

RINGKASAN

Pengolahan tanah menggunakan traktor dapat meningkatkan efisiensi dan produktivitas kerja dalam pengolahan lahan pertanian. Namun demikian, penggunaan traktor dapat menyebabkan pemadatan tanah, yang dapat merugikan sistem perakaran tanaman serta sirkulasi air dan udara dalam tanah. Disisi lain, pemberian pupuk kandang sapi dikatakan dapat memperbaiki sifat fisik, kimia, biologi tanah serta meningkatkan pertumbuhan tanaman. Namun demikian penelitian tentang pengaruh pemberian pupuk kandang sapi terhadap pemadatan tanah akibat perlintasan traktor roda 2 masih jarang dilakukan. Lebih dari itu, analisis sifat fisik tanah dalam penelitian terdahulu dominan hanya dilakukan hingga kedalaman 30 cm, padahal beberapa jenis tanaman memiliki sistem perakaran yang mampu menembus lebih dari 30 cm. Oleh karena itu, penelitian ini bertujuan untuk (1) mengetahui pengaruh berbagai dosis pupuk kandang sapi terhadap pemadatan tanah akibat perlintasan traktor roda 2 pada kedalaman 0 – 50 cm, serta (2) mempelajari hubungan antara variabel sifat fisik tanah terkait dengan pengaruh pemberian pupuk kandang sapi terhadap pemadatan tanah akibat perlintasan traktor roda 2 pada kedalaman 0 – 50 cm.

Penelitian dilaksanakan pada bulan Desember 2023 – Juni 2024 di lahan pertanian Unit Penyewaan Jasa Alsintan (UPJA) Kecamatan Sokaraja dan Laboratorium Terpadu 1 IAB, Universitas Jenderal Soedirman. Bahan yang digunakan yaitu 4 petakan lahan 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* 100 cm³, oven, jangka sorong, timbangan digital, cawan alumunium, *falling head meter*, dan *stopwatch*. Penelitian dilakukan menggunakan Rancangan Acak Lengkap (RAL) dengan satu faktor/perlakuan dan satu kontrol sebagai pembanding. Perlakuan yang diberikan yaitu 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 total terdapat 100 sampel tanah. Variabel yang diukur adalah *hydraulic conductivity*, kadar air, *dry bulk density*, dan porositas. 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 mengurangi nilai *dry bulk density*, serta meningkatkan nilai *hydraulic conductivity*, dan porositas tanah. Peningkatan kedalaman tanah cenderung menghasilkan penurunan *bulk density*, serta peningkatan nilai *hydraulic conductivity*, dan porositas tanah. Analisis regresi menunjukkan bahwa *dry bulk density* memiliki hubungan linear *negative* dengan *hydraulic conductivity* ($R^2 = 0,3082$), sedangkan porositas dan kadar air memiliki hubungan linear *positive* dengan *hydraulic conductivity* ($R^2 = 0,3082$ dan $R^2 = 0,0405$).

SUMMARY

Tillage using tractors can increase the efficiency and productivity of agricultural labour. However, the use of tractors can cause soil compaction, which can be detrimental to plant root systems as well as water and air circulation in the soil. On the other hand, the application of cow manure is said to improve the physical, chemical, and biological properties of soil and increase plant growth. However, research on the effect of applying cow manure on soil compaction due to 2-wheel tractor crossings is still rare. Moreover, analyses of soil physical properties in previous studies were predominantly only conducted to a depth of 30 cm, whereas some plant species have root systems that can penetrate more than 30 cm. Therefore, this research aims to (1) determine the effect of various doses of cow manure on soil compaction due to 2-wheel tractor crossings at a depth of 0 – 50 cm, and (2) study the relationship between soil physical properties variables related to the effect of cow manure on soil compaction due to 2-wheel tractor crossings at a depth of 0 - 50 cm.

The research was conducted in December 2023 - June 2024 on the farmland of the Alsintan Service Rental Unit (UPJA) of Sokaraja District and Integrated Laboratory 1 IAB, Universitas Jenderal Soedirman. The materials used were 4 land plots measuring 1 m x 2 m, while the tools used included: two-wheeled tractor type Quick/G 3000 Zeva, head core ring sampler, soil ring sampler 100 cm³, oven, vernier caliper, digital scales, aluminium cup, falling head meter, and stopwatch. The research was conducted using a completely randomised design (CRD) with one factor/treatment and one control as a comparison. The treatments were 4 levels of cattle manure dosage: no cattle manure (P₀), 15 tonnes/ha (P₁₅), 20 tonnes/ha (P₂₀), and 25 tonnes/ha (P₂₅). 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 hydraulic conductivity, moisture content, dry bulk density, and porosity. Data were analysed using Analysis of Variance (ANOVA) with a significance level of 5%, followed by Duncan's Multiple Range Test (DMRT) and regression analysis. The variables measured were saturated hydraulic conductivity, water content, dry bulk density, wet bulk density, and porosity. Data analysis was performed using Analysis of Variance (ANOVA) with a 5% significance level, followed by Duncan's Multiple Range Test (DMRT) at a 5% level, and regression analysis.

The results showed that increasing the dose of cow manure reduced the dry bulk density value, and increased the hydraulic conductivity value, and soil porosity. Increasing soil depth tends to result in a decrease in bulk density, as well as an increase in hydraulic conductivity, and soil porosity. Regression analysis shows that dry bulk density has a negative linear relationship with hydraulic conductivity ($R^2 = 0.3082$), while porosity and moisture content have a positive linear relationship with hydraulic conductivity ($R^2 = 0.3082$ and $R^2 = 0.0405$).