

RINGKASAN

Penggunaan traktor roda empat sebagai alat pengolahan tanah kini semakin meningkat karena dinilai lebih efektif dan efisien, meskipun perlintasan traktor roda empat berpotensi menyebabkan terjadinya pemadatan tanah yang memiliki dampak negatif terhadap sifat fisik tanah dan pertumbuhan tanaman. Kebanyakan penelitian mengenai dampak pemadatan tanah lebih terfokus pada kedalaman 0 – 30 cm meskipun terdapat beberapa jenis tanaman yang perakarannya tumbuh hingga lebih dari 30 cm. Oleh karena itu, penelitian ini ditujukan untuk (1) mengkaji pengaruh jumlah perlintasan traktor roda empat terhadap sifat fisik tanah pada kedalaman tanah 0 – 50 cm dan (2) mengkaji hubungan antara beberapa variabel sifat fisik tanah terkait dengan tingkat pemadatan tanah pada kedalaman tanah 0 – 50 cm akibat perlintasan traktor roda empat.

Penelitian ini dilaksanakan pada bulan November 2023 – Februari 2024 di lahan UPTD Balai Benih Padi dan Palawija Purwanegara dan Laboratorium Terpadu 1 *Integrated Academic Building* (IAB). Perlakuan yang diberikan adalah 0 perlintasan (L_0), 1 perlintasan (L_1), 4 perlintasan (L_4), dan 7 perlintasan (L_7) traktor roda empat. Pengambilan sampel tanah tidak terganggu menggunakan *soil ring sampler* pada 4 petakan lahan berukuran 2 m x 6 m dengan masing-masing 4 kali ulangan di setiap level kedalaman tanah (0 – 10, 10 – 20, 20 – 30, 30 – 40, dan 40 – 50 cm) sehingga total sampel yang diambil sebanyak 80 sampel. Peralatan yang digunakan terdiri dari satu unit traktor roda empat dengan implemen bajak rotari, *head core ring sampler*, *soil ring sampler* 100 cm³ (diameter 5 cm dan tinggi 5 cm), oven, jangka sorong, timbangan *digital*, cawan alumunium, *falling head meter*, cangkul, sekop, linggis, pisau, patok, tali, meteran, kantong plastik, kain, papan kayu, palu, baki, *stopwatch*, dan isolasi. Terhadap sampel tanah tidak terganggu yang telah diambil, dilakukan pengukuran variabel sifat fisik tanah: kadar air tanah, *dry bulk density*, porositas tanah, dan konduktivitas hidrolis jenuh. Analisis data pada penelitian ini menggunakan metode *Analysis of Variance* (ANOVA) dan dilanjutkan dengan Uji *Duncan's Multiple Range Test* (DMRT) 5%.

Peningkatan jumlah perlintasan traktor roda empat cenderung meningkatkan *dry bulk density*, mengurangi porositas, dan menurunkan konduktivitas hidrolis jenuh pada seluruh kedalaman tanah yang diamati (0 – 50 cm) dengan perubahan signifikan terutama pada kedalaman 0 – 10 cm. Semakin bertambah kedalaman tanah, nilai *dry bulk density* cenderung naik, sedangkan nilai porositas dan konduktivitas hidrolis jenuh cenderung turun meskipun secara statistik dominan tidak berbeda nyata. Hasil regresi menunjukkan adanya hubungan antar beberapa variabel sifat fisik tanah, dimana peningkatan *dry bulk density* seiring dengan penurunan porositas dan konduktivitas hidrolis jenuh, sementara peningkatan porositas sejalan dengan peningkatan konduktivitas hidrolis jenuh.

SUMMARY

The use of four-wheel tractors as a tillage tool is increasing because it is considered more effective and efficient, although four-wheel tractor crossings have the potential to cause soil compaction which has a negative impact on soil physical properties and plant growth. Most research on the impact of soil compaction has focused on depths of 0 – 30 cm although there are plant species whose roots grow to more than 30 cm. Therefore, this study aimed to (1) assess the effect of the number of four-wheel tractor crossings on soil physical properties at a soil depth of 0 – 50 cm and (2) assess the relationship between several soil physical property variables related to the level of soil compaction at a soil depth of 0 – 50 cm due to four-wheel tractor crossings.

This research was conducted from November 2023 – February 2024 on the land owned by UPTD Balai Benih Padi and Palawija Purwanegara and Integrated Laboratory 1 Integrated Academic Building (IAB). The treatments given were 0 crossings (L_0), 1 crossing (L_1), 4 crossings (L_4), and 7 crossings (L_7) of four-wheel tractor. Sampling of undisturbed soil using a soil ring sampler on 4 plots measuring 2 m x 6 m with 4 replications each at each soil depth level (0 – 10, 10 – 20, 20 – 30, 30 – 40, and 40 – 50 cm) so that a total of 80 samples were taken. The equipment used consisted of one unit of four-wheel tractor with rotary plough implements, head core ring sampler, 100 cm³ soil ring sampler (5 cm diameter and 5 cm height), oven, vernier caliper, digital balance, aluminium cup, falling head meter, hoe, shovel, crowbar, knife, stakes, rope, meter, plastic bag, cloth, wooden board, hammer, tray, stopwatch, and insulation. Undisturbed soil samples were taken to measure soil physical properties variables: soil moisture content, dry bulk density, soil porosity, and saturated hydraulic conductivity. Data analysis in this study used the Analysis of Variance (ANOVA) method then continued with Duncan's Multiple Range Test (DMRT) 5%.

Increasing the number of four-wheel tractor crossings tends to increase dry bulk density, decrease porosity, and decrease saturated hydraulic conductivity at all observed soil depths (0 – 50 cm) with significant changes especially at 0 – 10 cm depth. As the soil depth increases, the dry bulk density value tends to increase, while the porosity and saturated hydraulic conductivity values tend to decrease although statistically dominant are not significantly different. The regression results show a relationship between several variables of soil physical properties, where an increase in dry bulk density goes along with a decrease in porosity and saturated hydraulic conductivity, while an increase in porosity goes along with an increase in saturated hydraulic conductivity.