil	13.80 ± 2.27 [cd]	5.00 ± 1.00 [ab]	10.43 ± 2.27 [bc]	23.1 ± 0.46 [c]
Pig compost + soil	12.00 ± 0.32 [c]	6.67 ± 2.08 [b]	16.90 ± 1.51 [d]	24.7 ± 0.59 [d]
Cattle compost + soil	10.10 ± 0.61 [b]	6.67 ± 1.53 [b]	12.93 ± 1.79 [c]	31.6 ± 1.07 [e]
Rice bran/husk compost + soil (control 2)	11.80 ± 1.72 [bc]	4.67 ± 0.58 [a]	9.83 ± 1.50 [b]	16.1 ± 0.75 [b]
No compost + soil (soil only) (control 1)	8.40 ± 0.20 [a]	3.85 ± 1.00 [a]	5.32 ± 0.81 [a]	11.2 ± 0.31 [a]

[a–e] represent a significant difference, $p < 0.05$.

Figure 3. Growth of sweet corn after treatment with different composts including control 1 (soil only), control 2 (rice brand and husk compost), composted dog manure, composted cattle manure, composted pig manure, composted cat manure, and composted hen manure.

The highest number of leaves (9.00 ± 1.00) was observed in corn grown with composted dog manure, and the second highest was with composted cat manure (8.00 ± 1.00), but there was no significant difference between the dog and cat compost. Composted dog manure significantly increased ($p < 0.05$) the number of leaves compared to the livestock compost and control groups. The highest leaf length was found in composted dog manure (18.87 ± 1.88), followed by the cat (18.57 ± 1.29) and pig composts (16.90 ± 1.51), but there is no statistical difference ($p > 0.05$). Moreover, composted dog and cat manures significantly supported ($p < 0.05$) the length growth of leaves compared to the hen compost, cattle compost, and control groups.

The longest root length was observed in composted cattle manure (31.6 ± 1.07 cm), and it was significantly different ($p < 0.05$) from other manures and the controls. The second longest root length was observed with composted cat manure (24.7 ± 0.40) and composted pig manure (24.7 ± 0.59).

3. Discussion

This study appears to be the first to compare the nutrient content and plant growth-promoting abilities of compost manures derived from pets and livestock faeces. As expected, the dog and cat manures contained higher nutrient levels than the livestock manures, particularly of nitrogen, sulphur, phosphorus, and calcium. This is likely attributed to their carnivorous diet, which predominantly consists of commercial food that is higher in protein, calcium, and phosphorus compared to livestock feed [16,17]. Similarly, previous research has shown comparable findings, with cat manure co-composted with spent coffee grounds exhibiting high nitrogen levels [13]. Additionally, composted canine manure was found to have a higher nitrogen content than municipal solid waste and urban pruning waste [15].

The present study demonstrated high levels of nitrogen, calcium, phosphorus, and sulphur in composted dog and cat manure. These nutrients are essential for plant growth, particularly during the vegetative stage of corn cultivation [18]. It is known that nitrogen plays a dominant role in plant growth and development, serving as a key component of proteins that regulate shoot branching, flowering, and panicle formation through cell division and metabolic processes [19]. Calcium is a vital regulator of growth and development, influencing nearly all aspects of plant function through enzyme activity and as a primary component of cell walls. It maintains plant structure, supports root and leaf growth, and aids in nutrient uptake and transport [20]. Phosphorus is crucial for energy transfer within plants, particularly through the production of ATP, which drives cellular processes. It is essential for root growth, flower and seed production, and plant maturation, though its availability in soil is often insufficient for optimal plant growth [21]. Sulphur is an essential structural element in disulfide bonds found in proteins (including enzymes), as well as in amino acids, vitamins, and cofactors, all of which are crucial for plant growth and metabolism. A deficiency in sulphur can result in stunted plant growth and, ultimately, a reduction in yield [22].

Regarding plant growth, this study demonstrated that both composted dog and cat manures promoted better growth, resulting in taller trunks, a greater number of leaves, and longer leaf lengths compared to other compost manures. These findings align with earlier research, which showed that composted cat manure with coffee grounds produced taller trunks and a higher number of leaves compared to composted chicken manure [23]. However, the plant-growing potential of dog manure has not previously been reported.

In this study, we used complex probiotics (EM) to accelerate the composting of manure. Without the use of EM, the initial composting of manure was slow, requiring over 30 days to undergo noticeable morphological changes into compost-like material. The use of probiotics, particularly complex ones, can hasten composting, reduce odour, decrease pathogenic bacteria, and improve growth performance, as observed in poultry and pigs [23,24]. In contrast, EM did not show significant benefits for cattle manure [25]. This lack of improvement may be attributed to the nature of cattle manure, which is already partially digested and fermented by microbes. The remaining materials in cattle manure are predominantly fibrous and more resistant to microbial breakdown compared to the less fibrous manure from carnivorous animals [26]. Additionally, probiotics are generally designed to decompose more readily degradable organic matter, such as that found in omnivorous animal manure. Therefore, microbial digestion tends to be more effective for manure from carnivorous or omnivorous animals than for herbivores.

Turning pet faeces into composted manure is a potential alternative that some environmentally conscious pet owners may consider. In addition to improving soil fertility, composting pet waste can help reduce global waste and minimise the release of pathogens into the environment. However, there are important considerations when it comes to composting pet waste. Pet faeces may contain zoonotic pathogens such as bacteria (e.g., *E. coli* and *Clostridium* spp.) and parasites (e.g., intestinal worms, *Toxoplasma* spp.) that may require extra treatment compared to conventional composting processes [27]. One limitation of the present study is the lack of an investigation of the hazard of composted dog and cat manure before and after composting. Most studies about composting manure mainly investigate the dynamics of bacteria in the faeces, and it is believed that temperatures above 55 °C are necessary to eliminate pathogenic bacteria during the composting process in livestock manures [28]. Several studies have shown that some dog composting processes can reach 55–60 °C [14,15], whereas cat manure composts reach a maximum temperature of around 40 °C [13], similar to the present study. Additionally, one study showed that although the temperature of the anaerobic digestion of dog waste does not reach 55 °C (28–44 °C), the number of pathogenic bacteria is significantly reduced, both in terms of type and the total number [29].

Regarding intestinal parasites, the composting process markedly reduced the number of intestinal parasite eggs and cysts, including Ascaris eggs and Entamoeba cysts, after composting [30,31]. One study showed that no viable eggs of many intestinal parasites were observed at temperatures above 50 °C after 33 days [32].

Among various pathogens, *Toxoplasma gondii* is particularly concerning in cat faeces, as cats are the definitive hosts of this parasite. *T. gondii* oocysts have been found in soil samples from public areas worldwide, with a global prevalence of approximately 16% [33]. While soil contamination with *T. gondii* has been attributed to feline faeces, research findings on this association remain contradictory [34]. For instance, high levels of contamination have also been reported in locations without cats, such as farms and hospitals [34,35]. It is known that the cysts and oocysts of *T. gondii* can be inactivated at 50 °C and completely destroyed at temperatures of 58 °C or higher sustained for 30 min [36]. Consequently, the existing protocols for the natural composting of cat manure may be insufficient to fully eliminate *T. gondii* oocysts from faeces or contaminated soil. Supporting this, traces of *T. gondii* have been detected in commercial fertilisers [37].

There is a misunderstanding about the concept that pet manures are more dangerous than livestock manures. In fact, pet animals are usually well kept, clean, and have regular vaccinations and deworming. In Thailand, zoonotic pathogens are usually found more often in livestock manure than in pet dogs and cats, possibly due to intensive farming and the inappropriate use of antimicrobials [38–41]. Importantly, a microbiome study in large agricultural composts found that only 1% of potential pathogens were observed, and there was no significant difference between compost made using the in-vessel or windrow methods, suggesting that composted animal manures are quite safe [42].

Another limitation of this study is that the manure was weighed directly without accounting for moisture content, which varies among different types of animal manure. This approach may have influenced the nutrient levels reported in the manure. The lower nutrient content observed in livestock manure could be attributed to its higher moisture content compared to dog and cat manure. However, weighing manure directly reflects real-world conditions and provides a straightforward, practical method for application. In this study, animal manures were composted for 14 days for practical use in home gardens, and the composted dog and cat manures showed promising results, providing a higher nutrient content and promoting better plant growth. However, the temperature data suggest that full maturation may not have been achieved, as the temperature did not reach the maximum thermophilic phase before cooling down, which is typical in conventional composting processes [43]. Additionally, compost maturation can be assessed using alternative methods, such as measuring the pH and odour. In this study, the pH of the composted dog and cat manures increased from 6 to 8, and the odour was significantly reduced, indicating that the compost may be nearly or fully mature [44]. Therefore, 14 days of composting manure with complex probiotics might be enough for dog and cat manure, while without probiotics, around 30 days may be required to fully compost cat manure, as shown in a previous study [13].

Given the limited knowledge about composting dog and cat manure, future studies should focus on optimising the use of probiotics and other factors to enhance the composting process. The key areas of improvement include reducing the composting time, improving the quality and safety of the resulting compost, and examining the changes in the microbial community, nutrient levels, and plant growth after incubation over various time frames.

4. Materials and Methods

4.1. Sample Collection

This project was approved by the Institutional Animal Care & Use Committee (WU-ACUC-66082). This study utilised five sources of manure, comprising waste from cats, dogs, pigs, beef cattle, and hens. Faeces from pets (dogs and cats) were sourced from local households, while faeces from livestock (pig, beef cattle, and hens) were collected from local animal farms in Tha Sala district, Nakhon Sri Thammarat province, Thailand.

Following prompt defecation (within an hour), 30 samples were obtained from each animal by the owners, who then notified the researcher to collect. The samples were sealed in clear plastic bags, collected by the researcher within 30 min, and transported to the laboratory at Walailak University in Nakhon Sri Thammarat, Thailand, where they were stored at 4 °C. Upon arrival, each faecal sample, weighing 200 g, was transferred to clear plastic bags and stored at −20 °C for subsequent chemical analysis and compost production. A total of 6000 g of faeces was collected from each animal manure source.

4.2. Preparation of Compost

In this experiment, animal faeces from dogs, cat, hens, cattle, and pigs were composted for 14 days, as this would be convenient for the pet owner to apply in the future. Prior to composting, fresh manure from each species (6000 g per manure type) was mixed. Of this, 2000 g was combined with rice husk and rice bran in a 1:1:1 ratio by weight. Additionally, 500 mL of EM Extra® probiotics (EM Extra Company, Bangkok, Thailand) was added to the mixture. The EM Extra® probiotics, as per the manufacturer's data, consist of oxygenic photosynthesis bacteria, Lactobacillales, Bacillus, and yeast. The composting process was conducted with three replicates.

The compost mixture was prepared in a lidded plastic container with dimensions of 40 × 60 × 15 cm (width × length × height). Throughout the entire composting period, a daily spray of 10 mL of sterilised tap water was applied to the compost to uphold the necessary moisture content. The compost was stored in a well-ventilated indoor environment at a room temperature of 28 ± 4 °C. To ensure optimal composting conditions, the composting materials were turned over every other day.

4.3. Physical and Chemical Analysis of Manure

The temperature was recorded daily at 11 a.m. throughout the transformation of fresh manure into composted manure. Additional parameters, including the pH, organic matter content percentage, moisture content percentage, and percentages of phosphorus, nitrogen, potassium, calcium, magnesium, and sulphur, were assessed on day 0 (fresh manure) and day 14 (composted manure).

Six grams of fresh and composted manure was collected to analyse the moisture content percentage and organic matter percentage. These samples were then subjected to 24 h of drying in an oven set at 70 °C, after which the final weight was recorded. Subsequently, the oven-dried samples were transferred to a desiccator before being combusted in a furnace at 550 °C for another 24 h. The final weight was again recorded using a calibrated analytical balance. The moisture content and organic matter content were calculated based on the wet weight of the samples using Equations (1) and (2), respectively [45].

$$\text{Moisture content } (\%\ w/w \text{ wet basis}) = \frac{ma - mo}{ma} \times 100 \quad (1)$$

$$\text{Organic matter content } (\%\ w/w \text{ wet basis}) = \frac{mo - mf}{ma} \times 100 \quad (2)$$

Abbreviations used in the formulas: "ma" for the mass of air-dried soil samples, "mo" for the mass of oven-dried soil samples, and "mf" for the mass of combusted soil samples.

The pH and electrical conductivity of the organic materials were assessed using a 1:2 solid-to-water ratio, following a previous report [46]. The total organic nitrogen concentrations were determined using a complete nitrification analyser (VarioMax CNS macro-element analyser, Elementar Analytical Systems GmbH, Hanau, Germany). For the determination of total potassium and total phosphorus, the organic material underwent digestion in a 2:1 HNO_3:$HClO_4$ mixture at 360 °C. Subsequently, the total nitrogen and total phosphorus contents were measured using an inductively coupled plasma optical emission spectrometer (ICP-OES) in radial view configuration in digests obtained by boiling 1 g of the sample in 20 mL HNO_3 and 5 mL HCl [47]. The digestion with a 2:1 $HNO_3/HClO_4$ mixture allowed the determination of calcium and magnesium through atomic absorption spectrometry [48]. The experiments were repeated 3 times for each manure.

4.4. The Ability of Composted Dog and Cat Manure to Support Plant Growth

Composted manure was mixed with soil as a growth medium for sweet corn cultivation. As a widely grown crop that responds noticeably to environmental factors and nutrient levels, sweet corn serves as an ideal model for assessing how compost impacts plant development. The experiment was conducted in a greenhouse (geographic coordinates: 8.637818786780855, 99.8831329291851), where water was manually regulated, while light and humidity remained natural. The plant growth period spanned from February to March 2024, with a 12:12 h day–night cycle. The average air temperature was 32.33 ± 1.15 °C during the day and 24.33 ± 0.66 °C at night, and the average humidity was 64.92 ± 6.60%. In each of the 60 pots (30 × 22 cm), 3 seeds were planted using 1 kg of soil per pot. The pots were watered twice a day, and after 3 days, the weaker plants (smaller ones) were removed, leaving only the strongest plant in each pot. Thirty-five pots with growing plants were randomly selected for the experiment, with each group including five pots. The experiment comprised 7 groups, including cat compost, dog compost, hen compost, pig compost, cattle compost, rice bran/husk compost, and no compost.

On day 7 and day 14, 300 g of each compost type was added to the pots, with each compost type used in 5 pots. Three weeks (on day 21) after sowing, the growth of the sweet corn was assessed. The growth characteristics, including the number and length of leaves, length of the trunk, and length of the root, were examined across various animal compost types and control groups. The number of leaves was counted, and an average per plant was calculated. The length of each leaf was measured from the leaf stalk to the leaf apex using a ruler. The average length of leaves was calculated for each pot. Plant height was measured with a measuring tape, determining the distance from the soil surface at the base of the stem to the apex of the stem. For root growth measurement (radicle roots), soil was carefully washed away to avoid cutting fine roots, and the roots were subsequently washed with running water more than three times to remove soil from the root surface.

4.5. Statistical Analysis

Statistical analysis was performed using Jamovi 1.6.12 [49]. All parameters, except for odour, were represented as the mean ± standard deviation (SD). One-way analysis of variance (ANOVA) tests were employed to examine statistical differences between the manure samples, with post hoc Tukey tests applied for multiple comparisons. A p value less than 0.05 was considered a statistically significant difference.

5. Conclusions

This study represents the first evidence that composted dog and cat manure can be utilised to enhance plant growth, yielding higher nutrient concentrations (including nitrogen, calcium, phosphorus, and sulphur) and promoting the accelerated development of plant leaves and trunks when compared to livestock manure. The proposed protocol involves a 14-day composting process in which dog or cat manure is combined with rice bran, rice husk, and probiotics. These findings highlight the potential of composted pet waste as an alternative fertiliser, offering a promising solution to global waste management challenges. However, the potential contamination of pet faeces with pathogens, particularly *Toxoplasma* spp. from cats, raises significant biosafety concerns. Further investigations are necessary to ensure the safety of composted dog and cat manure, including the development of effective protocols to eliminate pathogens while preserving optimal nutrient content.

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