

CHAPTER I

INTRODUCTION

1.1 Background

Soil is the primary growing medium for plants, but not all soil types possess the physical and chemical properties that support optimal plant growth; for example, Ultisol. One approach to improving soil quality is the use of soil amendments. Soil amendments are materials or substances added to the soil to enhance fertility and productivity in soils that are acidic, nutrient-poor, or have low cation exchange capacity (CEC) (Sianipar *et al.*, 2024). The use of soil amendments offers various benefits, including raising soil pH, reducing toxic aluminum (Al) saturation, and increasing nutrient availability (Telaumbanua *et al.*, 2023).

Generally, soil amendments are divided into two groups: inorganic amendments (such as dolomite, calcite lime, and natural phosphate) and organic amendments (such as compost, manure, biochar, and agricultural waste). One potential yet underutilized source of organic amendments is chicken bone waste, which has not been fully utilized. Chicken bones processed into flour contain high levels of phosphorus (P) and calcium (Ca), which can serve as both a nutrient source and a soil acidity neutralizer (Lestari, 2014).

Chicken bones are a waste product that currently has no economic value but instead has negative impacts, particularly regarding disposal and cleanup processes, which incur costs and can pollute the environment (Lestari, 2015). According to data from the Central Statistics Agency, Padang ranks third in broiler chicken production in West Sumatra, with a total of approximately 5,191,726 kg. This finding aligns with research on the distribution of Ultisol soils, which cover 635,500 ha in West Sumatra and are currently used for agricultural development (Munir, 2019).

One solution to address the above issues is to utilize it as a raw material for powdered organic fertilizer. This serves as a cost-effective alternative source of nutrients and a solution to reduce environmental pollution (Cetingul, 2022). The use of soil conditioners derived from bone waste is expected to serve as a new technological innovation and a solution to the challenges facing agricultural land in Indonesia, which currently requires the expansion of farmland due to a shortage of

fertile soil resulting from inappropriate land use.

A study by Sianipar *et al.* (2024) emphasizes that organic matter is a key factor in maintaining soil health and supporting sustainable crop production. Previous research on chicken bone meal has shown that applying it to Ultisol can significantly increase phosphorus (P) levels by up to 12-fold (Lestari and Azwin, 2014). A dose of 15 g of chicken bone meal per polybag yielded the best results in enhancing sorghum plant growth in Ultisol soil (Lestari, 2015). Meanwhile, a dose of 30 g per plant improved cabbage growth (Abdillah, 2020). In addition to dosage, the frequency of fertilizer application also affects plant growth. Research by Wibowo *et al.* (2023) states that the frequency of fertilizer application affects the growth of okra plants. However, based on a review of the current literature, no studies have specifically investigated the effect of the application frequency of chicken bone meal as a soil amendment on Ultisol soils; therefore, further research is needed on the application of chicken bone meal as a soil amendment to optimize its use in improving soil fertility and crop productivity.

Water spinach is a popular vegetable in Indonesia due to its rapid growth and high nutritional content. However, the growth and nutritional content of spinach can be influenced by soil fertility conditions (Suryaningsih *et al.*, 2018). Therefore, research on the use of chicken bone meal as an organic soil amendment to enhance water spinach growth in Ultisol is important to conduct.

1.2 Research Objectives

1. How do various doses of chicken bone meal affect water spinach growth in Ultisol soil?
2. How do different application frequencies of chicken bone meal affect water spinach growth?
3. Is there an interaction between the dose and frequency of chicken bone meal application on water spinach growth in Ultisol?

1.3 Research Benefits

1. To determine the effect of chicken bone meal dosage on water spinach growth in Ultisol.
2. To determine the effect of chicken bone meal application frequency on water spinach growth.

3. To determine the most effective combination of chicken bone meal dose and application frequency for enhancing water spinach growth in Ultisol soil.

1.4 Research Benefits

The results of this study are expected to provide innovative solutions for the government in achieving sustainable agriculture by utilizing organic soil amendments as a source of nutrients for plants, while also addressing the problem of nutrient-poor Ultisol soils and increasing the currently low production of water spinach in Indonesia.

