

RINGKASAN

Penggunaan traktor roda 4 dapat meningkatkan efisiensi dalam proses pengolahan tanah. Meski demikian, alat ini juga berpotensi menyebabkan pemadatan tanah yang berdampak negatif terhadap pertumbuhan tanaman, kemampuan akar menembus tanah, serta sirkulasi air dan udara di dalam tanah. Kajian mengenai pengaruh tekanan angin pada traktor roda 4 terhadap pemadatan tanah masih tergolong terbatas. Sebagian besar penelitian sebelumnya hanya meneliti pengaruh tekanan angin pada kedalaman tanah hingga 30 cm. Maka dari itu penelitian ini dilakukan dengan tujuan: (1) mengkaji pengaruh perbedaan tekanan angin roda traktor roda 4 terhadap tingkat pemadatan tanah pada kedalaman tanah 0 – 50 cm pada saat 6 bulan setelah perlintasan traktor, dan (2) mengkaji hubungan antara variabel sifat fisik tanah terkait pengaruh perbedaan tekanan angin roda traktor roda 4 terhadap tingkat pemadatan tanah pada kedalaman 0 – 50 cm pada saat 6 bulan setelah perlintasan traktor.

Penelitian dilaksanakan pada bulan Juli 2024 – Juli 2025 di lahan pertanian Unit Penyewaan Jasa Alsintan (UPJA) Kecamatan Sokaraja dan Laboratorium Terpadu 1 IAB, Universitas Jenderal Soedirman. Bahan yang digunakan adalah 4 plot penelitian ukuran 2 m x 2 m, sedangkan alat yang digunakan meliputi: traktor roda 4, *pressure gauge*, *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 tingkat tekanan angin roda traktor roda 4 yang terdiri dari: tanpa lintasan traktor (T₀), 7 psi (T₇), 15 psi (T₁₅), dan 20 psi (T₂₀). Tanah yang diambil yaitu pada kedalaman 0 – 10, 10 – 20, 20 – 30, 30 – 40, dan 40 – 50 cm. Pada masing-masing kedalaman tanah dilakukan 5 kali ulangan sehingga jumlah total sampel tanah yang diambil adalah 100. Variabel sifat fisik tanah yang diukur yaitu konduktivitas hidrolik jenuh, *dry bulk density*, porositas tanah dan kadar air tanah. Analisis data menggunakan analisis regresi, *Analysis of Variance* (ANOVA) dengan uji lanjut menggunakan uji *Duncan's Multiple Range Test* (DMRT) 5%, dan uji T.

Penelitian menunjukkan bahwa peningkatan tekanan angin pada roda traktor roda 4 pada saat 6 bulan setelah dilintasi traktor meningkatkan nilai *dry bulk density*, yang disertai dengan penurunan konduktivitas hidrolik jenuh, porositas, dan kadar air tanah. Sementara itu, semakin dalam lapisan tanah, nilai *dry bulk density* menurun, diikuti dengan kenaikan nilai konduktivitas hidrolik jenuh, porositas, dan kadar air. Hasil analisis regresi menunjukkan bahwa *dry bulk density* memiliki hubungan negatif terhadap konduktivitas hidrolik jenuh, sedangkan porositas dan kadar air menunjukkan hubungan positif terhadap konduktivitas hidrolik jenuh. Dibandingkan saat 0 bulan, pada saat 6 bulan setelah perlintasan traktor terjadi peningkatan nilai *dry bulk density* dan penurunan nilai porositas tanah, kadar air tanah, serta konduktivitas hidrolik jenuh. Secara statistik perbedaan nilai *dry bulk density*, porositas, kadar air, dan konduktivitas hidrolik jenuh tanah berbeda nyata antara data 6 bulan dengan data 0 bulan.

SUMMARY

The use of 4-wheeled tractors can increase efficiency in the tillage process. However, this tool also has the potential to cause soil compaction which has a negative impact on plant growth, the ability of roots to penetrate the soil, and the circulation of water and air in the soil. Studies on the effect of wind pressure on 4-wheel tractors on soil compaction are still limited. Most previous studies have only examined the effect of wind pressure on soil depths of up to 30 cm. Therefore, this study was carried out with the aim of (1) examining the effect of the difference in wind pressure of the 4-wheel tractor wheel on the level of soil compaction at a soil depth of 0 – 50 cm at 6 months after the tractor crossing, (2) and examining the relationship between soil physical property variables related to the effect of the difference in wind pressure of the 4-wheel tractor wheel on the soil compaction rate at a depth of 0 – 50 cm at 6 months after the tractor crossing.

The research was carried out in July 2024 – July 2025 on agricultural land of the Alsintan Service Rental Unit (UPJA) of Sokaraja District and the IAB Integrated Laboratory 1, Jenderal Soedirman University. The materials used are 4 land maps measuring 2 m x 2 m, while the tools used include: 4-wheel tractor, pressure gauge, head core ring sampler, soil ring sampler 100 cm³, oven, calipers, digital scales, aluminum cups, falling head meters, and stopwatch. The study was conducted using a Complete Random Design (CRD) with one factor/treatment and one control as a comparison. The treatment provided is 4 levels of wind pressure of 4-wheel tractors consisting of: without tractor track (T_0), 7 psi (T_7), 15 psi (T_{15}), and 20 psi (T_{20}). The soil taken is at depths of 0 – 10, 10 – 20, 20 – 30, 30 – 40, and 40 – 50 cm. At each soil depth, 5 replicates were conducted, resulting in a total of 100 soil samples taken. The physical soil properties measured were saturated hydraulic conductivity, dry bulk density, soil porosity, and soil moisture content. Data analysis was conducted using regression analysis, Analysis of Variance (ANOVA) with further testing using Duncan's Multiple Range Test (DMRT) at 5%, and T-test.

Research shows that the increase in tire pressure on 4-wheeled tractor wheels at 6 months after the tractor passes tends to increase the dry bulk density value, accompanied by a decrease in saturated hydraulic conductivity, porosity, and soil water content. Meanwhile, as the soil layer gets deeper, the dry bulk density value tends to decrease, followed by an increase in saturated hydraulic conductivity, porosity, and water content. Regression analysis results show that dry bulk density has a negative relationship with saturated hydraulic conductivity, while porosity and water content show a positive relationship with saturated hydraulic conductivity. Compared to the value at 0 months, at 6 months after the tractor crossing, there is an increase in dry bulk density values and a decrease in soil porosity, soil water content, and saturated hydraulic conductivity. Statistically, the differences in dry bulk density, porosity, moisture content, and saturated hydraulic conductivity tend to be significantly different between the 6-month data and the 0-month data.