International Journal Applied and Scientific Research (IJASR)
Vol. 3, No. 7, 2025: 617-624

The Effect of *Lactobacillus Sp.* and *Trichoderma Harzianum* in Cattle Feces Compost on the Growth of Land Water Spinach

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ARTICLE INFO

Keywords: Compost, Cattle, Feces, Water Spinach

Received : 5 May
Revised : 23 June
Accepted: 23 July

ABSTRACT

The aim of this study was to determine the effect of *Lactobacillus sp*. and *Trichoderma harzianum* in cattle feces compost on the growth of land water spinach. The experiment was conducted from January to February 2025 at the Greenhouse Animal Feed Production Laboratory, Polytechnic of Agricultural Development Yogyakarta Magelang, using a completely randomized design (CRD) consisting of 5 treatments and 4 replications: 100% soil (P0), 50% soil + 50% regular compost (P1), 50% soil + 50% compost + 20 ml *Lactobacillus sp.* (P2), 50% soil + 50% compost + 20 g *Trichoderma harzianum* (P3), and 50% soil + 50% compost + 20 ml Lactobacillus sp + 20 g Trichoderma harzianum (P4). The parameters observed included plant height, total number of leaves, and fresh weight. The data from the observation of water spinach plants were analyzed using ANOVA. The results showed that the combination of the two organic materials had a significant effect on plant growth parameters, such as stem height, number of leaves, and fresh weight in treatment P4

DOI: https://doi.org/10.59890/ijasr.v3i7.75
E-ISSN: 3025-7670
https://journal.multitechpublisher.com/index.php/ijasr/

INTRODUCTION

Organic farming is produced from an agricultural production system that relies on natural materials without using synthetic chemicals, such as chemical fertilizers, synthetic pesticides, growth hormones, and genetically modified organisms (GMOs) (IFOAM – Organics International, 2022). Compost is an organic fertilizer made from plant residues and animal feces that have undergone decomposition. Cattle feces are often used as the main ingredient in compost due to their effectiveness and nutrient content. Livestock waste rich in nutrients such as nitrogen, phosphorus, and potassium can be processed into compost, making it a sustainable solution to improve soil fertility while addressing livestock waste issues (Prihandini & Purwanto, 2007). The use of bioactivators in the composting of organic materials includes accelerating the decomposition process, eliminating pathogens, and removing unpleasant odors (Zulaehah & Mirwan, 2018). The use of *Lactobacillus sp.* probiotics produces lactic acid, which enhances the decomposition or breakdown of organic materials such as lignin and cellulose (Zhou et al., 2023). Meanwhile, *Trichoderma harzianum* has the ability to absorb plant nutrients. As a growth regulator, *Trichoderma harzianum* actively promotes plant cell proliferation to enhance plant development and yield (Li et al., 2015). Livestock manure is left to decompose naturally into organic fertilizer, but the resulting fertilizer tends to be moist, not fully matured, susceptible to fungi, and has a short shelf life. The potential of livestock manure waste can be processed into organic fertilizer using biological decomposers such as the decomposing bacteria *Lactobacillus sp* and *Trichoderma harzianum*. It is hoped that this innovation in compost production can serve as a solution to help farmers manage livestock manure waste and promote the use of compost fertilizer from animal waste to minimize the use of synthetic or chemical fertilizers.

LITERATURE REVIEW

Unused cattle feces waste will have an impact on the environment in the form of air, water, and soil pollution, which can become a source of disease. Cattle feces are a potential material for organic fertilizer. Compost fertilizer is made using a fermentation method assisted by decomposing microorganisms called bioactivators. Bioactivators accelerate the decomposition of organic matter in feces, converting it into nutrients needed by plants. During the composting process, bioactivators also function to eliminate pathogens in the manure and remove unpleasant odors. The microorganisms contained in bioactivators that play a role in the compost fermentation process are *Lactobacillus sp.* and *Trichoderma harzianum* (Organo et al., 2022).

METHODOLOGY

This research was conducted from January 2 to February 27, 2025, at the Green House Laboratory for Animal Feed Production, Polytechnic of Agricultural Development Yogyakarta Magelang. The materials used in this study were: soil, cattle feces, *Lactobacillus sp* bacteria from propunic products, *Tricoderma harzianum*, water spinach seeds, seedling trays, digital scales, thermometers, sieves, pH meters, 25 x 25 cm plastic polybags, sprayers, and rulers.

The research method used in this study is an experimental method employing a completely randomized design. Water spinach plants were divided into 5 treatments and 4 replications, resulting in 20 experimental units. Each experiment used 2 water spinach plants randomly planted in polybags. The treatments consisted of 5 levels:

a. P0: 100% soil
b. P1: 50% soil + 50% regular compost
c. P2: 50% soil + 50% compost + 20 ml *Lactobacillus sp.*
d. P3: 50% soil + 50% compost + 20 grams *Trichoderma harzianum*
e. P4: 50% soil + 50% compost + *Lactobacillus sp.* 20 ml + *Trichoderma harzianum* 20 grams.

Waste Collection

Waste collection Cattle manure waste is obtained from cattle raised at the Polytechnic of Agricultural Development Yogyakarta Magelang, Department of Animal Husbandry. The types of cattle whose feces are collected are Limousin, Ongole, and Bali cattle. The types of feed that affect the cattle feces come from fresh grass and concentrate.

Compost Installation

Fresh cattle feces are collected in a storage area. The composting area is shaded from rain using a UV-resistant plastic roof, which also allows light to enter, which is useful for the drying process. The structure is simple in design to prevent rainwater from entering. One side is left open to allow air circulation for drying. The composting area is covered with a UV-resistant plastic roof to prevent rainwater from entering. The structure is simply designed to prevent rainwater from entering. One side is left open to allow air circulation for drying.

Compost Production

Composting was carried out by preparing raw materials consisting of cattle fecesand bioactivators in the form of *Lactobacillus sp.* bacteria in Propunic products from CV. Pendawa Kencana Multifarm and *Trichoderma harzianum.* Composting was carried out by adding biological agents to cattle fecesaccording to the treatment and concentration and different concentrations. Every treatment with repetition was grouped into one place. The composting treatment was divided into 4 groups, the first being regular compost without the addition of bioactivators, the second being compost with the addition of *Lactobacillus sp.* bacteria in Propunic, the third being compost with the addition of *Trichoderma harzianum*, and the fourth being compost with the addition of *Lactobacillus sp.* bacteria and *Trichoderma harzianum.* The composting process used an aerobic method, meaning it was exposed to air and light but not direct sunlight and not exposed to rain.

Compost Harvesting

The compost is harvested after a 7-day composting period and then dried in another location to reduce its water content. The dried compost is then ground using a sieve or grinding machine. The finished compost is dark brown in color, odorless, and has a smooth texture. The mature compost can be applied to plants.

Organoleptic Assessment

Organoleptic assessment of compost can be conducted by observing four indicators: texture (coarse, moderately crumbly, crumbly, very crumbly), color (brown, dark brown, black, very black), odor (strong odor, odor, moderate, earthy odor), and pH measurement using a pH indicator. pH measurement is performed by dipping the pH indicator into the sample and allowing it to react until the indicator shows the pH result. Compost has a neutral pH of 6.5–7.5. Measurements are taken by dipping the pH indicator into the sample and allowing it to remain until the pH indicator shows the result. Compost has a neutral pH of 6.5-7.5.

Growing Water Spinach Seeds

Growing water spinach seeds is done by preparing a seed tray. The seed tray is filled with a soil and husk growing medium in a 2:1 ratio for 14 days. The seed tray filled with seeds is placed in a shaded area that is not exposed to rain. The seeds are watered every day in the morning and evening. After the seeds are sown, they will sprout into small seedlings on the 14th day. After that, seedlings with 2-4 leaves can be immediately transferred to the experimental polybag. After sowing, the seeds will have grown into small seedlings by day 14. After that, the seedlings with 2–4 leaves can be immediately transferred to the experimental polybags.

Culture Medium Preparation

Culture medium preparation in the form of treatments containing soil and compost for planting water spinach seedlings. Soil and compost are mixed according to the concentration of each treatment with the appropriate number of repetitions. After the culture medium is mixed, put it into polybags. Each polybag is filled with a mixture of compost and soil weighing 2 kg.

Planting Water Spinach

After sowing, the water spinach seedlings are planted in polybags, each containing one seedling, for a total of 40 polybags. Water them every morning and evening using water. After that, measure the height of the plants and the total number of leaves on days 10, 15, 20, and 25, and weigh the wet weight (grams) of the water spinach plants on day 25.

Monitoring Plant Growth and Yield

In this study, monitoring was conducted to observe the effect of adding *Lactobacillus sp.* and *Trichoderma harzianum* to cattle feces compost fertilizer on plant growth and yield.

a. Plant Height

Plant height was measured from the base of the plant to the tip of the growing point at 10, 15, 20, and 25 days after planting using a ruler and measuring tape.

b. Total Number of Leaves

Leaves were counted at 10, 15, 20, and 25 days after planting, with the criteria being fully opened leaves; yellow and wilted leaves were not counted.

c. Wet Plant Weight

Wet plant weight was measured at harvest, i.e., 25 days after planting, by weighing the entire fresh plant without drying. The roots, stems, and leaves of

the plants were washed and drained, then the remaining water was air-dried, and each plant was weighed using digital scales.

Data Collection Techniques

Data collection techniques involved observation conducted during the study, beginning with organoleptic observation after the compost was harvested. It was then applied to water spinach plants 14 days after sowing. Observation began on the 10th day.

Data Analysis

The data is descriptive analysis to analyze the results of water spinach observations and statistical analysis using the ANOVA (Analysis of Variance) method with the SPSS program to see the effect of *Lactobacillus sp.* and *Trichoderma harzianum* in cattle feces compost on the growth and yield of water spinach. If there are significant differences, a follow-up test will be conducted using the Duncan test.

RESULT AND DISCUSSION

The results of observation and data analysis using the One Way ANOVA test were used to determine the effect of biological agents in compost on water spinach plants. The test results are presented in the following table.

Table 1. Results of Plant Parameter Testing Analysis

Parameters	P0	P1	P2	P3	P4
Plant Height (cm)	23,6	30,5	33,3	47,5	58,1
Total Number of Leaves (sheets)	3	5	6	6,75	7
Wet Plant Weight (gram)	5	10,3	12,1	12,8	12,1

Source. Data Processed (2025)

Plant Height

Statistical analysis results show that the type of compost fertilizer and the addition of bioactivators have a significant effect on the height of water spinach plants ($P<0.05$). The best treatment was obtained from the combination of cattle fecescompost with *Lactobacillus sp.* and *Trichoderma harzianum* bioactivators, resulting in an average plant height of 58.13 cm. This indicates that the addition of bioactivators enhances the effectiveness of compost as a nutrient source for plants.

The increase in plant height is strongly suspected to be caused by the active role of microorganisms present in the bioactivator. *Lactobacillus sp.* is known to produce enzymes and organic acids that accelerate the decomposition of organic matter, making nutrients such as nitrogen, phosphorus, and potassium more readily available to plants (Amrullah et al., 2021). Meanwhile, *Trichoderma harzianum* plays a role in accelerating mineralization and producing plant hormones such as auxin and cytokinin, which are known to be important in stimulating plant height growth (Sari et al., 2022).

These results align with previous research by Nugroho et al., (2020), which reported that the application of compost supplemented with *Trichoderma harzianum* significantly enhances the growth of cabbage plants. Bioactivators not only accelerate the composting process but also improve soil structure and enhance root absorption of nutrients. With sufficient nutrients available in an easily absorbable form, plants can grow more optimally, especially in the early vegetative phase, which is characterized by rapid plant height increase. Therefore, it can be concluded that the combination of *Lactobacillus sp.* and *Trichoderma harzianum* bioactivators contributes positively to the availability of nutrients in the culture medium, which directly impacts the increase in water spinach plant height.

Total Number of Leaves

The results of the analysis of variance showed that the treatment of cattle feces compost with the addition of bioactivators had a significant effect ($P<0.05$) on the total number of leaves of water spinach plants. The treatment with a combination of *Lactobacillus sp.* and *Trichoderma harzianum* produced the highest total number of leaves compared to other treatments. This indicates that microbial activity in bioactivators can increase the availability of essential nutrients, especially nitrogen, which plays an important role in the formation of vegetative tissues such as leaves (Sari et al., 2022).

Lactobacillus sp. is known to produce organic acids and enzymes that accelerate the decomposition of organic matter, thereby making nutrients more available (Wahyuni et al., 2021). Meanwhile, *Trichoderma harzianum* plays a role in improving soil structure, enhancing nutrient uptake by roots, and stimulating plant growth through the production of secondary metabolites. The combination of both provides more optimal growing conditions for plants, especially during the early vegetative phase.

Wet Plant Weight

The results of the analysis of variance showed that the treatment of cattle feces compost with the addition of bioactivators had a significant effect on the fresh weight of water spinach plants ($P<0.05$). The combination treatment of *Lactobacillus sp.* and *Trichoderma harzianum* produced the highest fresh weight of plants compared to the single treatment and control.

This increase in fresh weight indicates that the activity of microorganisms in the bioactivator synergistically accelerates the decomposition of organic matter, making nutrients such as nitrogen, phosphorus, and potassium more available and easily absorbed by plants. *Lactobacillus sp.* is known to produce enzymes and organic acids that accelerate the mineralization process, while *Trichoderma harzianum* can enhance root absorption and stimulate plant growth through the production of secondary metabolites that act like growth regulators (Wahyuni et al., 2021; Nugroho et al., 2020).

These results align with the findings of Sari et al., (2022), who reported that the use of bioactivators in the composting process can enhance the growth and yield of horticultural crops. The availability of sufficient nutrients and the improvement of soil physical properties from compost use play a role in supporting optimal plant biomass growth.

CONCLUSIONS AND RECOMMENDATIONS

The application of composted cattle feces enriched with *Lactobacillus sp.* and *Trichoderma harzianum* significantly influenced the vegetative growth of water spinach (Ipomoea aquatica), as indicated by increased plant height, number of leaves, and fresh weight. The synergistic activity of both bioactivators accelerated organic matter decomposition, improved nutrient availability, and enhanced soil conditions, which contributed to optimal plant growth. The combined treatment of *Lactobacillus sp*. and *T. harzianum* resulted in the most favorable outcomes across all growth parameters.

ADVANCED RESEARCH

Future studies should investigate the microbial mechanisms by which *Lactobacillus sp.* and *Trichoderma harzianum* enhance nutrient availability and plant growth. Research should also evaluate the effectiveness of this bioactivator-enriched compost across various crops and soil types, optimize its formulation for stability and shelf life, and explore potential synergies with other organic amendments such as biochar or vermicompost. Additionally, field-scale trials and economic feasibility studies are essential to support practical application and farmer adoption.

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