

RINGKASAN

Cemaran logam timbal merupakan salah satu hambatan dalam budidaya kedelai karena dapat menurunkan produksi dan mencemari hasil kedelai. Kedelai kaya akan kandungan protein serta banyak diolah menjadi beragam produk seperti tahu, tempe, susu, tepung, minyak, dan sebagainya. Kedelai yang diolah menjadi produk makanan harus dipastikan aman dari cemaran logam timbal agar terciptanya keamanan pangan. Salah satu upaya yang dapat dilakukan untuk menekan cemaran logam berat timbal sekaligus meningkatkan produksi tanaman yaitu dengan menggunakan pupuk *slow release* yang dilapisi dengan bahan-bahan yang dapat mengikat logam berat, seperti zeolit dan asam humat. Pupuk N-ZEO-SR Plus merupakan modifikasi pupuk N yang dilapisi dengan bahan zeolit, montmorillonit, dan asam humat yang menggunakan teknologi nano yang berpotensi meningkatkan produksi dan menekan cemaran logam berat timbal di dan tanaman. Penelitian ini bertujuan mengetahui pengaruh pemberian dosis pupuk N-ZEO-SR Plus dan logam berat Pb terhadap pertumbuhan, hasil kacang kedelai, serta kandungan logam berat Pb di dalam tanah dan biji kedelai serta interaksi keduanya.

Penelitian dilakukan pada Desember 2023 sampai Juni 2024 di *screen house* dan Laboratorium Ilmu Tanah Fakultas Pertanian Universitas Jenderal Soedirman. Penelitian ini menggunakan rancangan acak kelompok (RAK) dengan dua faktor. Faktor pertama adalah dosis pupuk (D), terdiri dari D0 (0 kg/ha), D1 (50 kg/ha), D2(100 kg/ha), dan D3 (150 kg/ha). Faktor kedua adalah konsentrasi logam Pb (K), terdiri dari K0 (0 ppm), K1 (50 ppm), dan K2 (100 ppm). Setiap perlakuan dilakukan 3 kali ulangan, sehingga menghasilkan 36 unit percobaan. Variabel pengamatan meliputi tinggi tanaman, jumlah daun, luas daun, kandungan klorofil, kandungan prolin, bobot kering tanaman, jumlah polong isi, bobot 100 biji, bobot biji pertanaman, kandungan logam Pb di tanah dan biji kedelai, serta persentase penurunan Pb.

Hasil penelitian menunjukkan bahwa pemberian pupuk N-ZEO-SR Plus secara tunggal pada dosis 150 kg/ha dapat meningkatkan jumlah daun 6 MST sebesar 9%, kandungan klorofil sebesar 32%, bobot biji pertanaman sebesar 23%, dan menekan kandungan Pb di tanah sebesar 11% dibandingkan tanpa pemupukan. Pemberian konsentrasi Pb 100 ppm secara tunggal dapat meningkatkan kandungan Pb di tanah sebesar 40% dibandingkan tanpa pemberian logam Pb. Terdapat interaksi antara pupuk N-ZEO-SR Plus dan logam berat Pb terhadap variabel jumlah polong isi, kandungan klorofil, kandungan Pb di tanah dan persentase penurunan Pb di tanah. Dosis 100 kg/ha dengan Pb 100 ppm meningkatkan jumlah polong isi (49,33 buah), kandungan klorofil (38,33 mg/L), menekan kandungan Pb pada tanah akhir penelitian (29,56 ppm), serta meningkatkan persentase penurunan Pb pada tanah (75%).

SUMMARY

Lead contamination is a significant obstacle in soybean cultivation, as it can reduce production and contaminate the soybean yield. Soybeans are rich in protein and are processed into various products such as tofu, tempeh, soy milk, flour, oil, and more. Soybeans intended for food products must be free from lead contamination to ensure food safety. One approach to reducing heavy metal contamination while also increasing plant production is the use of slow-release fertilizers coated with materials that can bind heavy metals, such as zeolite and humic acid. N-ZEO-SR Plus is a modified nitrogen fertilizer coated with zeolite, montmorillonite, and humic acid using nanotechnology, which has the potential to enhance production and reduce heavy metal lead contamination in plants. This study aims to investigate the effects of different doses of N-ZEO-SR Plus fertilizer and lead (Pb) contamination on soybean growth, yield, and lead content in the soil and soybean seeds, as well as their interactions.

The research was conducted from December 2023 to June 2024 in a screen house and the Soil Science Laboratory at the Faculty of Agriculture, Universitas Jenderal Soedirman. The study employed a randomized complete block design (RCBD) with two factors. The first factor was the fertilizer dosage (D), including D0 (0 kg/ha), D1 (50 kg/ha), D2 (100 kg/ha), and D3 (150 kg/ha). The second factor was lead concentration (K), including K0 (0 ppm), K1 (50 ppm), and K2 (100 ppm). Each treatment was replicated three times, resulting in 36 experimental units. The observed variables included plant height, number of leaves, leaf area, chlorophyll content, proline content, dry weight of the plant, number of seeds per pod, 100-seed weight, seed weight per plant, lead content in the soil and soybean seeds, and percentage reduction of Pb.

The results showed that the application of N-ZEO-SR Plus fertilizer at a dosage of 150 kg/ha significantly increased the number of leaves at 6 MST by 9%, chlorophyll content by 32%, seed weight per plant by 23%, and reduced Pb content in the soil by 11% compared to no fertilization. A lead concentration of 100 ppm alone increased Pb content in the soil by 40% compared to no Pb application. There were interactions between N-ZEO-SR Plus fertilizer and lead contamination affecting the number of seeds per pod, chlorophyll content, Pb content in the soil, and percentage reduction of Pb in the soil. A dosage of 100 kg/ha with 100 ppm Pb increased the number of seeds per pod to 49.33, chlorophyll content to 38.33 mg/L, reduced Pb content in the soil at the end of the study to 29.56 ppm, and increased the percentage reduction of Pb in the soil to 75%.