Comparative Quality of Broiler Manure based Compost with or without Compost Additive and its Effect on the Germination of Pechay

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***Abstract*—** *Utilizing broiler manure for composting at the same time addressing environmental issues can be a feasible alternative for broiler raisers. The study aimed to determine the effects of adding a rapid odor erasing and composting microbes (OECM) at different inclusion rates of 350 grams per 100 kg raw material (50 kg broiler manure + 50 kg fly ash), T2 400 grams per 100 kg raw material (50 kg broiler manure + 50 kg fly ash), T3 and 450 grams per 100 kg or raw material (50 kg broiler manure + 50 kg fly ash), T4 on physical properties, temperature, pH, germination rate, and percentage compost recovery. The control T1 was 100 kg raw material with no OECM. A Completely Random Design (CRD) was used consisting of 4 treatments with each treatment replicated thrice. Tukey HSD was used to further analyze significant differences.*

Result showed that the odor of treated compost was no longer evident on day 13 for T2, T3, and T4. The texture from coarse to fine was observed in day 13 of T2, T3, and T4, while the color from black to grayish black was demonstrated on day 13 of T2, T3, and T4.

The temperature (p. < 0.01), pH (p. < 0.01), compost recovery (p. < 0.01), and germination rate (p. < 0.01) were significantly different over the control. Therefore, the OECM at 350 grams, 400 grams, and 450 grams per 100 kg raw material is an indispensable additive for broiler-based manure as it significantly improved the varying compost quality parameters.

***Keywords*— Broiler manure composting, poultry waste management, OECM, organic fertilizer, fly ash, odor control, compost quality, germination rate, pH, temperature, compost recovery, sustainable farming.**

I. INTRODUCTION

According to Bolan et al. (2010), one of the biggest and quickest expanding agricultural sectors in the Philippines and in other country was the poultry industry. Due to its acceptability by most societal segments and its comparatively low cholesterol level, chicken meat was in higher demand. Globally, poultries are one of the Philippines' most significant agricultural subsectors. Among all the animals reared for commercial use, chickens accounted for most of the poultry production in the country.

To date, the Philippines' Central Luzon region has the greatest number of backyard and commercial farms. However, several environmental issues are now facing the chicken sector. This was attributed to the buildup of numerous wastes, particularly manure and litter. If management techniques that are both ecologically and economically viable are not used, the accumulation of these wastes may cause environmental degradation.

Improper waste management has a detrimental effect on the ecology (Maheshwari, 2013). Near chicken farms, land degradation, and nuisances including stink, insects, and rodents are common neighborhood drawbacks. Poor manure management frequently results in the contamination of water and soil containing pathogens, heavy metals, and nutrients in areas where manure was stored. Poultry services emit unpleasant smells and draw rodents, flies, and other pests that spread disease and annoy the neighborhood. Numerous substances, such as ammonia (NH3), volatile organic compounds (VOCs), and hydrogen sulfide (H2S), can contribute to odor emissions. Consequently, the lives of those who live close to poultry houses are impacted by poultry farms. (Maheshwari, 2013).

Broiler manure was the excess of chicken from poultry industry that can be recycled as nutrient source as it contains the macro nutrients namely: nitrogen, phosphate, and potassium, which can be applied to crops and pasturelands. In Nueva Ecija chicken manure was proven to be efficient as source of organic fertilizer among farmers for their crops (Villegas, 2017).

Moreover, organic fertilizer was a type of fertilizer in which all the components are organic. Because of its composition, it was also safer than synthetic fertilizers. Organic fertilizer can make your plant vibrant, larger, and more nutritious. An organic fertilizer composition includes the manure of chicken, hog, goat, and quail manure, dried leaves, mulching, and other bulking agents. Organic fertilizer was also less expensive than chemical fertilizers, which was why most farmers apply it for their crops and minimizing the use of chemical-based farming.

According to Wardynski (2015), for livestock and poultry farmers, composting has become a more popular strategy for managing animal waste in recent years. Animal dung has been applied as a soil supplement to enhance soil health for a very long time. Application of animal manure compost has several advantages namely: enhanced storage possibilities, reduction in the amount of material that must be carried and distributed on fields, and a better match for hay and pastures throughout the growth period than raw waste.

The researcher was interested in this investigation since organic fertilizer is more chemical-free, inexpensive, and prevent the adverse effects of occupational hazards to farmers. Recently, there was now a growing awareness on the consumption of chemically tainted unhealthy food to our health. The shift to the use of organic fertilizer should be encouraged and maximized. Novel strategies then on how to process animal wastes particularly broiler manure efficiently and rapidly should be explored as it was demand would be expected soon.

1.1 Significance of the Study:

Considering the increasing acidity of the soil in recent years, the need to popularize the use of organic fertilizer must be explored to address environmental degradation and mitigate the adverse effect of climate change. Moreover, biomass by-products such as fly ash, which is abundant in Nueva Ecija, should be utilized for maximum productive use, particularly as a bulking agent to produce organic fertilizer. Moreover, out of 65.22M broiler in the Philippines with an average of monthly intake of 195,660,000 million this will produced 48,915,00 kilogram of manure monthly. If this will be now converted for organic production and equal amount of bulking agent will be added there will be a total of 97,830,000 of compost that will be produced. If percentage weight loss in broiler manure-based composting 0.35%, therefore a total of 34,240,500 of organic fertilizer monthly is expected or 684,810 bags of organic fertilizers at 50kg per bag can be produced. This is a potential source of macronutrients supply (NPK) for paddy field rice in the Philippines.

1.2 Scope and Limitation of the Study:

The annual based manure is limited to broiler manure only. The different Odor Erasing Microbial Compost additives were 350, 400, and 450 grams per 100 kg raw materials composed of 50 kg broiler manure and 50 kg fly ash. Moreover, different of varying parameters was done from day 1 to 14 days only. The physical parameters of the compost were limited to texture, color, and odor. While the compost quality was measure by compost recover and the germination rate of pechay seeds.

II. LITERATURE REVIEW

2.1 Poultry Manure and its Nutrients:

According to Shaji et al., (2021), chicken manure was a wealthy basis of supplements like nitrogen and phosphorus with contaminants such as antibiotics, hormones, heavy metals, and pathogens. It also increases the fertility of the soil, root development, strength of the plants and their resistant to damages from diseases and pest. However, the negative effects on the utilization of poultry manure can be offset if they are not applied to the soil during warm season due to mineralization (Dikinya & Mufwanzala, 2010).

Animals increased in comprehensive structure ingest a substantial quantity of nitrogenous matter and other materials in their diet. Since between 50% and 80% of the nitrate in food was excreted, turning dietary nitrogen into animal products was inefficient (Arogo et al., 2001). According to Campagnolo et al., (2002), antimicrobic residues were discovered to assess the prevalence of antimicrobial substances close to large-scale poultry farms in both surface and groundwater resources in Ohio, 12 water samples (67%) were taken.

2.2 Waste Management of Broiler Manure:

The main issue with raising poultry was the waste, which needs to be properly treated or it might be dangerous for both the environment and people. Manure was a common term for animal feces and urine; it includes organic material and nutrients that enhance its fertilizer value. Bedding materials, feces, unused feed, and feathers make up the waste byproduct of the chicken business known as litter (Barthod et al., 2018).

Fleming and Freedman (2003), claim that improper disposal of poultry carcasses might cause issues with water quality, particularly in locations that are prone to floods or where the water table was shallow. The following techniques can be used to dispose of poultry carcasses, namely: incineration, composting, and body disposal are all options. Large numbers of sick birds were slaughtered in recent incidents of highly pathogenic avian influenza (HPAI) has created new and difficult issues related to environmental pollution. The likelihood of environmental contamination was increased when there are large quantities of corpses since they can produce enormous quantities of urine and other pollutants.

2.3 The Impact of Chicken Manure in Environment:

Chang (2007) it was discovered that the Philippine chicken sector had also encountered constant growth since the introduction of advanced technology in the mid-1950s, as well as the demand viewpoint for the nation's chicken meat and dairy industry would seem favorable considering the country's economic relatively low per capita consuming and estimated economic growth and population growth. In addition, the countries poultry business was dealing with rising consumer demands for product quality, and food safety, as well as public worries about animal protection and the effects of industrialized chicken production on the environment, are all present.

Nevertheless, overusing these organic fertilizers results in environmental pollution like failing air efficiency, enhanced greenhouse gas (GHG) emissions, and abundance of dangerous chemical contaminants. Moreover, nutrient enrichment in water bodies, soil contamination, and improved nutritional loss, especially phosphorus and nitrogen can also be expected. Soil leaching, destruction, and surface runoff stimulated by disregard for agricultural nutrient needs are still prevailing issues (Ru et al., 2018). Improper chicken manure releases an unpleasant stench that attracts flies, pests, and rats, which leads to the spread of infections and antibiotic resistance, as well as being an obvious hazard to people's health (Duan et al., 2019). Therefore, processing and using poultry manure in a sustainable and cost-effective way should be an alternative priority.

2.4 Efficient Composting and Strategies:

Composting was a process that quickens the breakdown of manure by utilizing microorganisms like Trichoderma species and other aerobic bacteria and fungi. The so-called Natural Recycling method involves composting. Microorganisms break down poultry dung, which invertebrates then eat. The nutrients, often known as "the compost," are added back to the soil to help plants thrive. The soil's health and water-holding capacity are both improved by compost. (Adugna, 2016). Animal manure management are ways to improve environmental conditions for both animals and humans.

Moreover, composting was the practice of mixing manure with certain other organic materials and fillers to promote aerobic microbial degradation and stabilize biological material while accelerating progress at ideal higher temperatures. Therefore, a product should be available that has unchanging, pathogen-free, and appropriate for use on (Akdeniz, 2019). A compost contains more vitamins and contains organisms that encourages plant development; adding compost to the soil increases its organic material content, soil composition, and farming practices (Manogaran et al., 2017).

2.5 Bulking Agent and its Importance in Composting:

The use of bulking agents like “fly ash”, could potentially raise pH levels during composting (Wang et al., 2016). Thus, critical composting technology should be done particularly on the quantity of bulking agent to be incorporated and the regularity of turning the compost pile (Morales et al., 2016).

Moreover, bulking agents help maintain moisture levels and carbon to nitrogen percentage. Air supply control can similarly be the rule of a bulking agent. Finally, wood chips, sawdust, grass hay, wheat bran, corn stalks, grass cuttings, animal manure, fruit and vegetable waste, garden waste, deciduous leaves, and other materials are some examples of the various bulking agents used in composting (Batham et al., 2018).

2.6 Sources and Compositions of Fly ash:

"Fly ash" has already been evaluated both chemically and physically when combined with other substances added to industrial substrates, and it was discovered to offer more flexibility to the finished substrate, enhancing the quality of crops (Castoldi et al., 2014). According to Gupta (2012), "fly ash" serves as one of the bulking agents used in compost, and when it was mixed with other organic supplements such as mud press, organic compost, cow and animal manure, wastewater, and agricultural residues, it can enhance nutritional value of soil vulnerable to deterioration.

Additionally, "fly ash" is regarded as a global environmental risk because it typically includes organic contaminants and potentially harmful metals, including Pb, Se, B, Cr, V, As, Al, and Hg, as well as radioactive elements like uranium and thorium. Furthermore, Philrice in Region III assembled a 6.5 hp water pump modified from UC Davis and NEDO models from Japan. The water pump is powered by biomass and can run continuously for 1.35 hours at a mean pump output of 7.5 lps to a waterway depth of 1.3 meters deep (Juliano et al., 2016).

In Central Luzon, being the rice granary of the Philippines has been disposing a vast quantity of "fly ash" which is the by-product Rice Hull Gasifier Plant. These plants are I. Power Gasifier Plant in San Jose City and GIFT Gasifier Plant in Bacal II Talavera City. According to Reurasia (2016), the I. Power Gasifier Plant is loading 360 tons of rice hull daily to produce 12 Megawatts of electricity while the Talavera Plant is Producing 12 Megawatts out of an input of 480 tons of rice hull daily and a daily disposal of 16 tons of "fly ash". Therefore, the maximum utilization of "fly ash" should be explored.

2.7 Qualities of an Ideal Compost:

Composting is a crucial component of the natural greenhouse's production chain. Although the complexity of organic greenhouse production might vary, it is often a system that has significant levels of organic material cycle, large supplies of energy and nutrients, and large production rates (Wurff, 2016).

According to Stehouwer et al., (2022), a broad variety of parameters, including air flow rate, pH, temperature, carbon/nitrogen (C/N) ratio, moisture content, enzyme activity, bulk density, respiration, water holding capacity, microbial colony, porosity, and bioactivity, must be met for compost to be of high quality. These parameters also need to ensure optimal chemical and physical properties in addition to the efficacy of stabilization and maturity. To regulate the procedure "in situ" and make informed judgments regarding its performance, the physical and chemical characteristics of excess must be understood and the variables that affect how well it performs during composting.

Another advantage is the effect that high-quality composting may have on the condition of the soil. When applied to the soil, the addition of compost can supply and restore the soil integrity and structure (Cerda et al., 2018).

2.8 Role of Humidity in Influencing Compost Quality:

According to Richard et al., (2002), one significant environmental component that has an impact on many parts of the composting process is moisture. Moisture has an impact on the kinetics of biodegradation by altering the rates of microbial growth, oxygen transport, and water potential and activity.

Composting's dynamic character, which entails variations in particulate size and composition over time, contributes to the intricacy of these molecules. These correlations have been established using a logical theory of the impacts of moisture on composting processes based on basic biological mechanisms and physical properties. Haug (1993), recommended preserving the moisture content of the compost pile between 40% and 60%. Low (below 40%) moisture content limits microbial activity.

2.9 Advances in Composting Technology:

The originally primitive composting technique has undergone constant iteration and improvement because of rising demand for intensive livestock farms and growing environmental consciousness among the general population. However, the effect of the energy input and composting facilities on eco-efficiency is minimal (Zhou et al., 2022). According to Jim (2016), there are three commonly used composting techniques: aerobic composting, which uses air to hasten the decomposition of materials; anaerobic composting, which is the reverse of aerobic composting and requires relatively little effort; and vermicomposting, which uses oxygen, worms, and moisture to safely and odorlessly break down biological matter.

Moreover, the miracle catalyst known as the Bio Plus Activator (BPA) contains beneficial microorganisms (BM) that have been cultivated to be extremely active so they can carry out each of their specific activities as effectively as they were designed to. They have not been genetically altered or artificially created; they have been isolated from natural sources. They are kept in a genetically designed food foundation that contains trace minerals, amino and organic acids, enzymes, growth-promoting chemicals, and organic-based substances such as chelating, coagulating, emulsifying, stabilizing, and surface-active agents. The result of more than 40 years of research and development, Beneficial Microbes (BM) includes a variety of naturally occurring microorganisms. With the help of our technology, these Beneficial Microbes collaborate effectively. Beneficial microbes are extremely active and proliferate rapidly under the correct conditions. Beneficial microbes create enzymes to speed up the decomposition of organic materials, which is why they are often referred to as "Super Decomposers." This distinctive quality of BM may be used in a variety of sectors to provide cost-effective solutions that are also environmentally beneficial (Ruiz, 2018).

2.10 Features of Rapid Composting Microbes:

According to Raza (2016), composting is a significant and cost-effective way of reusing organic material. The process of generating "developed compost" is ongoing. The study conducted by Kim et al., (2007), found that compost contained a substantial number of heterotrophs and bacterial nitrogen fixers after 90 days of composting utilizing a microbial concoction treatment of sawdust and manure. They documented that a compost additive can influenced enzyme and microbial activity in compost pile aside from hastening its maturity. This suggests that the additive used in a compost pile significantly affected the enzyme reactions of the composting microorganisms, resulting in a considerably quicker breakdown process.

Moreover, in the study of Kim et al., (2005), examine the result of *Synechocystis sp.* on the Chinese cabbage germination index, KACC 91007 is used when there is pig manure or liquid fertilizer for pigs. The initial test entailed the screening of inoculant levels that were, 0.05%, 0.1%, 0.2% and 0.3% correspondingly. Low phytotoxicity and a high Germination index resulted to the choice of 0.05% as the inoculant amount. The results demonstrated that aerobic processing of Pig Liquid Fertilizer for 107 days was superior to anoxic processing and produced more T-N, a macronutrient fertilizer material. Therefore, under aerobic processing conditions, the addition of 0.05% microbial inoculant caused the Chinese cabbage's Germination Index to increase.

Meanwhile, the application of *Trichoderma spp.* to composting is a common strategy for controlling many plant diseases. The biocontrol activities among these species are mostly due to a mixture of different modes of action that may impact the microbiota engaged in compost suppression (Blaya et al., 2013). As a result, Thaha et al., (2020), discovered that utilizing Trichoderma species while composting for 28 days can raise the pH of bio-compost as well as the amounts of potassium, nitrogen, calcium, phosphorus, and C-organics.

According to DA Communication (2022), Dr. Mercedes Garcia of UPLB-Biotech established a microbial-based Bio N biofertilizer to assist Filipino farmers in increasing crop production, such as maize and rice, while preserving soil quality. *Azospirillum*, a nitrogen-fixing bacterium found in soil and charcoal, is present in Bio N. It gives strength to the root structure of a plant, enhances nutritional uptake, offers immunity to pests and diseases, and enhances soil conditions. Finally, applying Bio-N microbial fertilizer is not only increases crop productivity and quality but may also cut rice and corn production costs, which farmers usually agree on.

Furthermore, an Isabela farmer-businessman who has used Bio N for a year, describes the advantages of this unique microbe-based approach. According to Mabunga (2022) believes in using Bio N microbial fertilizer because it helped him produce an additional PHP 15,000.00 per hectares than he previously did with synthetic fertilizers. Also, he experiences with Bio-N has shown amazing outcomes for his rice harvests since he began using it a decade ago. He was able to make savings since these fertilizers are less expensive than those that are currently highly priced on the market. He has been urging his fellow farmers to utilize it since it will benefit us in some manner (Agapito & Mercado, 2022).

III. METHODOLOGY

3.1 Broiler Manure Collection:

The broiler manure was collected from Three J Poultry Farm at Barangay Mangandingay Science City of Muñoz, Nueva Ecija. The broiler manure was collected using the truck of ELR family trading Company and it was delivered directly to ELR family trading Co., Inc. at Barangay Bagong Sikat Science City of Muñoz, Nueva Ecija when the conducting begins, using their truck carrying broiler manure.

FIGURE 1. Broiler Manure Collection trace map

3.2 The Composition and Preparation Process of the Odor Erasing Composting Microbes (OECM):

The OECM is organic based and was prepared as a concoction using the following: 7 bacteria for decomposition, enzyme production, and nutrients transformation; 3 bacteria for decomposition of polysaccharides and enzyme production; 3 bacteria for enhance decomposition, compost "sweetening" and probiotics; 5 bacteria for nitrogen fixation and nutrients transformation; 7 fungi for decomposition, probiotics production and nutrients transformation.

The preparation process involved the following: Classification of the substrate materials based on the modified growth media; comminution or griding of the substrate materials; mixing and blending of substrate materials for homogeneity; nutrient fortification of the substrate to enhance the growth of the super stain beneficial microbes; sterilization; inoculation and subsequent incubation of the beneficial microbes; and propagation and subsequent multiplication of the beneficial microbes in the prepared substrate.

The source of substrate were haystack and decaying woods, cattle manure and silage, dairy processing plant sewerage, fermented vegetables fruits, pineapple pulp, stale bread, waste lagoons, garbage landfills, biogas digester, soil in organic fertilizer plants, oxidation of sewage plants, decomposed sugar cane and waste mushroom substrate and waste effluent.

3.3 Compost Plot Preparation:

Twelve plots measuring 4 ft. x 4 ft. x 1 ft., representing 4 treatments, were replicated three times. Temperature, pH, and moisture were taken from three sampling sites (top, middle, and bottom of the treated plots). Replicates of samples from these treated plots were analyzed for temperature, pH, and moisture by a 4-in-1 soil survey instrument, while the odor, color, and texture were physically observed and recorded.

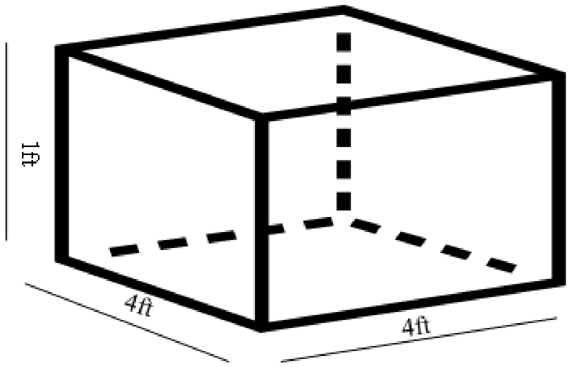

FIGURE 2: Compost Plot Diagram

3.4 Treatment Assignments:

TABLE 1
TREATMENTS AND COMPOSITION OF COMPOST IN THIS STUDY

Treatment	Composition
Treatment 1 (control)	50 kg Broiler Manure + 50 kg Fly Ash
Treatment 2	50 kg Broiler Manure + 50 kg Fly Ash + 350 grams OECM
Treatment 3	50 kg Broiler Manure + 50 kg Fly Ash + 400 grams OECM
Treatment 4	50 kg Broiler Manure + 50 kg Fly Ash + 450 grams OECM

3.5 Treatment Plots Management:

All the experimental treatment plots were stirred vigorously, and it was done at 6:00 AM; 2:00 PM and 10:00 PM from Day 1 to Day 7 and 6:00 AM; 6:00 PM from Day 8 to Day 14. The following compost parameters was recorded immediately after every stirring session.

3.6 Data Gathered:

To address production performance and improvements, the following data was collected in order.

1) (%) Weight Loss- the final weight was measured minus the original weight of the compost material divided by the original weight x 100. Harvest recovery was collected to know how much weight was left and how much was reduced after the composting process. The final weight of the compost was weighed using a 100kg dial table scale.
2) Temperature, pH, and Moisture – was measured by 3 in 1 portable soil test kit and was taken from three sampling sites (top, middle and bottom of the treated plots) from 6am, 2pm, and 10pm from day 1 to day 7 and 6am, and 6pm from day 8 – day 14. Before placing again 3 in 1 portable soil test kit to compost pile, the gadget was cleaned by tissue temperature or the pH gathered in the previous files monitored, minimizing the measurements biased during data gathering.
3) NPK - was analyzed in Soils Laboratory in San Fernando Pampanga
4) Texture, color, and odor – was physically observed in every treatment replicates
5) Germination rate, (%) - was computed by counting the number of seeds germinated divided by the total number of seeds sown multiplied by 100%. Counting the number of pechay seed that grew in each treatment replicates after 7 days was important to consider which treatment stood out using all treatment replicates in the growth of pechay seed.

3.7 Germination of Pechay Seed:

The 100 pieces of pechay seeds was sown directly to the treated compost piles, maintain the moisture of the soil until the sprouts appear and counting for germination was start at the moment of a pechay seed sprout. In just 3-4 days, you can see small buds starting to emerge from the soil. Counting terminates after 7 days only.

3.8 Statistical Analysis:

All analyses were performed using RStudio version 4.3.0. One-way Analysis of Variance (ANOVA) was used to test the difference among treatment means and a p-value less than the level of significance (0.05) indicates that there is at least one treatment mean is different. Tukey's HSD test as a post-hoc test was used to test the pairwise comparison among treatment means.

IV. RESULT AND DISCUSSION

4.1 Comparative Temperature compost with or without OECM:

(Table 2a-b) shows the 14 days temperature mean values gathered during composting period from T1 (50 kg broiler manure + 50 kg fly ash), T2 (50 kg broiler manure + 50 kg fly ash + 350 grams OECM), T3 (50 kg broiler manure + 50 kg fly ash + 400 grams OECM), and T4 (50 kg broiler manure + 50 kg fly ash + 450 grams OECM).

TABLE 2a
COMPARATIVE TEMPERATURE OF BROILER BASED MANURE COMPOST WITH OR WITHOUT OECM

Treatment	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
T1	39.67^{c}	49.00^{c}	47.78^{d}	48.00^{d}	47.00^{d}	41.56^{d}	41.00^{c}
T2	41.44^{a}	57.33^{a}	55.89^{a}	55.11^{a}	55.56^{a}	55.67^{a}	51.67^{a}
T3	38.22^{d}	49.56^{c}	51.33^{c}	49.89^{c}	48.67^{c}	48.56^{c}	47.11^{b}
T 4	40.44^{b}	52.67^{b}	54.56^{b}	53.56^{b}	52.11^{b}	49.89^{b}	48.11^{b}
p-value	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*

TABLE 2b
COMPARATIVE TEMPERATURE OF BROILER BASED MANURE COMPOST WITH OR WITHOUT OECM

Treatment	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14
T1	38.67^{d}	37.50^{d}	35.17^{d}	34.67^{d}	34.33^{d}	33.67^{c}	32.67^{a}
T2	48.00^{a}	47.50^{a}	45.17^{a}	44.00^{a}	39.50^{a}	36.67^{a}	32.33^{a}
T3	44.50^{b}	42.17^{b}	40.00^{b}	39.00^{b}	36.50^{b}	35.00^{b}	31.67^{a}
T4	41.00^{c}	39.00^{c}	38.00^{c}	37.17^{c}	35.50^{c}	33.33^{c}	31.67^{a}
p-value	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	0.16

Significant at 5% level

The temperature measurements and assessed mean values from day 1 to day 7 are summarized in (table 2a) to highlight the 7-day temperature trends of different compost treatments and in (table 2b) is the assessed values from day 8 to day 14 of composting in the study. The data results showed that their significant difference between T2, T3, and T4, whereas T1 was significantly different from T2, T3, and T4. Moreover, temperatures in compost piles range from 38.22 to 41.44 °C at the initial phase of composting. The mean temperature recorded after 14 days of composting ranged from a minimum of 39.67 °C for T1 (50 kg broiler manure + 50 kg fly ash) to a maximum temperature of 49 °C. For T2 (50 kg broiler manure + 50 kg fly ash + 350 grams OECM), 41.44°C to 57.33 °C; for T3 (50 kg broiler manure + 60 kg fly ash + 400 grams OECM), 38.22 to 51.33 °C and T4 (50 kg broiler manure + 50 kg fly ash + 450 grams OECM), 40.55 to 54.56 °C. (Table 2a-b).

Meanwhile, the data showed that, from Day 8 to Day 14 (table 2b) the temperature starts to drop, the maximum temperature ranged, can be seen on Day 8 to Day 14 the maximum ranged was 48°C and the minimum ranged was 31°C. Temperatures in compost piles means range from 39°C to 57°C at the initial phase of composting. All experimentally treated piles were able to reach the three temperature phases necessary for efficient sanitization during the composting duration (CCME 2005; Eusufzai et al., 2013) of the feedstock and process efficiency: the mesophilic phase, where temperatures are between 15°C and 45 °C; the thermophilic phase, with temperatures between 45°C and 70°C; and the cooling phase, when the pile temperatures drop below 60 °C.

Hence, aeration is the primary purpose for turning the compost three times each day from day 1 to day 7. Microbes are responsible for decomposition, and to survive and perform their necessary functions, these microbes must be able to breathe. These microorganisms disappear in the absence of oxygen, which slows down degradation. It must be turned whenever the temperature falls below 40°C to maintain a thermophilic pile before harvesting,

Further, a biological and metabolic process called composting includes bacteria and the enzymes they release (Zeng et al., 2010). Changes in composting temperature indicate changes in microorganisms in the compost substrate and increases in compost substrate temperature are due to metabolic heat accumulation of microorganisms in the compost substrate, indicating the metabolic intensity and conversion rate of organic matter. What is important for microbes in the matrix (Wang et al., 2011).

One of the key factors used to assess the composting process is temperature because it affects both the frequency at which multiple biological reactions occur and how sanitary the outcome is (Bustamante et al., 2008).

4.2 Comparative pH of compost with or without OECM:

(Table 3a-b) shows the 14 days pH mean values gathered during the 14 days composting from T1 (50 kg chicken manure + 50 kg fly ash), T2 (50 kg chicken manure + 50 kg fly ash + 350 grams OECM), T3 (50 kg CM + 50 kg fly ash + 400 grams OECM), and T4 (50 kg CM + 50 kg fly ash + 450 grams OECM).

TABLE 3a
COMPARATIVE pH OF BROILER BASED MANURE COMPOST WITH OR WITHOUT OECM

Treatment	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
T1	5.80[b]	5.69[b]	5.33[b]	5.46[a]	5.37[ab]	5.46[a]	5.54[a]
T2	6.21[a]	6.03[a]	5.71[a]	5.50[a]	5.57[a]	5.54[a]	5.44[a]
T3	6.09[a]	5.86[ab]	5.22[b]	5.36[a]	5.27[ab]	5.50[a]	5.57[a]
T4	5.79[b]	5.92[ab]	5.22[b]	5.48[a]	5.24[b]	5.4	5.38[a]
p-value	<0.001*	0.014*	<0.001*	0.1	0.035*	0.656	0.33

Significant at 5% level

TABLE 3b
COMPARATIVE pH OF BROILER BASED MANURE COMPOST WITH OR WITHOUT OECM

Treatment	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14
T1	5.25[a]	5.30[a]	5.63[a]	5.57[a]	5.48[a]	5.60[a]	5.58[a]
T2	5.43[a]	5.62[a]	5.82[a]	5.72[a]	5.62[a]	5.63[a]	5.62[a]
T3	5.22[a]	5.52[a]	5.77[a]	5.77[a]	5.55[a]	5.40[a]	5.62[a]
T4	5.40[a]	5.62[a]	5.78[a]	5.67[a]	5.67[a]	5.55[a]	5.63[a]
p-value	0.223	0.44	0.418	0.24	0.226	0.099	0.857

Significant at 5% level

pH of compost piles ranges from 5.79 to 6.21 at the initial phase of composting. The mean pH values recorded after 14 days of composting ranged from 5.2 to 5.8 for T1, 5.4 to 6.2 for T2, 5.2 to 6.0 for T3, and 5.2 to 5.9 for T4. During 14 days of composting, the mean pH values recorded on T2, T3, and T4 were not significantly different, whereas T1 was significantly different to T2, T3, and T4.

Moreover, the final pH value gathered from different compost piles was 5.58 for T1, 5.62 for T2, 5.62 for T3, and 5.63 for T4. T2, T3, and T4 pH values are classified as moderately acidic (5.6-6.0) by the United States Department of Agriculture's National Resources Conservation Service, whereas T1 pH value is classified as extremely acidic (5.1-5.5) (Burt, 2014). Beck-Friis et al., (2001) noted that the transition from mesophilic to thermophilic conditions correlated with a change in pH from acidic (pH = 4.5–5.5) to alkaline (pH = 8–9); in addition, all experimental plots in this study reached the thermophilic phase (45–70 °C) (Papale et al., 2021). The constant temperature (39–57°C) throughout composting resulted in stable pH levels ranging from 5.2–6.2 from days 1–14. In accordance with Bunt (1988), the final pH values recorded from all experimental piles (Table 3b) were within the ideal range for growing media, which is between 5.2 and 7.3.

4.3 Comparative Physical Properties of compost with or without OECM:

Composting was carried out for 14 days. Table 4a -4d below informs the results of the color, odor, texture, and moisture of the compost during the study. In general, the mature compost has physical characteristics such as Grayish Black color and smells close to the smell of earth. This is because the material it contains already resembles soil material.

TABLE 4a
COMPARATIVE DAILY PHYSICAL PARAMETERS OF BROILER-BASED MANURE WITHOUT OECM

Days	Treatment 1		
	Texture	Color	Odor
1	Coarse	Black	Slightly Offensive
2	Coarse	Black	Slightly Offensive
3	Coarse	Black	Slightly Offensive
4	Coarse	Black	Slightly Offensive
5	Coarse	Black	Slightly Offensive
6	Coarse	Black	Slightly Offensive
7	Coarse	Black	Slightly Offensive
8	Coarse	Black	Slightly Offensive
9	Coarse	Black	Slightly Offensive
10	Coarse	Black	Slightly Offensive
11	Coarse	Black	Slightly Offensive
12	Coarse	Black	Slightly Offensive
13	Coarse	Black	Slightly Offensive
14	Coarse	Black	Slightly Offensive

Table 4a shows that from day 1 to day 14, the texture of the broiler-based manure compost appeared to be coarse, black in color, and had a slightly odor. There were no changes observed in treatment 1 physical parameters during 14 days of composting.

TABLE 4b
COMPARATIVE DAILY PHYSICAL PARAMETERS OF BROILER-BASED MANURE WITH 350 GRAMS OF OECM

Days	Treatment 2		
	Texture	Color	Odor
1	Coarse	Black	Slightly Offensive
2	Coarse	Black	Slightly Offensive
3	Coarse	Black	Slightly Offensive
4	Coarse	Black	Slightly Offensive
5	Coarse	Black	Slightly Offensive
6	Coarse	Black	Slightly Offensive
7	Coarse	Black	Slightly Offensive
8	Slightly coarse	Black	Slightly Offensive
9	Slightly coarse	Black	Slightly Offensive
10	Slightly coarse	Black	Odorless
11	Slightly coarse	Black	Odorless
12	Slightly coarse	Black	Odorless
13	Fine	Grayish Black	Odorless
14	Fine	Grayish Black	Odorless

Table 4b shows that from day 1 to day 7, the texture of the broiler-based manure compost appeared to be coarse; on days 8 to 12, it was slightly coarse, then appeared to be fine on days 13 to 14. The color on days 1 to 12 was black and became grayish black on days 13 to 14. Further, the odor of the compost from day 1 to day 9 was slightly offensive, and on day 10 of composting, it became odorless. The result showed that the compost was ready to be used after 14 days of composting.

TABLE 4c
COMPARATIVE DAILY PHYSICAL PARAMETERS OF BROILER-BASED MANURE WITH 400 GRAMS OECM

Day	Treatment 3		
	Texture	Color	Odor
1	Coarse	Black	Slightly Offensive
2	Coarse	Black	Slightly Offensive
3	Coarse	Black	Slightly Offensive
4	Coarse	Black	Slightly Offensive
5	Coarse	Black	Slightly Offensive
6	Coarse	Black	Slightly Offensive
7	Coarse	Black	Slightly Offensive
8	Slightly coarse	Black	Slightly Offensive
9	Slightly coarse	Black	Slightly Offensive
10	Slightly coarse	Black	Odorless
11	Slightly coarse	Black	Odorless
12	Slightly coarse	Black	Odorless
13	Fine	Grayish Black	Odorless
14	Fine	Grayish Black	Odorless

Table 4c shows that from day 1 to day 7, the texture of the broiler-based manure compost appeared to be coarse; on days 8 to 12, it was slightly coarse, then appeared to be fine on days 13 to 14. The color on days 1 to 12 was black and became grayish black on days 13 to 14. Further, the odor of the compost from day 1 to day 9 was slightly offensive, and on day 10 of composting, it became odorless. The result showed that the compost was ready to be used after 14 days of composting.

TABLE 4d
COMPARATIVE QUALITY PHYSICAL PARAMETERS OF BROILER-BASED MANURE WITH 450 GRAMS OECM

Day	Treatment 4		
	Texture	Color	Odor
1	Coarse	Black	Slightly Offensive
2	Coarse	Black	Slightly Offensive
3	Coarse	Black	Slightly Offensive
4	Coarse	Black	Slightly Offensive
5	Coarse	Black	Slightly Offensive
6	Coarse	Black	Slightly Offensive
7	Coarse	Black	Slightly Offensive
8	Slightly coarse	Black	Slightly Offensive
9	Slightly coarse	Black	Slightly Offensive
10	Slightly coarse	Black	Odorless
11	Slightly coarse	Black	Odorless
12	Slightly coarse	Black	Odorless
13	Fine	Grayish Black	Odorless
14	Fine	Grayish Black	Odorless

Table 4d shows that from day 1 to day 7, the texture of the broiler-based manure compost appeared to be coarse; on days 8 to 12, it was slightly coarse, then appeared to be fine on days 13 to 14. The color on days 1 to 12 was black and became grayish black on days 13 to 14. Further, the odor of the compost from day 1 to day 9 was slightly offensive, and on day 10 of composting, it became odorless. The result showed that the compost was ready to be used after 14 days of composting.

In general, tables 4a–d showed that there was no significant variation in physical parameters (odor, color, and texture) observed over 14 days of composting between treatments 2, 3, and 4, however T1 was found to be different throughout all the treatments treated with OECM. The final form of compost does not resemble the original form because it has been destroyed due to natural decomposition by microorganisms that live in the compost. *Thiobacillus thiooxidans* and *Thiobacillus ferrooxidans* microbes eliminated the slightly offensive odor in the piles. Furthermore, as described by Ayunin et al. (2016), characteristics of compost with inclusion rates of 350 grams, 400 grams, and 450 grams of OECM in this study display signs of maturation after only 13 to 14 days of composting, having a grayish black color, no foul odor, and a fine texture (Table 4a–d).

4.4 Comparative Weight loss of compost with or without OECM:

Weight Loss is measured to differentiate the influence of compost additive to the mass of different compost treatments used in the study. Higher values in the provided data below means greater weight loss (Table 5).

TABLE 5
COMPARATIVE WEIGHT LOSS OF BROILER BASED MANURE COMPOST, %

Treatment	Harvest Recovery
Treatment 1	28.667^{b}
Treatment 2	39.667^{a}
Treatment 3	32.000^{b}
Treatment 4	36.667^{a}
p-value	<0.001*

Analysis of variance at .05% level of significance

Data showed that there was significant difference (p-<0.01) between T1 (control), T2, T3, and T4. Based on the result, significant maximum reduction in total weight was observed in treatment 2 (39.67) and the lowest reduction was observed in treatment 1 (28.67). On the basis of fully decomposed broiler manure, fly ash with different inclusion of OECM compost, the carbon content was worked out at 14 days in that observed maximum reduction in total organic carbon content. (Miller & Spoolman (2013) confirmed once more that compost is created when worms, microorganisms, primarily fungi and aerobic bacteria, break down organic waste in the presence of oxygen. Similarly, PCAMRD-DOST (2014) described how fungus and bacteria break down waste so that worms can finish the job and improve decomposition. Hence, all experimentally treated piles in the study lost 10 to 50% of their starting weight, related to the work of Breitenbeck and Schellinger (2013).

In addition, the more compost ingredient put to the pile, the greater the weight loss. (Table 5). The compost pile decreases in size from when it first started to compost, which shows that different bacteria are degrading the compost.

4.5 Comparative Germination rate of compost with or without OECM:

The Germination Index is calculated to illustrate which of the experimental treatments will be most effective and to distinguish between compost made from Chicken manure and pechay germination. A higher rate of germination is indicated by higher values for this measurement.

TABLE 6
COMPARATIVE GERMINATION RATE OF PECHAY, %

Treatment	Germination
Treatment 1	36.667^{d}
Treatment 2	87.333^{a}
Treatment 3	76.667^{b}
Treatment 4	61.000^{c}
p-value	<0.001*

Analysis of variance at .05% level of significance

Data showed that there was significant difference (p-<0.01) between Treatment 1 (control), Treatment 2, Treatment 3, and Treatment 4. T1 (50kg broiler manure and 50 kg fly ash) got the lowest germination rate having (36.667), followed by Treatment 4 (50kg broiler manure, 50kg of fly ash and 450 grams OECM) got (61.000), Treatment 3 (50kg broiler manure, 50kg fly ash and 400 grams OECM) got (76.667), and Treatment 2 (50kg broiler manure, 50kg fly ash and 350 grams OECM) which get the highest germination rate among all the treatments having (87.337). Based on the result, treatment 2 was stood-out between treatment, treatment 3 and treatment 4 because of high germination rate

The study by Kim et al. (2005) shows that adding 0.05% of microbial inoculants enhances the pig liquid fertilizer (PLF) and increases the germination index of Chinese cabbage. The study findings also indicated that aerobic processing of PLF for 107 days was superior to anoxic processing and produced more macronutrient fertilizer material such as nitrogen, potassium, and phosphorus. Furthermore, Sace (2018), the plants cannot adequately absorb nutrients and would exhibit signs of shortages if the pH were too high (alkaline) or too low (acidic). Also, data showed (Table 6) showed that the effectiveness of using compost quality harvested compost as a potting media of pechay seeds in terms of GI. To assess the phytotoxicity and maturity of compost using one of these methods, the seed germination index (GI) has been widely used (Luo et al., 2018). Zucconi et al. (1981), proposed the GI, which includes the effect of phytotoxic substances on seedling germination rate and radicle elongation.

V. SUMMARY

The environmental impact of poultry production has received increasing attention over the last several decades. Masarirambi et al. (2012) have further stated that chicken manure, would help to decrease the measure of harmful mixture created by ordinary manures. It was stated in their study that chicken manure is perceived as perhaps the best of this organic compost because of its high nitrogen content. In addition, manures supply different supplements and fill in as soil revision. The main objectives of the study were to (a) determine the odor, color, texture, temperature, pH, and moisture of the various compost treatments, (b) determine the harvest recovery of the various compost treatments, and (c) determine the germination index of pechay seeds from the various compost media. To achieve the objectives that were established and carried out from April to May 2023 at Muñoz, Nueva Ecija's Barangay Bagong Sikat Science City.

Compost additives are combinations of fertilizer, bacteria, or fungi that are meant to hasten the composting process. Fly ash has considerable value as a bulking agent in composting organic wastes, it is anticipated to solve the difficulties of industrial waste disposal, and it is expected to solve these problems.

Twelve replications and four treatments are used in the study. Prior to being added to the potting media trays, the chicken manure degraded in just 14 days. The outcomes reveal that T2 87.333 average's GI, which is composed of (50 kg CM, 50 kg fly ash, and 350g BPA), has a significantly significant impact on GI in comparison to the other treatments.

VI. CONCLUSION

The study has shown that T2 was most effective in reducing the weight of the compost Likewise, it produced the highest percentage on the germination of pechay which 87.333 % among other treatments tested got the lowest rate of germination like in the t1 (control) had a total of 36.67 % only. For economic reason, composting alone may also be a good alternative treatment for vermicompost production. Moreover, the study confirmed on day 14 that all the inclusion levels of the OECM to the broiler manure did not influence increased in temperature. The study confirmed that all the inclusion levels of the OECM to the broiler manure did not influence significant change in pH. The study concluded that the inclusion level of OECM at 350 grams (p-<0.01) significantly increased the % weight loss at 39.67% over the control which is only 28.67%

VII. RECOMMENDATION

The study recommends a higher inclusion level to significantly increased the temperature in future studies because the ideal composting temperature requirements is around 60-65°C for thermophilic microbes. The study recommends a higher inclusion level to significantly increased the pH because is essential to the plants. The study recommends an inclusion level of 350 grams OECM to significantly increase germination index. The study recommends an inclusion level of 350 grams of OECM to significantly increase compost weight loss.

Considering the economics of the utilization of the OECM, a lower inclusion rate can thus be recommended to lower the production cost of the compost. Furthermore, the researcher recommends including the following parameters for future studies: present of heavy metals, porosity, NPK, and C:N ratio.

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