RINGKASAN

Perlintasan traktor di lahan pertanian dapat menyebabkan pemadatan tanah yang berdampak buruk bagi pertumbuhan tanaman karena porositas dan kadar air tanah menurun. Salah satu solusi untuk mengurangi pemadatan adalah dengan menerapkan mulsa organik. Namun, penelitian mengenai dampak pemberian mulsa organik terhadap pemadatan tanah saat 6 setelah bulan perlintasan traktor masih jarang dilakukan. Selain itu, sebagian besar penelitian sebelumnya lebih terfokus pada sampel tanah hingga kedalaman 30 cm. Oleh sebab itu, penelitian ini dilakukan dengan tujuan untuk: (1) mempelajari pengaruh jenis mulsa organik terhadap pemadatan tanah akibat perlintasan traktor roda dua pada kedalaman 0 – 50 cm saat 6 bulan setelah perlintasan traktor, (2) menentukan jenis mulsa organik yang paling efektif dalam mengurangi dampak pemadatan tanah akibat perlintasan traktor roda dua saat 6 setelah bulan perlintasan traktor, serta (3) menganalisis hubungan antar variabel sifat fisik tanah dalam kaitannya dengan penggunaan jenis mulsa organik dan pemadatan tanah pada kedalaman 0 – 50 cm.

Penelitian dilaksanakan pada bulan Agustus 2024 hingga Mei 2025 di Desa Karangduren, Kecamatan Sokaraja, Kabupaten Banyumas, dan Laboratorium Terpadu 1 *Integrated Academic Building*, Universitas Jenderal Soedirman. Peralatan yang digunakan meliputi: traktor roda dua, *headcore ring sampler*, *soil ring sampler*, oven, jangka sorong, timbangan digital, cawan aluminium, *falling head meter*, sekop, linggis, gunting, meteran, wadah kantong plastik, kain, palu, dan *stopwatch*. Sementara bahan yang digunakan mencakup jerami padi, sekam padi, serasah daun bambu, serta 4 plot penelitian masing-masing berukuran 1 m × 2 m. Penelitian ini menggunakan Rancangan Acak Lengkap (RAL) dengan 4 perlakuan jenis mulsa: tanpa mulsa (M_0), mulsa jerami padi (M_j), mulsa sekam padi (M_s), dan mulsa serasah daun bambu (M_d). Variabel yang dianalisis meliputi konduktivitas hidrolik jenuh (k_s), kadar air tanah (*w),* kerapatan massa tanah kering (ρd), dan porositas (f). Data dianalisis menggunakan regresi serta *Analysis of Variance* (ANOVA) dengan uji lanjut *Duncan's Multiple Range Test* (DMRT) 5% serta uji *Paired Sample T-test*.

Hasil penelitian memperlihatkan bahwa ketiga jenis mulsa organik (M_j, M_s, dan M_d) secara umum menurunkan nilai *dry bulk density* dan meningkatkan nilai konduktivitas hidrolik jenuh, porositas, serta kadar air tanah jika dibandingkan dengan perlakuan tanpa mulsa (M_0). Di antara ketiganya, M_j menunjukkan hasil terbaik dalam menurunkan *dry bulk density* dan meningkatkan k_s, porositas, serta kadar air, diikuti oleh M_d dan kemudian M_s. Semakin dalam pengambilan sampel tanah, maka semakin rendah nilai *dry bulk density* dan semakin tinggi nilai konduktivitas hidrolik jenuh, porositas, serta kadar air tanah. Hasil analisis regresi menunjukkan adanya hubungan negatif antara *dry bulk density* dengan konduktivitas hidrolik jenuh ($R^2 = 0{,}5048$), serta hubungan positif antara porositas dan kadar air dengan konduktivitas hidrolik jenuh, dan kadar air dengan konduktivitas hidrolik jenuh dengan nilai R^2 masing-masing sebesar 0,5048 dan 0,3152. Selama periode 6 bulan setelah perlintasan traktor roda dua, terjadi perubahan signifikan pada sifat fisik tanah dibandingkan kondisi awal (0 bulan).

Nilai *dry bulk density* cenderung meningkat, sedangkan porositas dan konduktivitas hidrolik jenuh menurun secara signifikan, khususnya pada perlakuan tanpa mulsa. Namun di sisi lain, kadar air tanah relatif stabil bahkan meningkat pada lapisan tanah yang lebih dalam. Perlakuan dengan mulsa, terutama mulsa jerami padi, mampu menahan laju degradasi sifat fisik tanah secara lebih baik dibandingkan tanpa mulsa, sebagaimana dibuktikan melalui uji statistik (*paired t-test*) yang menunjukkan perbedaan signifikan antara waktu 6 dan 0 bulan.

SUMMARY

The passage of tractors over agricultural land can lead to soil compaction, which negatively affects plant growth due to decreased soil porosity and moisture content. One solution to reduce compaction is the application of organic mulch. However, research on the impact of organic mulch application on soil compaction six months after tractor traffic remains limited. Moreover, most previous studies have focused on soil samples up to a depth of only 30 *cm. Therefore, this study was conducted with the following objectives:* (1) *to examine the effect of organic mulch types on soil compaction caused by two-wheel tractor traffic at depths of* 0 – 50 *cm six months after compaction*, (2) *to determine the most effective type of organic mulch in reducing soil compaction six months after tractor traffic, and* (3) *to analyze the relationships among soil physical properties in relation to organic mulch application and soil compaction at depths of* 0 – 50 *cm.*

The research was carried out from August 2024 *to May* 2025 *in* Karangduren *Village,* Sokaraja *Sub-district,* Banyumas *Regency, and at the Integrated Laboratory* 1 *of the Integrated Academic Building,* Jenderal Soedirman *University. The equipment used included a two-wheel tractor, headcore ring sampler, soil ring sampler, oven, caliper, digital scale, aluminium dish, falling head meter, shovel, crowbar, scissors, measuring tape, plastic bags, cloth, hammer, and stopwatch. The materials used included rice straw, rice husks, bamboo leaf litter, and four experimental plots each measuring* 1 *m* × 2 *m. A Completely Randomized Design* (*CRD*) *was employed with four mulch treatments: no mulch* (M_0), *rice straw mulch* (M_j), *rice husk mulch* (M_s), *and bamboo leaf mulch* (M_d). *The variables analyzed were saturated hydraulic conductivity* (k_s), *soil moisture content* (w), *dry bulk density* (ρd), *and porosity* (f). *Data were analyzed using regression and Analysis of Variance (ANOVA), followed by Duncan's Multiple Range Test* (*DMRT*) *at a 5% significance level and a paired sample t-test.*

The results showed that all three organic mulch types (M_j, M_s, and M_d) *generally reduced dry bulk density and increased saturated hydraulic conductivity, porosity, and soil moisture content compared to the no-mulch treatment* (M_0). *Among them*, M_j *(rice straw mulch) demonstrated the best performance in reducing dry bulk density and increasing ks, porosity, and moisture content, followed by Md and then* M_s. *As sampling depth increased, dry bulk density decreased, while saturated hydraulic conductivity, porosity, and moisture content increased. Regression analysis indicated a negative relationship between dry bulk density and saturated hydraulic conductivity* (R^2 = 0.5048), *as well as positive relationships between porosity and moisture content with saturated hydraulic conductivity, with* R^2 *values of* 0.5048 *and* 0.3152*, respectively.*

Over the six-month period following the application of organic mulch and tractor traffic, significant changes in soil physical properties were observed compared to the initial condition (0 *months*). *Dry bulk density tended to increase, while porosity and saturated hydraulic conductivity significantly decreased, particularly in the no-mulch treatment. On the other hand, soil moisture content remained relatively stable or even increased in deeper soil layers. The application*

of mulch, especially rice straw mulch, was more effective in maintaining soil physical quality and mitigating degradation, as evidenced by the paired t-test results showing statistically significant differences between the 0 *and* 6 *month measurement.*