# CHAPTER I. INTRODUCTION

## 1.1. Background

Indonesia is an agricultural country where the majority of its population relies on farming, making agriculture a vital sector in ensuring the nation's welfare. One important factor in agriculture that plays a significant role in crop productivity is soil fertility. As a medium for plants to grow and a provider of water and nutrients, soil fertility in an area determines tillage techniques and fertilization doses that support agricultural productivity.

According to Ardanari and Santosa (2018), the soil texture in the southern part of Ngawi District is influenced by Lawu mountain material and is dominated by humus sand texture. The central part of Ngawi District is mostly clay. The northern region of Ngawi District lies at the confluence of two major rivers, resulting in finer soil texture predominantly composed of limestone, making it unsuitable for rice cultivation[1]. Based on the Central Statistics Agency (CSA) in 2020, around 56,753.10 hectares or 43.47% of the total area of Ngawi Regency is grumusol soil.

Grumusol is a soil type with low fertility, characterized by a loam texture that is relatively hard, pliable, and prone to breaking or crumbling. It has a clay content exceeding 30%, extending to a depth of 50 cm from the surface,

[1] Tara Ardanari dan Sigit Heru Murti B. Santosa, "Pemanfaatan Penginderaan Jauh untuk Analisis Potensi Lahan Sawah Padi di Kabupaten Ngawi Jawa Timur," *Jurnal Bumi Indonesia* 7, No. 4 (2018).

with cracks wider than 1 cm observed at the same depth[2]. Grumusol soils exhibit a dark gray to black coloration and are relatively low in organic matter, with deep cracks forming during dry conditions. They have a heavy clay texture, becoming hard when dry and sticky when wet. The soil reaction ranges from neutral to occasionally acidic or alkaline. These soils originate from materials such as limestone, shale, calcareous (argillaceous) deposits, ancient alluvium, and volcanic substances. Found at altitudes from sea level up to 200 meters, they thrive in humid tropical to subtropical climates with annual rainfall between 800 and 2000 mm.[3].

Despite its unfavorable properties and characteristics, grumusol soils are still promising, particularly for rice farming. However, supporting aspects such as proper drainage and adequate irrigation systems must first be ensured to mitigate the negative impacts and shortcomings of this type of soils. Allah said in the Qur'an surah Al- A'raaf verse 58 as follows:

وَالْبَلَدُ الطَّيِّبُ يَخْرُجُ نَبَاتُهُ بِإِذْنِ رَبِّهِۖ وَالَّذِي خَبُثَ لَا يَخْرُجُ إِلَّا نَكِدًا ۚ كَذَٰلِكَ نُصَرِّفُ الْآيَاتِ لِقَوْمٍ يَشْكُرُونَ

"And the fertile land produces abundantly by the Will of its Lord, whereas the infertile land hardly produces anything. This is how We vary ˹Our˺ lessons to those who are thankful."

Grumusol soils possess exceptionally high expansion and shrinkage coefficients, which cause them to dry, swell, and crack in the absence of

[2] Joni Gunawan, Rini Hazriani, and Rabbirl Yarham Mahardika, *Buku Ajar Morfologi Dan Klasifikasi Tanah* (Pontianak: Fakultas Pertanian Universitas Tanjungpura, 2020).

[3] Constantine Purba, Saberina Hasibuan, dan Syafriadiman, "Pemanfaatan Vermikompos yang Berbeda Terhadap Perubahan Parameter Kimia pada Media Tanah Gambut," *Jurnal Online Mahasiswa Fakultas Perikanan Dan Ilmu Kelautan Universitas Riau* 4, No. 2 (2017): 1–19.

irrigation. This leads to plant roots being severed, particularly when they grow laterally, ultimately resulting in suboptimal crop yields. Additionally, another challenge associated with grumusol soils is their low nitrogen levels, which negatively impact plant growth, necessitating the use of fertilizers to achieve optimal results. One type of organic fertilizer that plays an important role in improving soil physical, chemical, and biological fertility is vermicompost.

Vermicompost is an organic fertilizer derived from the digestion process within worms, consisting of fermented waste combined with the medium in which the worms reside[4]. Vermicompost is considered the most effective fertilizer widely utilized in industrial practices to enhance plant growth and soil microbial communities, owing to its nutrient richness, high nutritional content, and microbial diversity[5]. This aligns with the statement of Kiyasudeen et al. (2016), who highlighted that vermicompost possesses greater levels of micro and macronutrients than other commercially available organic fertilizers[6].

The activity of earthworms in finding food, hollowing out the soil and releasing their metabolic waste products changes the physical, chemical and biological properties of organic matter and soil to meet the nutritional needs

[4] Sunawan, Sama' Irodat Tito, dan Nurhidayat, "Inovasi Teknologi Budidaya Sayuran Organik Menggunakan Pupuk Vermikompos di Kota Batu," *JMM (Jurnal Masyarakat Mandiri)* 6, No. 2 (2022): 1114–23.

[5] Fengyan Zhao et al., "Vermicompost Improves Microbial Functions of Soil with Continuous Tomato Cropping in a Greenhouse," *Journal of Soils and Sediments* 20, No. 1 (2020): 380–91, Https://Doi.Org/10.1007/S11368-019-02362-Y.

[6] S Katheem Kiyasudeen et al., "Vermicompost, Its Applications and Derivatives," in *Prospects of Organic Waste Management and the Significance of Earthworms*, 2016, 201–30, https://doi.org/10.1007/978-3-319-24708-3.

of earthworms[7]. Thus, the quality of the vermicompost produced depends on the type of worm feed provided. Based on the explanation above, this research was carried out to assess the impact of different kinds of earthworm (*Lumbricus rubellus*) vermicompost on grumusol soil in paddy fields and drylands in Ngawi Regency, specifically focusing on the growth and nitrogen (N) uptake of corn (*Zea mays*) plants.

## 1.2. Problem Formulation

1. How does the application of various vermicomposts affect the growth and N uptake of corn plants?
2. How does land use type affect the growth and N uptake of corn plants?
3. How does the interaction between the application of various vermicomposts and land use types on the growth and nitrogen uptake of corn plants?

## 1.3. Research Objectives

1. Studying the effect of various vermicomposts on the growth and N uptake of corn plants.
2. Studying the effect of land use type on the growth and N uptake of corn plants.
3. Studying the interaction between various vermicomposts and land use type on the growth and N uptake of corn plants.

[7] Kartika Utami et al., "Peran Vermikompos Kotoran Sapi Terhadap Peningkatan Hara di Tanah Inceptisol dan Ultisol Bengkulu," in *Seminar Nasional dalam Rangka Dies Natalis Ke-47 UNS Tahun 2023 "Akselerasi*, vol. 7, 2023, 465–73.

## 1.4. Research Benefits

The benefits of research are divided into two, namely practical benefits and theoretical benefits.

1. Practical benefits. The study is anticipated to provide an alternative approach to enhancing the fertility of grumusol soil in Ngawi Regency in a cost-effective, efficient, economical, and environmentally friendly manner. Through this research, it is expected that farmers can reduce the need for inorganic fertilizers by utilizing organic and highly nutritious earthworm (*Lumbricus rubellus*) vermicompost, especially in corn (*Zea mays*) commodity production activities.
2. Theoretical benefits. This research can serve as a foundation for future studies and act as a reference for the advancement of vermicompost as an emerging field in the application of organic fertilizers and soil conditioners.