

Provision of Urea Fertilizer and Chicken Manure on Chemical Characteristics of Inceptisol Soil in Pangkatan District

Pemberian Pupuk Urea dan Pupuk Kandang Ayam Terhadap Karakteristik Sifat Kimia Tanah Inceptisol di Kecamatan Pangkatan

Muhammad Rizwan^{1*}, Fitra Syawal Harahap²

¹ Program Studi Agroteknologi, Fakultas Pertanian, Universitas Islam Sumatera Utara.

² Program Studi Agroteknologi, Fakultas Sains dan Teknologi, Universitas Labuhanbatu.

*Corresponding author: mhdrizwan04@gmail.com

ABSTRACT

Inceptisol soil is an agricultural land in Indonesia, which is widely distributed, but has a problem, namely the element of N in the soil is relatively low, so it is necessary to carry out proper cultivation techniques, one of which is through the provision of balanced fertilizers, namely organic fertilizers which aim to improve soil fertility and reduce use of NPK fertilizer. This study aims to determine the effect of various kinds of organic fertilizers, namely sometimes goat and urea fertilizer on the chemical properties of Inceptisols from Pangkatan. This research was conducted in the Agrotechnology Practice Area, Faculty of Science and Technology, Labuhanbatu University, Rantau Prapat, with a height of 25 meters above the sea surface. The research was started from February 2021 to June 2021. This study used a factorial randomized block design (RBD) with 2 treatment factors. namely: Urea fertilizer factor with four levels and goat manure factor with three levels. Soil analysis parameters which include, pH H₂O using the electrometric method, determination of N-total soil using the Kjeldahl method, soil organic C using the Wakley and Black method. The results showed that the application of goat manure was able to increase soil N-total on Inceptisol Pangkatan, at a dose of U₁K₃ (Urea: 0.25g and goat manure: 75g) while the interaction of urea and goat manure application increased N-total soil of Rantau Inceptisol. South with a dose of U₁K₃ (Urea: 0.25g and goat manure: 75g).

Keywords: Inceptisol, Nutrients, Urea, Goat Manure, Pangkatan

ABSTRAK

Tanah Inceptisol termasuk tanah pertanian di Indonesia yang sebarannya cukup luas yaitu akan tetapi memiliki permasalahan yaitu unsur N pada tanah yang relatif rendah sehingga perlu dilakukan teknik budidaya yang tepat salah satunya melalui pemberian pupuk berimbang, yaitu pemberian pupuk organik yang bertujuan untuk memperbaiki kesuburan tanah dan mengurangi penggunaan pupuk NPK. Penelitian ini bertujuan untuk mengetahui pengaruh dari pemberian macam pupuk organik yaitu kadang Ayam dan pupuk Urea terhadap sifat kimia pada Inceptisol asal Pangkatan. Penelitian ini dilaksanakan di Lahan Praktek Agroteknologi Fakultas Sains dan Teknologi Universitas Labuhanbatu Rantau Prapat, dengan ketinggian tempat 25 Meter diatas Permukaan Laut, Penelitian dimulai pada Februari 2021 s/d Juni 2021. Penelitian ini menggunakan Rancangan Acak Kelompok (RAK) faktorial dengan 2 faktor perlakuan yaitu : Faktor pupuk Urea dengan empat taraf dan Faktor pupuk kandang Ayam dengan tiga taraf. Parameter Analisis Tanah yang meliputi , pH H₂O dengan metode elektrometri, Penetapan N-total tanah dengan metode Kjeldahl, C-organik tanah dengan menggunakan metode Wakley and Black. Hasil penelitian menunjukan aplikasi pupuk kandang Ayam mampu meningkatkan N-total tanah pada tanah Inceptisol Pangkatan, pada dosis U₁K₃ (Urea:0,25g dan Pupuk kandang Ayam:75g) sedangkan interaksi aplikasi urea dan pupuk kandang Ayam Meningkatkan N-total tanah Inceptisol Pangkatan dengan dosis U₁K₃ (Urea:0,25g dan Pupuk kandang Ayam:75g).

Kata kunci: Inceptisol, Kecamatan Pangkatan, Pupuk Kandang Ayam, Urea, Unsur Hara

INTRODUCTION

Increasing the efficiency of fertilization can be done by giving organic matter. One source of organic matter that is widely available around farmers is manure (Oktabriana, 2018). Provision of manure can reduce the use and increase efficiency in the use of chemical fertilizers. It will also contribute nutrients to plants and increase nutrient uptake by plants (Walida et al., 2020)

In addition, the application of manure can also improve the physical properties of the soil, namely the capacity of the soil to hold water, soil mass density, and total porosity (Sufardi, IS, 2012), improve the stability of soil aggregates (Swanda Adi et al., 2015) and increase the humus content. soil (Priambodo et al., 2019) a condition desired by plants. (Oktabriana, 2018), that the application of urea fertilizer can reduce soil pH and vice versa according to Sudirja et al., (2017), found that the application of manure can increase soil pH while Triyanto et al., (2020), that the application of N fertilizer in The form of NH_4NO_3 can reduce soil pH significantly, but the decrease in pH decreases with increasing dose of manure given.

Inceptisol is the main agricultural land in Indonesia with a fairly wide distribution, which is around 70.52 million ha (37.5%) so that it has the potential to cultivate food crops, especially rice, corn and soybeans if managed properly and appropriately (Wiwik Hartatik, Husnain, 2018) Constraints faced by Inceptisols are poor soil chemical properties seen from the low organic C and N soils (Nazimah Nilahayati; Safrizal, Safrizal; Jeffri, Ary, 2020), Inceptisols generally have less fertile soil properties, including: The soil pH is slightly acidic, the organic-C content is moderate, and the NPK nutrients are low (Yuniarti et al., 2020).

In Inceptisol soil it is necessary to provide organic matter so that this soil can be used for plant cultivation and maintain nutrient balance through fertilization (Fadhlina et al., 2017). In general, the management carried out is the use of high inorganic fertilizers, but it is not balanced with the provision of organic matter (Subiksa, 2018).

Based on the Minister of Agriculture No. 40 of 2007 states that the return of organic matter or the application of organic fertilizers combined with inorganic fertilizers with the aim of improving soil conditions and fertility. According to (Syofiani et al., 2020) showed that the chemical properties of Inceptisols were not good as seen

from the low amount of C-organic soil (1.88%) and low N-total soil (0.15%) which could not guarantee the sustainability of the soil. optimum seedling growth (Triadiawarman et al., 2020)

In general, the fertility and chemical properties of Inceptisols are relatively low, but efforts can still be made to improve with appropriate handling and technology, namely by applying balanced fertilization (Murdhiani, 2020) while according to Solfianti et al., (2021), Efforts to increase the content C-organic, total N, and alkaline cations in Inceptisol soil can be done by applying soil ameliorants such as application of organic matter (compost, green manure and others). Based on data from Farrasati et al., (2018), Inceptisol soil has a low to high potential P content, an acidic to slightly acidic soil pH (pH 4.6-5.5) and a low to moderate organic matter content. Therefore, Inceptisol soil has several obstacles to be developed in agricultural cultivation in Indonesia. Research results Arabia et al., (2018), application of chicken manure and 150 kg/ha of SP-36 fertilizer can increase the available P-available of Inceptisol soil and can increase the P-uptake of maize and maize plant growth. The use of chicken manure can reduce the use of SP-36 fertilizer on corn plants on Inceptisol soil. This is important because nutrients are one of the factors that can determine plant productivity (Harahap et al., 2021).

The purpose of this study was to obtain a combination of doses of chicken manure and urea fertilizer on the chemical properties of Inceptisols from Pangkatan.

MATERIALS AND METHODS

This research was carried out at the Agrotechnology Practice Field, Faculty of Science and Technology, Labuhanbatu Rantau Prapat University, with an altitude of 18 meters above sea level and soil analysis was carried out in the PT Socfindo Kebun Bangun Bandar laboratory, Dolok Masihul District, the research began in February 2021 to June 2021. The materials used in this study were inceptisol soil material from Pangkatan District as a planting medium, urea (45% N) as a treatment material, chicken manure as a treatment material, labels as ingredients to indicate each treatment as well as chemicals for purposes of treatment. analysis. The tools used were a hoe to take soil samples from the field, a scale to weigh the soil, polybags with a capacity of 5 kg for corn plant containers, plastic

sacks, a meter to measure plant height, a sieve to sift the soil.

This study used a factorial randomized block design (rack) with 2 treatment factors, namely: urea fertilizer factor with four levels and chicken manure factor with three levels. factor 1. application of urea (u) fertilizer with 4 levels, namely: $u_0 = 0$ kg urea /ha equivalent to 0 g urea / 5 kg of oven dry soil weight, $u_1 = 100$ kg urea/ha equivalent to 0.25 g urea / 5 kg weight of oven dry soil, $u_2 = 200$ kg urea/ha equivalent to 0.50 g urea / 5 kg weight of oven dry soil, $u_3 = 300$ kg urea/ha equivalent to 0.75 g urea / 5 kg weight of oven dry soil and factor 2. giving chicken manure with 3 levels, namely: $k_0 = 0$ tons n/ha equivalent to 0 g of chicken manure/5 kg of oven dry soil weight $k_1 = 10$ tons n/ha equivalent to 25 g of fertilizer, chicken coop/5 kg weight of oven dry soil $k_2 = 20$ tons n/ha equivalent to 50 g of fertilizer, chicken coop/5 kg weight of oven dry soil $k_3 = 30$ tons n/ha equivalent to 75 g of fertilizer, chicken coop/5 kg weight of oven dry soil.

Each treatment was carried out with 3 replications to obtain 48 experimental units. So that obtained 16 treatment combinations with an additive linear model as follows: $Y_{ij} = \mu + i + j + k + (\alpha\beta)_{jk} + ijk$, Y_{ij} : The data obtained were analyzed statistically based on analysis of variance on each observed variable that was measured and tested continued for the real treatment using the Duncan Multiple Range Test (DMRT) difference test at the 5% level. Parameters observed were soil analysis which included , pH H₂O using electrometric method, determination of N-total soil using the Kjeldahl method, C-organic soil using the Walkley and Black method.

RESULTS AND DISCUSSION

Soil chemical analysis, namely pH, C-Organic, N-Total Soil was carried out after incubation at the end of the vegetative period of the plant

pH Soil

The results of the variance showed that the application of urea fertilizer and the application of chicken manure, presented in Table 1, had a significant effect on soil pH, while the interaction of urea fertilizer with chicken manure had no significant effect on soil pH. The results of the average difference test of the single effect of urea fertilizer application, chicken manure on soil pH are presented in Table 1.

From the results of the mean difference test in Table 1, it is known that the application of Urea fertilizer at the level of U_1 (0.25 g Urea) significantly increased soil pH compared to U_2 (0.50 g Urea) which increased from (4.64) to (4.70) but when compared with U_0 (0 g Urea) it was not significantly different. The results of the analysis of diversity in Table 1 show that the application of urea and chicken manure did not significantly affect the pH of the inceptisol soil, this was due to the reaction of urea fertilizer. acidic soil in inceptisols so that the application of chicken manure which will increase the pH does not react to inceptisol soils because inceptisol soils are also slightly acidic this is in accordance with (Istiqomah et al., 2020), which is clayey, the reaction of the soil is slightly acidic to slightly alkaline, nutrient content and reserves are relatively moderate, and the cation exchange capacity of the soil is moderate to high, which is in accordance with the research of Sebayang et al., (2021) which states that in the treatment well, chicken manure and N fertilizer and their interactions have no significant effect on pH H₂O. This is because although given additional chicken manure which can increase soil pH, the dose has not been able to balance the dose of N fertilizer given according to the treatment, namely urea 50 kg/ha, considering that urea is a fertilizer that reacts acidly so that it can increase the acidity of the soil that is given fertilizer. the urea. The increase that occurred due to the application of urea and chicken manure to the pH of the inceptisol soil was still within the acid criteria according to the soil characteristics criteria of the Agricultural Research and Development Agency of the Ministry of Agriculture (2012).

C-Organik Soil

The results of variance showed that the application of urea fertilizer and the application of chicken manure presented in Table 2 showed that the application of urea fertilizer with chicken manure had a significant effect on soil C-Organic while the application of chicken manure had a significant effect on Soil C-Organic. The results of the average difference test of the single effect of application of chicken manure on C-Organic soil are presented in Table 2.

It is known that the application of chicken manure has a significant effect on increasing soil C-Organic at each level where the highest C-Organic is found in K_2 (1.59%) treatment and the lowest is K_0 (1.03%).

Table 1. Effect of application of Urea, chicken manure on soil pH at the end of the vegetative period of the plant.

Treatment	pH Tanah	Treatment	pH Tanah
U ₀	4,75 a	K ₀	4,64 b
U ₁	4,64 a	K ₁	4,83 a
U ₂	4,70 a	K ₂	4,87 a
U ₃	4,78 a	K ₃	4,88 a

Note: the numbers followed by the same letter mean that they are not significantly different (5%) according to the DMRT test

Table 2. Effect of application of chicken manure on C-Organic soil

Treatment	C-Organik (%)
K ₀	4,64 b
K ₁	4,83 a
K ₂	4,87 a
K ₃	4,88 a

Note: the numbers followed by the same letter mean that they are not significantly different (5%) according to the DMRT test

Table 3. Effect of chicken manure application on total soil N at the end of the vegetative period.

Treatment	N-Total (%)
K ₀	0,165 b
K ₁	0,175 b
K ₂	0,192 a
K ₃	0,190 a

Note: the numbers followed by the same letter mean that they are not significantly different (5%) according to the DMRT test

The application of chicken manure significantly increased soil C-Organic at the end of the vegetative period as shown in the results of the variance in Table 2 where the lowest Organic C-Organic in the application of chicken manure was at K₀ (1.03%) and the highest was at the K₂ level (1.59%) but this increase is still in the low criteria according to the soil characteristics criteria of the Agricultural Research and Development Agency of the Ministry of Agriculture (2012).

The increase in the C-organic content in the inceptisol soil was caused by the chicken manure which is an organic fertilizer which has a high C-Organic content so that it can provide organic C-content for the inceptisol soil so that the activity of microorganisms in the inceptisol soil increases. This is in accordance with Rauf and Harahap, (2019) which states that in the tropics the rate of

weathering of organic matter is very high so that the turnover of C-organic in the soil is short, resulting in low levels of soil organic matter. Given its large role in improving the physical, chemical, and biological soils, organic matter (manure and/or green manure) needs to be added in large quantities.

N-Total Soil

The results of the variance show that the application of urea fertilizer and the application of chicken manure presented in Table 3 shows that the application of chicken manure has a significant effect on total soil N, while the interaction of urea with chicken manure has no significant effect on total soil N. The results of the average difference test of the single effect of application of chicken manure on total soil N are presented in Table 3.

From the results of the average difference test in Table 3, it is known that the effect of application of chicken manure has a significant effect on the increase in N-total soil at each level where the highest N-total soil is at the K2 level (0.192 ppm) and the lowest at K0 (0.165 ppm).

From the results of the variance in Table 3, it shows that the application of chicken manure has a significant effect on increasing total soil N until the end of the vegetative period of the plant because chicken manure has high N nutrients. This is in accordance with (Ariyanti et al., 2018), which states that Chicken Manure which has a high content of total N, organic matter, available Ca, available S, and available K, so it is hoped that the addition of chicken manure can increase soil fertility and sufficient nutrients are available to plants. Chicken manure, apart from containing important nutrients, can also improve the physical properties of the soil.

The application of urea fertilizer was not significantly different to the total N-inceptisol soil this was due to the N nutrients in the urea fertilizer being quickly available to plants but also quickly lost because the N nutrients were immobilized. This is in accordance with Faqih *et al.*, (2019) which states that Urea is more quickly available to plants and can also be quickly lost due to evaporation and leaching, while N itself is mobile.

CONCLUSION

1. Application of chicken manure was able to increase total soil N, N uptake, on Inceptisol grade soil, at a dose of U1K3 (Urea: 0.25g and Chicken manure: 75g).
2. Interaction of urea and chicken manure application to increase total soil N-inceptisol dose of U1K3 (Urea: 0.25g and Chicken manure: 75g).

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