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Research Article

Effect of Vermicast from *Eudrilus Euginae* on the growth and yield of loose-leaf lettuce *Lactuca Sativa L.*

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Abstract

It is essential to note that responsible consumption and production practices are crucial in achieving Sustainable Development Goal (SDG) 12 for better and more sustainable farming practices. That is the use of an organic fertilizer called vermicast. Vermicast, also called worm castings, is an incredibly effective organic fertilizer that earthworms produce. Through vermicomposting, specific species of earthworms consume organic matter and excrete waste that is then transformed into organic fertilizer. Recent research has conclusively shown that vermicast produced by the African nightcrawler earthworm species Eudrilus euginae is not only profitable for large-scale production but also results in an average yield of 5.25 tons per hectare of loose-leaf lettuce. The study has provided conclusive evidence that using vermicast significantly improves the growth of lettuce and is economically feasible based on the Estimated Cost of Return Analysis. Furthermore, vermicast has been found to substantially affect the agronomic characteristics of lettuce plants during harvest time. Given its effectiveness on vegetables and crops, it is highly recommended that further investigation be carried out to determine its potential effectiveness on other crops, fruit trees, root crops, and cereals under similar conditions.

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Introduction

The leafy green vegetable, commonly known as lettuce or scientifically named *Lactuca sativa*, is an annual plant believed to have originated from either India or Central Asia. This salad staple has been enjoyed globally since ancient times, notably by Greeks and Romans. Lettuce is categorized into three main groups: heading lettuce, which resembles cabbage with a tight core; loose-leaved lettuce, which has a more loosely arranged leaf structure; and cos romaine lettuce, which has a round and oblong head (Wikipedia contributors 2024). Lettuce is a hardy and fast-growing plant that can flourish in all temperate regions, especially in areas with high humus and organic fertilizer. It thrives best in moderately cool soil and air, with ideal growth temperatures between 15-21°C. High temperatures may cause bitterness and elongation of the seed stalk, so it is crucial to maintain appropriate growing conditions.

In 2021, the world's production of lettuce was 27 million tons, with China alone producing 14.4 million tons or 53% of the world's total reported by FAO in 2006 (Wikipedia contributors 2023). Lettuce is the only genus of *Lactuca* to be grown commercially (S.T. Koike, 2006)Lettuce is an increasingly popular vegetable because it is mainly used in making Ceasar salads, leaf filling in sandwiches and burgers, leaf decoration in recipes, and as an appetizer in a mixed vegetable salad.

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The vermicast organic fertilizer used a special kind of composting using earthworms called the African Nightcrawler *Eudrilus euginae*. The earthworms digest and grind this material uniformly, mixing nutrients in simple forms. The product is "super humus," which is exceptionally fertile topsoil conditioned adequately for best root growth, containing in rich proportion and water-soluble form for optimum plant nutrition, so plants need only minimal effort to obtain them combating abiotic plant growth (Rehman et al., 2023).

The vermicast in the form of earthworm castings, compared to the soil itself, is higher in bacteria and organic matter, nitrate nitrogen, exchangeable calcium and magnesium, available phosphorus and potassium, pH base saturation, and cation exchange capacity (Anand & Sinha, 2020). Vermicompost is an excellent soil amendment and a biocontrol agent, which makes it the best fertilizer and more eco-friendly as compared to chemical fertilizer (Joshi et al., 2015). Considering chemical fertilizers' problems, vermicast characteristics are very suitable for lettuce cultivars and their growing stages, which abundantly utilize nutrients for production.

In this study, vermicast was utilized in the experiment. This organic fertilizer comes from earthworm castings, which are excellent natural plant food direct from Mother Nature in their purest form (Heider, 1987). Vermicast has been one of nature's most significant procedures of readily available plant food. When used in greater concentration, this non-burning, long-lasting organic fertilizer can provide nutrients easily absorbed by plants as food. Another point is that Earthworm Casting is highly concentrated with beneficial bacteria and microbes added to them by the earthworm in the digestive process (Kaur et al., 2018). These microscopic creatures help different elements of the soil in conjunction with each other to create healthy working soil that provides the best possible atmosphere for optimum growth (Mahboub Khomami et al., 2019).

Aim of Study

This study aims to determine the growth and yield of loose-leaf lettuce in different formulations of vermicast organic fertilizer and to compare their growth and yield with a synthetic fertilizer 18-46-0, 0-0-60, and 46-0-0. This study would guide the researchers and lettuce growers who plan to conduct future research in lettuce, especially in using Earthworm Casting (Vermicast).

Method

This field experiment utilized an area of 226.95 sq m using a Randomized Complete Block Design (RCBD), with six treatments measuring two m wide and four m long with an alley of 0.3 m between blocks and plots. The treatments were as follows: T1 – Control, T2 – Full recommended rate of chemical fertilizer such as (18-46-0), (0-0-60) and urea (46-0-0), T3 – ½ recommended rate of chemical fertilizer plus one ton of vermicast organic fertilizer, T4 – one ton of vermicast organic fertilizer, T5 – one ton of vermicast organic fertilizer plus total recommended rate of chemical fertilizer, T6 – ½ recommended rate of chemical fertilizer.

The experimental area was thoroughly prepared by plowing three times, alternating with three times harrowing, until the soil particles became fine enough for proper aeration and good moisture retention for adequate root penetration. Building and putting up a shade cloth was necessary to protect the lettuce from rain and too much sun exposure.

Transplanting was done three weeks after sowing the seeds in the seedbed. Then, the seedlings were bagged and hardened. When the seedlings reached 8 cm tall, they were transferred to the prepared plots at 33 cm between rows and 25 cm between hills. Fertilization was done by applying vermicast organic fertilizer in the soil before planting at one ton per hectare. Chemical fertilizers such as 46-0-0, 18-46-0, and 0-0-60 were used based on the soil analysis results. The first dose was applied as basal at transplanting, and the second was applied 15 days after the first weeding. Shallow cultivation using hoe and hand cultivation was done to loosen the soil and give aeration to the roots. Weeding was done to control weeds that compete with plants for nutrients. Watering was done at seven o'clock in the morning and four o'clock in the afternoon every day to maintain sufficient moisture to ensure good growth and development of lettuce during the early growth stage. Aphids, fleas, beetles, cabbage moths, and grasshoppers were the common insect pests attacking lettuce. Chemical insecticides such as Cymbush and Karate control these insect pests. Among the most destructive diseases that infest and cause severe losses to lettuce growers are lettuce drops, bottom rot, gray mold rot, Downey

mildew, and Cercospora leaf spot. Benlate, a fungicide, was used to prevent the onset of these diseases. Loose-leaf lettuce is ready to harvest 45-50 days after transplanting. Harvesting was done by cutting the base with a sharp knife, and then the harvested plants were placed under the shaded area and soaked in the water to maintain their crunchiness. Matured and dried leaves were removed before weighing to determine the total yield.

These were the parameters gathered at the time of harvest. An average number of leaves: This was done by harvesting and counting all the opened leaves of 10 representative sample plants picked up randomly from each plot and recorded. The average diameter of leaves – The diameter of each leaf of the ten usual sample plants picked up randomly from each plot was measured in centimeters using a tape measure. Yield of loose-leaf lettuce – The harvested plants from each plot were weighed in kilograms using a weighing scale, which was converted to tons per hectare.

Results

Analysis and Interpretation of Data

Table 1. Average number of leaves of loose-leaf lettuce

Treatments	Average Number of Leaves
T1	10.050[a]
T2	14.900[b]
T3	15.900[b]
T4	14.700[b]
T5	14.725[b]
T6	12.775[ab]
C.V (%)	30.96
F-test	significant

ns – not significant, *significant at a 5% level of confidence

Table 1 shows the average number of leaves of loose-leaf lettuce affected by applying vermicast organic fertilizer. It was observed that plants treated with ½ recommended rate of Chemical fertilizer plus one ton of vermicast organic fertilizer as (Treatment 3) obtained the highest number of leaves over all other treatments. Statistical Analysis revealed a significant result at (p<0.05).

Table 2. The average diameter of loose-leaf lettuce in centimeters

Treatments	Average Number of Leaves
T1	17.0475[a]
T2	23.180[b]
T3	22.756[b]
T4	20.988[b]
T5	22.798[b]
T6	21.295[b]
C.V (%)	14.10
F-test	significant

ns – not significant, *significant at a 5% level of confidence

Table 2. Revealed a significant result at (p<0.05). This result was proven in the statement (Guerrero III, 1985) that vermicast as a plant growth media significantly improved ornamentals, flowers, and vegetables and (Guerrero III, 1996) In the study conducted in Dolores, Quezon City, cabbages treated with vermicompost obtained the largest average diameter of the head versus chicken manure.

Table 3. Average yield of loose-leaf lettuce in (ton/ha)

Treatments	Average Number of Leaves
T1	2.825[a]
T2	6.000[b]

T3	5.500[b]
T4	5.250[b]
T5	5.625[b]
T6	4.750[ab]
C.V (%)	30.96
F-test	significant

ns – not significant, *significant at a 5% level of confidence

Table 3 shows the yield of loose-leaf lettuce in tons per hectare at harvest. Significant (p<0.05) results confirmed the statement of (El-Goud & Amal, 2020) that earthworm casting contributes effectively to a high yield of lettuce; (Blouin et al., 2019) that a 31% increase in plant growth was obtained using 4 tons of earthworm casting and (Bellitürk et al., 2017) during the test on eggplant and pepper plants, the lettuce responded well and produced a high yield.

Discussions

It is a fact that the use of organic fertilizer has been known for 100 years. The acceptance of this practice is laborious and slow, but the effect of organic fertilizer is continuous. It also improved the biological and physical properties of the soil composition essential for plant growth. The continued use of synthetic commercial fertilizer eventually makes the soil acidic and toxic to beneficial soil organisms. Thus, vermicast organic fertilizer from Edrilus Euginae is highly recommended, though comparatively low in nutrients and slow in releasing these to the plants and is usually known to improve the physical and biological properties of the soil (Bundan, 1992). It contributes effectively to the best quality, better tasting, and higher lettuce yield (Corpus, 1983). Hence, this study was conducted to prove helpful to vegetable growers, particularly to people with lettuce production and to our future researchers who love to engage in organic farming and those who also engage more in developing the effectiveness of organic fertilizer. Based on the above findings and conclusion, the following are the study's recommendations:

Recommendations

- The study with the use of vermicast organic fertilizer from Eudrilus Euginae is also recommended to use as one of the sources of good fertilizer as a substitute to other fertilizers because the natural plant food was readily available and has an easily absorbed nutrient that is suitable for better farming.
- The use of vermicast organic fertilizer from Eudrilus Euginae is recommended for its considerable and profitable production.
- Since vermicast organic fertilizer from Eudrilus Euginae is effective in vegetables and crops, further study is recommended for other crops, fruit trees, root crops, and cereals in the same conditions to determine the efficacy of this organic fertilizer.

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