

RINGKASAN

Kegiatan pengolahan tanah menggunakan traktor roda 2 dinilai lebih efektif dan efisien dibandingkan pengolahan tanah menggunakan peralatan tradisional. Namun penggunaan traktor dapat menyebabkan pemadatan tanah yang membuat sistem perakaran tanaman serta sirkulasi air dan udara di dalam tanah terhambat. Salah satu solusi untuk mengatasi permasalahan tersebut dapat berupa pemberian pupuk kandang sapi yang diyakini mampu memperbaiki sifat fisik, kimia, dan biologi tanah sehingga meningkatkan pertumbuhan tanaman. Analisis sifat fisik tanah dalam penelitian terdahulu umumnya hanya dilakukan hingga kedalaman 30 cm, sementara terdapat beberapa jenis tanaman dengan sistem perakaran lebih dari 30 cm. Disisi lain, penelitian tentang pengaruh pupuk kandang sapi terhadap pemadatan tanah akibat perlintasan traktor roda 2 saat 6 bulan setelah perlintasan traktor masih jarang dilakukan. Oleh karena itu, penelitian ini bertujuan untuk (1) mengetahui pengaruh pemberian berbagai dosis pupuk kandang sapi terhadap tingkat pemadatan tanah pada kedalaman 0 – 50 cm pada saat 6 bulan setelah perlintasan traktor roda 2, serta (2) mengetahui hubungan antar variabel sifat fisik tanah terkait pengaruh pemberian berbagai dosis pupuk kandang sapi terhadap tingkat pemadatan tanah pada kedalaman 0 – 50 cm pada saat 6 bulan setelah perlintasan traktor roda 2.

Penelitian dilaksanakan pada bulan Agustus 2024 – Juni 2025 di lahan pertanian Unit Penyewaan Jasa Alsintan (UPJA) Kecamatan Sokaraja 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 2 tipe Quick/G 3000 Zeva, *head core ring sampler*, *soil ring sampler*, oven, jangka sorong, timbangan digital, cawan aluminium, *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 (P_0), 15 ton/ha (P_{15}), 20 ton/ha (P_{20}), dan 25 ton/ha (P_{25}). 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 *dry bulk density*, porositas, kadar air, dan konduktivitas hidrolis jenuh. Analisis data dilakukan menggunakan *Analysis of Variance* (ANOVA) dengan taraf signifikansi 5%, diikuti dengan uji *Duncan's Multiple Range Test* (DMRT), analisis regresi, serta *Paired Sample T-Test*.

Hasil penelitian menunjukkan bahwa penambahan dosis pupuk kandang sapi menurunkan nilai *dry bulk density*, serta meningkatkan nilai kadar air, konduktivitas hidrolis jenuh, dan porositas tanah. Peningkatan kedalaman tanah cenderung menghasilkan penurunan *bulk density*, serta peningkatan nilai kadar air, konduktivitas hidrolis jenuh, dan porositas tanah. Dosis pupuk kandang sapi 25 ton/ha merupakan dosis yang paling efektif dalam mengurangi pemadatan tanah. Analisis regresi menunjukkan adanya hubungan linier negatif antara *dry bulk density* dengan porositas, serta antara *dry bulk density* dengan konduktivitas hidrolis jenuh.

Sedangkan hubungan linier positif antara porositas dengan konduktivitas hidrolik jenuh, serta antara kadar air dengan konduktivitas hidrolik jenuh. Data 6 bulan pengamatan menunjukkan adanya kenaikan *dry bulk density* dan penurunan konduktivitas hidrolik jenuh, porositas, dan kadar air dibandingkan 0 bulan pengamatan. Hasil uji T menunjukkan bahwa rata-rata nilai *dry bulk density*, porositas, dan kadar air pada saat 6 bulan pengamatan cenderung tidak berbeda nyata dengan data 0 bulan, sedangkan rata-rata nilai konduktivitas hidrolik jenuh berbeda nyata antara 6 bulan dengan 0 bulan.

Penelitian ini berpotensi memberikan dampak jangka panjang dalam pengelolaan lahan pertanian yang lebih berkelanjutan, khususnya pada lahan yang intensif menggunakan traktor roda dua. Dengan diterapkannya dosis pupuk kandang sapi yang tepat, sistem perakaran tanaman dapat berkembang lebih optimal, sirkulasi air dan udara di dalam tanah membaik, sehingga pada akhirnya meningkatkan produktivitas pertanian dalam jangka panjang.



SUMMARY

Land processing activities using 2-wheel tractors are considered more effective and efficient than land processing using traditional equipment. However, the use of tractors can cause soil compaction which inhibits the plant root system and the circulation of water and air in the soil. One solution to overcome this problem is the provision of cow manure which is believed to be able to improve the physical, chemical, and biological properties of the soil, thereby increasing plant growth. Analysis of the physical properties of the soil in previous studies was generally only carried out to a depth of 30 cm, while there are several types of plants with root systems of more than 30 cm. On the other hand, research on the effect of cow manure on soil compaction due to the crossing of 2-wheel tractors 6 months after the tractor crossing is still rarely carried out. Therefore, this study aims to (1) determine the effect of administering various doses of cow manure on the level of soil compaction at a depth of 0-50 cm 6 months after a 2-wheel tractor crossing, and (2) determine the relationship between soil physical property variables related to the effect of administering various doses of cow manure on the level of soil compaction at a depth of 0-50 cm 6 months after a 2-wheel tractor crossing.

The research was conducted in August 2024 - June 2025 on agricultural land of the Agricultural Machinery Rental Unit (UPJA) of Sokaraja District and Integrated Laboratory 1 IAB, Jenderal Soedirman University. The materials used were 4 plots of land measuring 1 m x 2 m, while the tools used included: a 2-wheel tractor type Quick / G 3000 Zeva, head core ring sampler, soil ring sampler, oven, caliper, digital scales, aluminum cups, falling head meters, and stopwatches. The research was conducted using a Completely Randomized Design (CRD) with one factor / treatment and one control as a comparison. The treatments given were 4 levels of cow manure dose treatment: without 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, water content, and saturated hydraulic conductivity. Data analysis was performed using Analysis of Variance (ANOVA) with a significance level of 5%, followed by Duncan's Multiple Range Test (DMRT), regression analysis, and Paired Sample T-Test.

The results showed that the addition of cow manure doses decreased the dry bulk density value, and increased the water content, saturated hydraulic conductivity, and soil porosity. Increasing soil depth tended to result in a decrease in bulk density, and an increase in the water content, saturated hydraulic conductivity, and soil porosity. A dose of 25 tons/ha of cow manure was the most effective dose in reducing soil compaction. Regression analysis showed a negative linier relationship between dry bulk density and porosity, as well as between dry bulk density and saturated hydraulic conductivity. While a positive linier relationship between porosity and saturated hydraulic conductivity, as well as between water content and saturated hydraulic conductivity. Data from 6 months

of observation showed an increase in dry bulk density and a decrease in saturated hydraulic conductivity, porosity, and water content compared to 0 months of observation. The results of the T test showed that the average values of dry bulk density, porosity, and water content at 6 months of observation tended not to be significantly different from the data from 0 months, while the average value of saturated hydraulic conductivity was significantly different between 6 months and 0 months.

This study has the potential to provide long-term impacts on more sustainable agricultural land management, particularly on land that is intensively operated using two-wheeled tractors. By applying the appropriate dose of cattle manure, plant root systems can develop more optimally, water and air circulation in the soil can improve, and ultimately, agricultural productivity can increase in the long term.

