

RINGKASAN

Penggunaan traktor roda 4 dapat mempermudah dan mempercepat proses pengolahan tanah. Namun, penggunaan traktor roda 4 pada lahan juga dapat menimbulkan pemadatan tanah yang berdampak negatif terhadap sifat fisik tanah maupun pertumbuhan tanaman. Pemupukan merupakan salah satu upaya untuk memperbaiki sifat fisik tanah guna mendukung pertumbuhan dan hasil budidaya tanaman. Namun demikian, kajian tentang pengaruh penggunaan pupuk terhadap sifat fisik tanah dalam kaitannya dengan dampak pemadatan tanah akibat perlintasan traktor roda 4 belum banyak dilakukan. Lebih dari itu, penelitian sebelumnya lebih banyak mengkaji hanya pada kedalaman 0 – 30 cm saja. Maka dari itu penelitian ini dilakukan dengan tujuan (1) mengetahui perbedaan pengaruh pupuk organik, pupuk kimia dan pupuk campuran terhadap tingkat pemadatan tanah akibat perlintasan traktor roda 4 pada kedalaman 0 – 50 cm, dan (2) mengetahui hubungan antar variabel sifat fisik tanah terkait pemadatan tanah akibat perlintasan traktor roda 4 pada kedalaman 0 – 50 cm.

Penelitian dilakukan pada bulan Maret – Juli 2024 dengan tempat pengambilan sampel tanah di lahan pertanian Desa Karangduren, Sokaraja dan pengukuran sifat fisik tanah di laboratorium Terpadu 1 IAB, Universitas Jenderal Soedirman. Rancangan percobaan menggunakan Rancangan Acak Lengkap (RAL) dengan satu faktor dan satu kontrol dengan 4 taraf perlakuan yaitu: tanpa pupuk (P_0), pupuk organik (P_1), pupuk kimia (P_2), dan pupuk campuran (P_3). Pengambilan sampel tanah tidak terganggu dilakukan pada kedalaman 0 – 10, 10 – 20, 20 – 30, 30 – 40, dan 40 – 50 cm dengan jumlah 5 kali untuk setiap kedalaman sehingga total sampel yang diambil adalah 100. Alat dan bahan yang digunakan meliputi: traktor roda 4, *head core ring sampler*, *soil ring sampler* ukuran 100 cm³ (diameter 5 cm dan tinggi 5 cm), oven, jangka sorong, timbangan digital, *falling head meter*, *stopwatch*, pupuk kandang kambing, pupuk kimia, dan 4 petakan lahan berukuran 2 m x 2 m. Variabel yang diukur adalah *dry bulk density*, konduktivitas hidrolis jenuh, porositas, dan kadar air. Analisis data menggunakan analisis regresi serta *Analysis of variance* (ANOVA) dengan uji lanjut menggunakan uji *Duncan's Multiple Range Test* (DMRT) 5%.

Hasil penelitian menunjukkan bahwa pupuk organik dan pupuk kimia cenderung memberikan pengaruh terhadap penurunan nilai *dry bulk density*, yang diikuti dengan kenaikan nilai konduktivitas hidrolis jenuh dan porositas dibandingkan tanpa pupuk. Jenis pupuk paling efektif dalam mengurangi dampak pemadatan tanah akibat perlintasan traktor roda 4 adalah pupuk organik. Peningkatan tingkat kedalaman tanah cenderung menghasilkan penurunan nilai *dry bulk density*, serta menghasilkan peningkatan nilai konduktivitas hidrolis jenuh, porositas, dan kadar air tanah. Hasil analisis regresi menunjukkan hubungan antara beberapa variabel sifat fisik tanah, dimana *dry bulk density* berhubungan linear negatif dengan konduktivitas hidrolis jenuh dengan R^2 adalah 0,6986, sedangkan porositas dan kadar air berhubungan linear positif dengan konduktivitas hidrolis jenuh dengan nilai R^2 masing-masing adalah 0,6986 dan 0,6437.

SUMMARY

The use of 4-wheel tractors can simplify and speed up the tillage process. However, the use of 4-wheel tractors on land can also cause soil compaction which has a negative impact on soil physical properties and plant growth. Fertilization is one of the efforts to improve soil physical properties to support the growth and yield of plant cultivation. However, studies on the effect of fertilizer use on soil physical properties in relation to the impact of soil compaction due to 4-wheel tractor crossings have not been conducted. Moreover, previous studies have mostly examined only at a depth of 0 – 30 cm. Therefore, this study was conducted with the aim of (1) determining the differences in the effect of organic fertilizers, chemical fertilizers and mixed fertilizers on the level of soil compaction due to 4-wheel tractor crossings at a depth of 0 – 50 cm, and (2) determining the relationship between soil physical properties variables related to soil compaction due to 4-wheel tractor crossings at a depth of 0 – 50 cm.

The research was conducted from March to July 2024 with soil sampling in the farmland of Karangduren Village, Sokaraja and measurement of soil physical properties in Integrated Laboratory 1 IAB, Universitas Jenderal Soedirman. The experimental design used a completely randomized design (CRD) with one factor and one control with 4 treatment levels, namely: no fertilizer (P₀), organic fertilizer (P₁), chemical fertilizer (P₂), and mixed fertilizer (P₃). Undisturbed soil samples were taken at depths of 0 – 10, 10 – 20, 20 – 30, 30 – 40, and 40 – 50 cm with a total of 5 times for each depth so that a total of 100 samples were taken. Tools and materials used included: 4-wheel tractor, head core ring sampler, soil ring sampler size 100 cm³ (diameter 5 cm and height 5 cm), oven, vernier caliper, digital balance, falling head meter, stopwatch, goat manure, chemical fertilizer, and 4 plots of land measuring 2 m x 2 m. Variables measured were dry bulk density, saturated hydraulic conductivity, porosity, and moisture content. Data analysis used regression analysis and Analysis of variance (ANOVA) with further tests using Duncan's Multiple Range Test (DMRT) 5%.

The results showed that the effect of organic fertilizers and chemical fertilizers tended to decrease the value of dry bulk density, followed by an increase in the value of saturated hydraulic conductivity and porosity compared to no fertilizer. The most effective type of fertilizer in reducing the impact of soil compaction due to 4-wheel tractor crossings is organic fertilizer. Increasing the level of soil depth tends to result in a decrease in the value of dry bulk density, as well as an increase in the value of saturated hydraulic conductivity, porosity, and soil moisture content. Regression analysis results show the relationship between several soil physical properties variables, where dry bulk density is negatively linearly related to saturated hydraulic conductivity with R² of 0.6986, while porosity and moisture content are positively linearly related to saturated hydraulic conductivity with R² values of 0.6986 and 0.6437, respectively.