

RINGKASAN

Pengolahan tanah menggunakan traktor lebih efisien dibandingkan metode konvensional. Namun, penggunaan traktor dapat menyebabkan pemadatan tanah, yang merugikan sistem perakaran tanaman serta sirkulasi air dan udara dalam tanah. Disisi lain, pemberian pupuk kandang sapi dapat memperbaiki sifat fisik tanah sehingga meningkatkan pertumbuhan tanaman. Namun demikian, penelitian tentang pengaruh pemberian pupuk kandang sapi terhadap tingkat pemadatan tanah akibat perlintasan traktor roda dua saat 12 bulan setelah perlintasan traktor masih terbatas. Selain itu, analisis sifat fisik tanah pada penelitian terdahulu umumnya dilakukan hingga kedalaman 0 – 30 cm saja, padahal beberapa jenis tanaman memiliki sistem perakaran yang mampu menembus lebih dari 30 cm. Oleh karena itu, penelitian ini bertujuan untuk (1) mempelajari pengaruh berbagai dosis pupuk kandang sapi terhadap tingkat pemadatan tanah pada kedalaman 0 – 50 cm saat 12 bulan setelah perlintasan traktor roda dua, dan (2) mempelajari hubungan antar variabel sifat fisik tanah terkait dengan pengaruh pemberian pupuk kandang sapi terhadap tingkat pemadatan tanah pada kedalaman 0 – 50 cm saat 12 bulan setelah perlintasan traktor roda dua.

Penelitian dilaksanakan pada bulan Februari 2025 – Juli 2025 di lahan pertanian Desa Karangduren, Kecamatan Sokaraja, Kabupaten Banyumas, dan Laboratorium Terpadu 1 IAB, Universitas Jenderal Soedirman. Bahan yang digunakan yaitu 4 plot penelitian berukuran 1 m x 2 m, sedangkan alat yang digunakan meliputi: traktor roda dua tipe Quick/G 3000 Zeva, *head core ring sampler*, *soil ring sampler* ukuran 100 cm³, oven, jangka sorong, timbangan digital, cawan alumunium, *falling head meter*, dan *stopwatch*. Penelitian dilakukan menggunakan Rancangan Acak Lengkap (RAL) satu faktor dengan 4 taraf perlakuan dosis pupuk kandang sapi: tanpa pupuk kandang sapi (P₀), 15 ton/ha (P₁₅), 20 ton/ha (P₂₀), dan 25 ton/ha (P₂₅). Sampel tanah tidak terganggu diambil pada kedalaman 0 – 10, 10 – 20, 20 – 30, 30 – 40, dan 40 – 50 cm, dengan pengulangan sebanyak 5 kali untuk setiap kedalaman, sehingga diperoleh total 100 sampel tanah. Variabel yang diukur adalah *dry bulk density*, porositas, kadar air, dan konduktivitas hidrolik jenuh. Analisis data dilakukan menggunakan *Analysis of Variance* (ANOVA) dengan taraf signifikansi 5%, diikuti dengan uji *Duncan's Multiple Range Test* (DMRT) serta analisis regresi.

Hasil penelitian menunjukkan bahwa penambahan dosis pupuk kandang sapi menurunkan nilai *dry bulk density*, serta meningkatkan nilai kadar air, konduktivitas hidrolik jenuh, dan porositas tanah saat 12 bulan setelah perlintasan traktor roda dua. Peningkatan kedalaman tanah menghasilkan penurunan *dry bulk density*, serta peningkatan nilai kadar air, konduktivitas hidrolik jenuh, dan porositas tanah. Dosis pupuk kandang sapi 25 ton/ha merupakan dosis paling efektif dalam mengurangi pemadatan tanah. Analisis regresi menunjukkan bahwa *dry bulk density* memiliki hubungan linier negatif dengan konduktivitas hidrolik jenuh ($R^2 = 0,4878$) sedangkan porositas dan kadar air memiliki hubungan linier positif dengan konduktivitas hidrolik jenuh ($R^2 = 0,4878$ dan $R^2 = 0,4311$). Data 12 bulan pengamatan memberikan nilai *dry bulk density* yang lebih tinggi, namun nilai konduktivitas hidrolik jenuh, porositas dan kadar air yang lebih rendah dibandingkan data 6 dan 0 bulan pengamatan setelah perlintasan traktor roda dua.

SUMMARY

Tillage using tractors is more efficient than conventional methods. However, the use of a tractor can lead to soil compaction, which is detrimental to the plant's root system as well as the circulation of water and air in the soil. On the other hand, the application of cow manure can improve the physical properties of the soil so as to increase plant growth. However, research on the effect of cow manure application on soil compaction due to two-wheeled tractor crossings 12 months after tractor crossing is still limited. In addition, the analysis of the physical properties of the soil in previous research was generally carried out to a depth of 0 – 30 cm only, even though some types of plants have a root system that is able to penetrate more than 30 cm. Therefore, this study aims to (1) study the effect of various doses of cow manure on the level of soil compaction at a depth of 0 – 50 cm at 12 months after the crossing of two-wheeled tractors, and (2) study the relationship between variables of soil physical properties related to the effect of cow manure application on soil compaction at a depth of 0 – 50 cm at 12 months after the crossing of two-wheeled tractors.

The research was carried out in February 2025 – July 2025 on agricultural land in Karangduren Village, Sokaraja District, Banyumas Regency, and the IAB Integrated Laboratory 1, Jenderal Soedirman University. The materials used were 4 research plots measuring 1 m x 2 m, while the tools used included: Quick/G 3000 Zeva type two-wheeled tractor, head core ring sampler, soil ring sampler size 100 cm³, oven, caliper, digital scale, aluminum cup, falling head meter, and stopwatch. The study was conducted using a one-factor Complete Random Design (RAL) with 4 levels of treatment of cow manure dosage: no cow manure (P_0), 15 tons/ha (P_{15}), 20 tons/ha (P_{20}), and 25 tons/ha (P_{25}). Undisturbed soil samples were taken at depths of 0 – 10, 10 – 20, 20 – 30, 30 – 40, and 40 – 50 cm, with 5 repetitions for each depth, resulting in a total of 100 soil samples. The variables measured were dry bulk density, porosity, moisture content, and saturated hydraulic conductivity. Data analysis was carried out using Analysis of Variance (ANOVA) with a significance level of 5%, followed by Duncan's Multiple Range Test (DMRT), and regression analysis.

The results showed that the addition of the dose of cow manure reduced the value of dry bulk density, as well as increased the value of moisture content, saturated hydraulic conductivity, and soil porosity at 12 months after the crossing of two-wheeled tractors. Increased soil depth results in a decrease in dry bulk density, as well as an increase in moisture content values, saturated hydraulic conductivity, and soil porosity. The dose of cow manure of 25 tons/ha is the most effective dose in reducing soil compaction. Regression analysis showed that dry bulk density had a negative linear relationship with saturated hydraulic conductivity ($R^2 = 0.4878$) while porosity and moisture content had a positive linear relationship with saturated hydraulic conductivity ($R^2 = 0.4878$ and $R^2 = 0.4311$). The 12-month observation data provided a higher dry bulk density value, but the value of saturated hydraulic conductivity, porosity and moisture content was lower than the 6 and 0 month observation data after two-wheeled tractor crossing