RINGKASAN

Perlintasan traktor dapat menyebabkan pemadatan tanah yang berdampak pada perubahan sifat fisik tanah sehingga menghambat pertumbuhan akar serta mengganggu pergerakan air dan udara di dalam tanah. Salah satu cara untuk mengurangi dampak pemadatan tanah tersebut adalah dengan penambahan bahan organik seperti pupuk kandang sapi. Namun, penelitian mengenai efek pupuk kandang sapi terhadap pemadatan tanah akibat perlintasan traktor roda 4 masih terbatas. Selain itu, sebagian besar studi sebelumnya hanya menganalisis sifat fisik tanah hingga kedalaman 30 cm, padahal beberapa tanaman memiliki sistem perakaran yang menembus lebih dalam dari itu. Berdasarkan hal tersebut, penelitian ini ditujukan untuk (1) mengetahui pengaruh dosis pupuk kandang sapi terhadap pemadatan tanah akibat perlintasan traktor roda 4 pada kedalaman 0 – 50 cm saat 6 bulan setelah perlintasan traktor roda 4, serta (2) mempelajari hubungan antar variabel sifat fisik tanah terkait dengan pengaruh pemberian pupuk kandang sapi terhadap pemandatan tanah akibat perlintasan traktor roda 4 pada kedalaman 0 – 50 cm saat 6 bulan setelah perlintasan traktor roda 4.

Penelitian dilaksanakan pada bulan Agustus 2024 – Mei 2025 di lahan pertanian Desa Karangduren, Kecamatan Sokaraja, Kabupaten Banyumas serta lab Terpadu 1 IAB, Universitas Jenderal Soedriman. Dalam penelitian ini digunakan Rancangan Acak Lengkap (RAL) dengan 4 taraf perlakuan dosis pupuk kandang sapi, yaitu tanpa pupuk kandang sapi (P_0), 15 ton/ha (P_{15}), 20 ton/ha (P_{20}), dan 25 ton/ha (P_{25}). Alat yang akan digunakan dalam penelitian ini meliputi: Traktor roda 4, *head core ring sampler*, *soil ring sampler* ukuran 100 cm^3, oven, jangka sorong (*vernier calliper*), timbangan digital, *falling head meter*, dan *stopwatch*. Sedangkan bahan yang akan digunakan dalam penelitian ini meliputi: pupuk kandang sapi dan 4 petakan lahan berukuran 2 m x 2 m. Sampel tanah tidak terganggu diambil pada kedalaman 0 – 10, 10 – 20, 20 – 30, 30 – 40, dan 40 – 50 cm, dengan jumlah ulangan yang diambil sebanyak 5 kali untuk setiap kedalaman, sehingga total sampel tanah yang diambil sebanyak 100 sampel. Variabel yang diukur adalah konduktivitas hidrolik jenuh, kadar air, *dry bulk density,* dan porositas. Data dianalisis menggunakan *Analysis of Variance* (ANOVA) pada taraf signifikansi 5%, dilanjutkan dengan uji pembanding *Duncan's Multiple Range Test* (DMRT) pada tingkat yang sama. Analisis regresi digunakan untukmengetahui hubungan antar beberapa variabel sifat fisik tanah. Selain itu, dilakukan uji T (*T-test*) untuk membandingkan data antara 6 bulan dan 0 bulan.

Hasil penelitian menunjukkan bahwa pemberian pupuk kandang sapi menurunkan *dry bulk density* serta meningkatkan konduktivitas hidrolik jenuh, porositas, dan kadar air tanah saat 6 bulan setelah perlintasan traktor. Demikian juga penambahan tingkat kedalaman tanah menghasilkan penurunan nilai *dry bulk density*, serta menghasilkan peningkatan nilai konduktivitas hidrolik jenuh, porositas, dan kadar air tanah. Dosis pupuk kandang sapi 25 ton/ha paling efektif dalam mengurangi pemadatan tanah. Analisis regresi menunjukkan bahwa *dry bulk density* memiliki hubungan linier negatif terhadap konduktivitas hidrolik jenuh

(R^2 = 0,4315), sementara porositas dan kadar air memiliki hubungan linier positif (R^2 = 0,4315 dan 0,3725). Data 6 bulan pengamatan menghasilkan nilai *dry bulk* density yang lebih besar dan nilai porositas, kadar air serta konduktivitas hidrolik jenuh yang lebih rendah dibandingkan data 0 bulan. Uji T menunjukkan bahwa rata-rata *dry bulk density*, porositas, dan kadar air pada 6 dan 0 bulan tidak berbeda nyata pada setiap kedalaman, sedangkan konduktivitas hidrolik jenuh berbeda nyata.

SUMMARY

Tractor passes can lead to soil compaction, which affects the physical properties of the soil and ultimately inhibits root growth as well as the movement of water and air within the soil. One effort to mitigate the impact of this compaction is through the addition of organic materials such as cattle manure. However, studies on the effects of cattle manure on soil compaction caused by 4-wheeled tractor traffic remain limited. In addition, most previous research has only analyzed soil physical properties up to a depth of 30 cm, whereas some plants have root systems that penetrate deeper. Based on this, the objectives of this study were: (1) to determine the effect of cattle manure dosage on soil compaction caused by four-wheeled tractor passes at a depth of 0 – 50 cm, six months after the pass, and (2) to examine the relationship between soil physical property variables in response to cattle manure application following compaction from four-wheeled tractor traffic at 0 – 50 cm depth, six months after compaction.

The research was conducted from August 2024 to May 2025 in the agricultural land of Karangduren Village, Sokaraja Sub-district, Banyumas Regency, and at the Integrated Laboratory 1 IAB, Jenderal Soedirman University. A Completely Randomized Design (CRD) was used in this study with four treatment levels of cattle manure application: no manure (P_0), 15 tons/ha (P_{15}), 20 tons/ha (P_{20}), and 25 tons/ha (P_{25}). The equipment used included a 4-wheeled tractor, head core ring sampler, 100 cm³ soil ring sampler, oven, vernier caliper, digital scale, falling head meter, and stopwatch. The materials used were cattle manure and four land plots each measuring 2 m x 2 m. Undisturbed soil samples were taken at depths of 0 – 10, 10 – 20, 20 – 30, 30 – 40, and 40 – 50 cm, with five replications at each depth, resulting in a total of 100 soil samples. The measured variables were saturated hydraulic conductivity, water content, dry bulk density, and porosity. Data were analyzed using Analysis of Variance (ANOVA) at a 5% significance level, followed by Duncan's Multiple Range Test (DMRT) at the same level. In addition, regression analysis and T-tests were performed to compare data between month 6 and month 0.

The results showed that the application of cattle manure tended to reduce dry bulk density and increase saturated hydraulic conductivity, porosity, and soil moisture content six months after tractor traffic. Furthermore, increasing soil depth tended to decrease dry bulk density and increase saturated hydraulic conductivity, porosity, and moisture content. The cattle manure dose of 25 tons/ha was the most effective in reducing soil compaction. Regression analysis indicated that dry bulk density had a negative linear relationship with saturated hydraulic conductivity ($R^2 = 0.4315$), while porosity and moisture content had positive linear relationships ($R^2 = 0.4315$ and 0.3725, respectively). The six-month observation data tended to show higher dry bulk density and lower values of porosity, moisture content, and saturated hydraulic conductivity compared to the 0-month data. The T-test revealed that the average values of dry bulk density, porosity, and moisture content at 6 and 0 months were not significantly different at each depth, whereas saturated hydraulic conductivity was significantly different.