

RINGKASAN

Penggunaan traktor roda dua untuk pengolahan tanah dapat berdampak negatif berupa pemadatan tanah yang dapat menekan pertumbuhan tanaman. Disisi lain, kegiatan pemupukan diyakini dapat memperbaiki sifat fisika tanah dan menambah unsur hara kedalamnya. Kebanyakan kajian pemupukan lebih berfokus pada perbaikan sifat fisika tanah dalam kaitannya dengan pertumbuhan tanaman. Masih sedikit kajian pemupukan dalam kaitannya dengan perbaikan sifat fisika tanah dan dampak pemadatan tanah akibat perlintasan traktor. Lebih dari itu, kedalaman yang dikaji lebih terfokus pada kedalaman 0 – 30 cm, sementara perakaran tanaman ada yang dapat menembus lebih dari 30 cm. Oleh karena itu, penelitian ini bertujuan untuk (1) mengetahui perbedaan pengaruh pupuk organik, pupuk kimia, dan pupuk campuran terhadap tingkat pemadatan tanah pada kedalaman 0 – 50 cm, serta (2) mengetahui hubungan antara beberapa variabel sifat fisik tanah terkait pengaruh pupuk organik, pupuk kimia, dan pupuk campuran terhadap tingkat pemadatan tanah pada kedalaman 0 – 50 cm.

Penelitian dilakukan pada bulan Desember – Maret 2024 dengan tempat pengambilan sampel tanah di lahan pertanian Desa Karangduren, Sokaraja dan pengukuran sifat fisik tanah di Laboratorium Terpadu 1 IAB, Universitas Jenderal Soedirman. Rancangan percobaan menggunakan Rancangan Acak Lengkap (RAL) dengan satu faktor dan satu kontrol pada 4 taraf perlakuan yaitu: tanpa pupuk, pupuk organik, pupuk kimia, dan pupuk campuran. Pengambilan sampel tanah tidak terganggu dilakukan pada kedalaman 0 – 10, 10 – 20, 20 – 30, 30 – 40, dan 40 – 50 cm dengan jumlah ulangan sebanyak 5 kali untuk setiap kedalaman, sehingga total sampel yang diambil adalah 100. Alat dan bahan yang digunakan meliputi traktor roda dua tipe Quick/G 3000 ZEVA, *soil ring sampler* 100 cm³, *head core ring sampler*, oven, timbangan digital, jangka sorong, cawan alumunium, *falling head meter*, meteran, *stopwatch*, pupuk organik, pupuk kimia, pupuk campuran, dan 4 petakan lahan berukuran 2 m × 1 m. Variabel yang diukur adalah *dry bulk density*, *hydraulic conductivity*, porositas, dan kadar air. Analisis data menggunakan analisis regresi serta *Analysis of variance* (ANOVA) dengan uji lanjut menggunakan uji *Duncan's Multiple Range Test* (DMRT) 5%.

Hasil penelitian menunjukkan bahwa pemberian pupuk organik dan pupuk campuran cenderung menghasilkan penurunan nilai *dry bulk density*, yang diikuti dengan peningkatan nilai porositas dan konduktivitas hidrolik jenuh, sedangkan pupuk kimia menghasilkan hal yang sebaliknya. Pupuk organik paling efektif dalam mengurangi dampak pemadatan tanah akibat perlintasan traktor roda dua. Peningkatan kedalaman tanah cenderung menghasilkan penurunan nilai *dry bulk density* serta peningkatan nilai porositas dan konduktivitas hidrolik jenuh. Hasil regresi menunjukkan bahwa *dry bulk density* memiliki hubungan linear negatif dengan konduktivitas hidrolik jenuh ($R^2 = 0,6956$), sedangkan porositas dan kadar air keduanya memiliki hubungan linear positif dengan konduktivitas hidrolik jenuh (R^2 masing-masing adalah 0,6956 dan 0,5697).

SUMMARY

The use of two-wheeled tractors for tillage can have a negative impact in the form of soil compaction which can suppress plant growth. On the other hand, fertilization activities are believed to improve the physical properties of the soil and add nutrients to it. Most fertilizer studies focus more on improving soil physical properties in relation to plant growth. There are still few studies on fertilization in relation to improving soil physical properties and the impact of soil compaction due to tractor crossings. Moreover, the depth studied is more focused on a depth of 0 – 30 cm, while some plant roots can penetrate more than 30 cm. Therefore, this research aims to (1) determine the differences in the effects of organic fertilizers, chemical fertilizers and mixed fertilizers on the level of soil compaction at a depth of 0 – 50 cm, and (2) determine the relationship between several variables of soil physical properties related to the influence of organic fertilizers, chemical fertilizers, and mixed fertilizers on the level of soil compaction at a depth of 0 – 50 cm.

The research was carried out in December – March 2024 with soil samples taken on agricultural land in Karangduren Village, Sokaraja and measurements of the physical properties of the soil at the Integrated Laboratory 1 IAB, Jenderal Soedirman University. The experimental design used a Completely Randomized Design (CRD) with one factor and one control at 4 treatment levels, namely: no fertilizer, organic fertilizer, chemical fertilizer, and mixed fertilizer. Undisturbed soil samples were taken at depths of 0 – 10, 10 – 20, 20 – 30, 30 – 40, and 40 – 50 cm with 5 repetitions for each depth, so that the total samples taken were 100. Tools and materials used include a Quick/G 3000 ZEVA type two-wheeled tractor, 100 cm³ soil ring sampler, head core ring sampler, oven, digital scale, vernier caliper, aluminum cup, falling head meter, tape measure, stopwatch, organic fertilizer, chemical fertilizer, manure mixed, and 4 plots of land measuring 2 m × 1 m. The variables measured are dry bulk density, hydraulic conductivity, porosity, and water content. Data analysis used regression analysis and Analysis of variance (ANOVA) with further tests using Duncan's Multiple Range Test (DMRT) 5%.

The research results show that the application of organic fertilizer and mixed fertilizer tends to result in a decrease in dry bulk density values, which is followed by an increase in porosity and saturated hydraulic conductivity values, while chemical fertilizers produce the opposite. Organic fertilizer is most effective in reducing the impact of soil compaction due to the crossing of two-wheeled tractors. Increasing soil depth tends to result in a decrease in dry bulk density values as well as an increase in porosity and saturated hydraulic conductivity values. The regression results show that dry bulk density has a negative linear relationship with saturated hydraulic conductivity ($R^2 = 0.6956$), while porosity and water content both have a positive linear relationship with saturated hydraulic conductivity (R^2 are 0.6956 and 0.5697 respectively).