RINGKASAN

Traktor roda 4 memiliki arti penting dalam pengolahan tanah, dimana traktor berfungsi sebagai tenaga penggerak dalam melakukan pengolahan tanah. Adapun dampak dari penggunaan traktor roda 4 dalam pengolahan tanah adalah terjadinya pemadatan tanah. Pemadatan yang berlebihan pada tanah akan menyebabkan struktur tanah menjadi rusak, sehingga kandungan seperti mineral, bahan organik, air, dan udara dalam tanah akan terganggu. Alternatif untuk mengatasi pemadatan tanah yaitu pemberian mulsa yang dapat memperbaiki sifat fisik, kimia, dan biologi. Penelitian terdahulu menunjukkan limbah pertanian dapat digunakan sebagai mulsa organik seperti kulit buah kakao, brangkasan kacang tanah, dan jerami padi. Penelitian-penelitian tersebut dominan fokus pada efek pemberian mulsa organik sesaat setelah perlintasan traktor atau pada waktu 0 bulan. Sedangkan penelitian terkait pengaruh pemberian jenis mulsa organik terhadap pemadatan tanah saat 6 bulan setelah perlintasan traktor roda 4 masih jarang dilakukan.

Penelitian dilaksanakan pada bulan September 2024 – Juli 2025 di lahan pertanian Unit Penyewaan Jasa Alsintan (UPJA) Sokaraja serta lab Terpadu 1 IAB, Universitas Jenderal Soedriman. 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 pengambilan 5 kali pada setiap kedalaman tanah, sehingga total sampel tanah yang diambil adalah 100. Bahan yang digunakan meliputi: mulsa jerami, serasah daun bambu, sekam dan 4 buah petakan lahan berukuran 2 m x 2 m. Sedangkan alat yang digunakan meliputi: traktor roda 4, *head core ring sampler*, *soil ring sampler* standar, oven, jangka sorong, timbangan digital, cawan alumunium, *falling head meter*, cangkul, sekop, linggis, pisau, patok, tali, meteran, kantong plastik, kain, papan kayu, palu, isolasi, baki, pagar ploting dan *stopwatch*. Variabel yang diukur adalah *dry bulk density*, konduktivitas hidrolik jenuh, porositas, dan kadar air tanah. Analisis data menggunakan analisis regresi serta *Analysis of Variance* (ANOVA) 5 % dengan uji lanjut menggunakan uji *Duncan's Multiple Range Test* (DMRT) 5% serta uji *Paired Sample* T-*test*.

Hasil penelitian menunjukkan bahwa pemberian mulsa organik mulsa jerami (M_j), mulsa sekam (M_s), dan mulsa daun bambu (M_d) memberikan pengaruh pada penurunan *dry bulk density*, dan peningkatan porositas, kadar air, serta konduktivitas hidrolik jenuh. Bertambahnya tingkat kedalaman tanah memberikan pengaruh penurunan nilai *dry bulk density*, serta peningkatan nilai porositas, kadar air, dan konduktivitas hidrolik jenuh. *Dry bulk density* memiliki hubungan linier negatif dengan konduktivitas hidrolik jenuh (R^2 = 0.6594). Porositas memiliki hubungan linier positif dengan konduktivitas hidrolik jenuh (R^2 = 0.6594). Kadar air memiliki hubungan linier positif dengan konduktivitas hidrolik jenuh (R^2 = 0.3152). Data 6 bulan pengamatan cenderung menghasilkan nilai *dry bulk density* yang lebih tinggi 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 berbedanyata pada setiap kedalaman, sedangkan konduktivitas hidrolik jenuh berbeda nyata.

SUMMARY

Four-wheel tractors play a crucial role in land preparation, serving as the primary power source for tillage operations. However, one significant impact of using four-wheel tractors is soil compaction. Excessive compaction can damage soil structure, disrupting the balance of minerals, organic matter, water, and air within the soil. One alternative to mitigate soil compaction is the application of organic mulch, which helps improve soil physical, chemical, and biological properties. Previous studies have demonstrated that agricultural waste, such as cocoa pod husks, peanut plant residues, and rice straw, can be used as organic mulch. However, most of these studies focus on the immediate effects of mulch application after tractor passes (at 0 months), while studies examining the long-term effects (after 6 months) of various organic mulch types on soil compaction remain limited.

This study was conducted from September 2024 to July 2025 on agricultural land at the Farm Machinery Rental Unit (UPJA) in Sokaraja, and at the Integrated Laboratory 1 IAB, Jenderal Soedirman University. A Completely Randomized Design (CRD) was used with four treatments: no mulch (M_0), rice straw mulch (M_j), rice husk mulch (M_s), and bamboo leaf litter mulch (M_d). Undisturbed soil samples were taken at depths of 0 – 10, 10 – 20, 20 – 30, 30 – 40, and 40 – 50 cm, with five replications per depth, resulting in a total of 100 samples. Materials used included: rice straw, bamboo leaf litter, rice husks, and four 2m x 2m plots. Equipment included: four-wheel tractor, head core ring sampler, standard soil ring sampler, oven, caliper, digital scale, aluminum tins, falling head meter, hoe, shovel, crowbar, knife, stakes, ropes, measuring tape, plastic bags, cloth, wooden boards, hammer, adhesive tape, trays, fencing, and stopwatch. Variables measured were: dry bulk density, saturated hydraulic conductivity, porosity, and soil moisture content. Data were analyzed using regression analysis, Analysis of Variance (ANOVA) at 5%, Duncan's Multiple Range Test (DMRT) at 5%, and Paired Sample T-test.

The results showed that the application of organic mulches rice straw (M_j), rice husk (M_s), and bamboo leaf litter (M_d) affected the reduction of dry bulk density and increased porosity, moisture content, and saturated hydraulic conductivity. Increasing soil depth led to lower dry bulk density and higher porosity, moisture content, and saturated hydraulic conductivity. Dry bulk density was found to have a negative linear relationship with saturated hydraulic conductivity ($R^2 = 0.6594$). Porosity had a positive linear relationship with saturated hydraulic conductivity ($R^2 = 0.6594$), while moisture content had a positive linear relationship with saturated hydraulic conductivity ($R^2 = 0.3152$). Data from 6 months of observation generally showed higher dry bulk density and lower porosity, moisture content, and saturated hydraulic conductivity compared to data at 0 months. T-test results showed no significant difference in dry bulk density, porosity, and moisture content between 0 and 6 months at all depths, whereas saturated hydraulic conductivity showed a significant difference.