RINGKASAN

Traktor roda 4 memiliki peran penting dalam kegiatan pengolahan tanah yang berfungsi sebagai sumber tenaga utama untuk menggerakkan peralatan pengolahan tanah. Penggunaan traktor roda 4 memiliki dampak negatif berupa pemadatan tanah yang dapat merusak struktur tanah. Salah satu upaya yang dapat dilakukan untuk mengurangi dampak pemadatan adalah dengan pemberian mulsa organik yang dapat memperbaiki sifat fisik, kimia, dan biologi tanah. Penelitian sebelumnya menunjukkan bahwa limbah pertanian dapat dimanfaatkan sebagai mulsa organik, namun sebagian besar penelitian tersebut hanya meneliti efek pemberian mulsa organik sesaat setelah perlintasan traktor. Penelitian yang membahas pengaruh mulsa organik terhadap pemadatan tanah hingga 12 bulan setelah perlintasan traktor roda 4 masih sangat terbatas. Oleh karena itu, penelitian ini bertujuan untuk (1) mengetahui pengaruh mulsa jerami, sekam padi dan serasah daun bambu terhadap tingkat kepadatan tanah pada kedalaman 0 – 50 cm pada saat 12 bulan setelah perlintasan traktor roda 4 dan (2) mempelajari hubungan antar beberapa variabel sifat fisik tanah terkait pengaruh pemberian mulsa organik terhadap tingkat pemadatan tanah pada kedalaman 0 – 50 cm pada saat 12 bulan setelah perlintasan traktor roda 4.

Penelitian dilaksanakan pada bulan Maret 2025 – Desember 2025 di lahan pertanian Unit Penyewaan Jasa Alsintan (UPJA) Sokaraja serta lab Terpadu 1 IAB, Universitas Jenderal Soedirman. Rancangan percobaan menggunakan Rancangan Acak Lengkap (RAL) dengan 4 taraf perlakuan, yaitu tanpa mulsa (M_0), mulsa jerami (M_J), mulsa sekam (M_S), dan mulsa serasah daun bambu (M_d). Sampel tanah tidak terganggu diambil pada kedalaman 0 – 10, 10 – 20, 20 – 30, 30 – 40, dan 40 – 50 cm, dengan jumlah ulangan 5 kali pada setiap kedalaman tanah, sehingga total sampel tanah yang diambil adalah 100. Bahan yang digunakan yaitu: mulsa jerami, serasah daun bambu, sekam dan 4 plot lahan berukuran 2 m x 2 m. Sedangkan alat yang digunakan yaitu: traktor roda 4, *head core ring sampler, soil ring sampler* standar, oven, jangka sorong, *falling head meter*, timbangan digital, pisau, meteran, palu, dan *stopwatch*. Variabel yang diukur adalah *dry bulk density,* konduktivitas hidrolik jenuh, porositas, dan kadar air tanah. 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 pemberian mulsa organik berupa mulsa jerami (M_j), mulsa sekam (M_s), dan mulsa serasah daun bambu (M_d) berpengaruh dalam menurunkan nilai *dry bulk density* dan meningkatkan porositas, kadar air, dan konduktivitas hidrolik jenuh tanah. *Dry bulk density* menunjukkan korelasi linier negatif terhadap konduktivitas hidrolik jenuh (R^2 = 0,6915). Sebaliknya porositas dan kadar air memiliki hubungan linier positif dengan konduktivitas hidrolik jenuh (R^2 = 0,6915 dan R^2 = 0,4939). Data saat 12 bulan setelah perlintasan traktor menunjukkan nilai *dry bulk density* yang lebih tinggi, sedangkan nilai porositas, kadar air, dan konduktivitas hidrolik jenuh lebih rendah dibandingkan data saat 6 dan 0 bulan pengamatan.

SUMMARY

A four-wheel tractor plays an important role in soil tillage activities, serving as the main power source for operating tillage equipment. However, the use of four-wheel tractors also has negative impacts, particularly soil compaction, which can damage soil structure. One approach to mitigate this impact is the application of organic mulch, which can improve the physical, chemical, and biological properties of the soil. Previous studies have shown that agricultural waste can be utilized as organic mulch, but most of these studies have only examined the effects of mulch application immediately after tractor traffic. Research on the influence of organic mulch on soil compaction up to 12 months after four-wheel tractor traffic remains very limited. Therefore, this study aims to (1) examine the effects of straw mulch, rice husk mulch, and bamboo leaf litter mulch on soil bulk density at depths of 0–50 cm, 12 months after four-wheel tractor traffic, and (2) investigate the relationships among several soil physical properties in relation to the effects of organic mulch application on soil compaction at depths of 0–50 cm, 12 months after four-wheel tractor traffic.

The study was conducted from March 2025 to December 2025 on agricultural land managed by the Agricultural Machinery Service Unit (UPJA) in Sokaraja and at the Integrated Laboratory 1, Faculty of Agriculture, Universitas Jenderal Soedirman. The experimental design used was a Completely Randomized Design (CRD) with four treatments: no mulch (M_0), straw mulch (M_j), rice husk mulch (M_s), and bamboo leaf litter mulch (M_d). Undisturbed soil samples were collected 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 materials used included straw mulch, bamboo leaf litter, rice husks, and four experimental plots measuring 2 m × 2 m each. The equipment included a four-wheel tractor, head core ring sampler, standard soil ring sampler, oven, vernier caliper, falling head meter, digital balance, knife, measuring tape, hammer, and stopwatch. The variables measured were dry bulk density, saturated hydraulic conductivity, porosity, and soil moisture content. Data analysis was performed using Analysis of Variance (ANOVA) at a 5% significance level, followed by Duncan's Multiple Range Test (DMRT) and regression analysis.

. The results showed that the application of organic mulches—straw mulch (M_j), rice husk mulch (M_s), and bamboo leaf litter mulch (M_d)—had a significant effect in reducing dry bulk density and increasing soil porosity, moisture content, and saturated hydraulic conductivity. Dry bulk density exhibited a negative linear correlation with saturated hydraulic conductivity ($R^2 = 0.69150$). Conversely, porosity and soil moisture content showed positive linear relationships with saturated hydraulic conductivity ($R^2 = 0.6915$ and $R^2 = 0.4939$, respectively). Data collected 12 months after tractor passage indicated higher dry bulk density values, while porosity, moisture content, and saturated hydraulic conductivity values were lower compared to those observed at 6 and 0 months after tractor passage.