



PHOSPHORUS FERTILIZER RATE BASED ON PUTK SOIL ANALYSIS FOR POLYETHYLENE MULCHED TOMATO FERTIGATION

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**AGRONOMY AND HORTICULTURE MASTER STUDY PROGRAM
FACULTY OF AGRICULTURE
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SUMMARY

VITHO ALVENO. Phosphorus Fertilizer Rate Based on PUTK Soil Analysis for Polyethylene Mulched Tomato Fertigation. Supervised by KETTY SUKETI, ANAS DINURROHMAN SUSILA, AWANG MAHARIJAYA.

Implementing the precision farming system is one of the agricultural sector's adaptation strategies as the main food source in response to global climate change. Fertilizer recommendations in precision farming are based on soil nutrient content, so it is important to find the current soil nutrient content before applying fertilizer. From previous studies, correlation and calibration testing of available P and K analysis using PUTK on tomato plants has been carried out, so the next stage will be determining the recommended rate of P and K fertilizer for polyethylene mulched tomato plants.

Three experiments were performed to determine recommendations for P fertilizer rate based on soil analysis using the Upland Soil Test Kit (PUTK) in cultivating tomato plants using a fertigation system. This experiment was carried out by testing the rate of P fertilizer on soil with low, medium, and high P availability based on soil analysis with PUTK. This study was carried out using a Randomized Complete Block Design (RCBD), four replications with one treatment, namely phosphorus fertilizer consisting of 0% X, 50% X, 100% X, 150% X, and 200% X, with X the recommended SP-36 fertilizer of each P availability status from PUTK.

A higher P fertilizer rate in the low P availability experiment will increase tomato growth and yield but it is still linear. A higher P fertilizer rate in the high P availability experiment does not affect tomato growth and even lower yield. On the other hand, the P fertilizer rate treatment in the moderate P availability experiment didn't affect tomato growth and production, because the experimental field used was considered to have high phosphorus availability based on the Mechlich 1 test (44,6ppm).

Excessive fertilization will reduce crop yields and contribute to environmental degradation due to residual fertilizer accumulation. Therefore, applying fertilizers at optimal rates is essential to maximize production while ensuring environmental sustainability. PUTK is a rapid soil testing tool that can help farmers determine the nutrient content available in the soil. However, the PUTK test results are still qualitative, so they cannot differentiate between soil with medium-high and medium-low nutrient content. In this study, the experimental field was found to have moderate P availability according to PUTK analysis, whereas laboratory analysis using Mehlich-1 indicated high P availability. This suggests that further development of PUTK is necessary, such as replacing the P extractant with Mehlich-1, which has demonstrated strong correlations with vegetable crop performance. Moreover, developing methods to quantify soil analysis results could significantly enhance support for precision agriculture in horticultural crops.

Keywords: precision farming, precision fertilization, fertigation, Upland Soil Test Kit,

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RINGKASAN

VITHO ALVENO. Rekomendasi Pemupukan Fosfor Berdasarkan Analisis Tanah Menggunakan PUTK pada Fertigasi Tanaman Tomat dengan Mulsa Polyethylene. Dibimbing oleh KETTY SUKETI, ANAS DINURROHMAN SUSILA, AWANG MAHARIJAYA.

Salah satu aksi adaptasi sektor pertanian sebagai sumber pangan utama dalam menanggapi perubahan iklim global adalah penerapan sistem pertanian presisi. Dalam sistem pertanian presisi, rekomendasi pemupukan dibuat berdasarkan kandungan hara yang tersedia dalam tanah. Dari penelitian sebelumnya telah dilakukan uji korelasi dan kalibrasi analisis P dan K tersedia menggunakan PUTK pada tanaman tomat, sehingga tahap selanjutnya adalah menentukan dosis pupuk P dan K yang direkomendasikan untuk tanaman tomat.

Pada penelitian ini dilakukan tiga kali percobaan untuk menentukan rekomendasi dosis pupuk P berdasarkan analisis tanah menggunakan Perangkat Uji Tanah Kering (PUTK) dalam budidaya tanaman tomat menggunakan sistem fertigasi. Percobaan ini dilakukan dengan menguji dosis pupuk P pada tanah dengan ketersediaan P rendah, sedang, dan tinggi berdasarkan pengujian menggunakan PUTK. Penelitian ini dilakukan dengan menggunakan Rancangan Acak Kelompok (RAK), empat kali ulangan dengan satu perlakuan yaitu pupuk fosfor 0% X, 50% X, 100% X, 150% X, dan 200% X, dengan X merupakan pupuk SP-36 yang direkomendasikan untuk masing-masing status ketersediaan P dari PUTK.

Pemupukan P pada lahan dengan ketersediaan P rendah akan meningkatkan pertumbuhan dan produksi tomat tetapi pola responnya masih linier. Pemupukan P pada lahan dengan ketersediaan P tinggi tidak mempengaruhi pertumbuhan dan produksi tomat, bahkan menurunkan produksi. Pemupukan P pada tomat pada ketersediaan P sedang tidak mempengaruhi pertumbuhan dan produksi tomat, karena lahan percobaan yang digunakan dinilai memiliki ketersediaan fosfor yang tinggi berdasarkan uji Mechlich 1 (44,6 ppm).

Pemupukan yang berlebihan tidak hanya dapat menyebabkan penurunan produksi, tetapi juga dapat menimbulkan kerusakan lingkungan akibat residu pupuk, sehingga perlu dilakukan pemupukan dengan dosis yang tepat agar produksi maksimal dan lingkungan juga dapat terjaga. Untuk dapat memberikan pupuk dengan jumlah yang tepat, sangat penting untuk mengetahui kandungan hara yang tersedia dalam tanah. PUTK merupakan alat uji tanah cepat yang dapat membantu petani untuk mengetahui kandungan hara yang tersedia dalam tanah. Akan tetapi, hasil uji PUTK masih bersifat kualitatif. Lahan percobaan yang digunakan pada penelitian ini terdeteksi memiliki ketersediaan P sedang menurut PUTK, tetapi sudah tinggi berdasarkan analisis Mehlich-1 di laboratorium. Hal ini menunjukkan bahwa PUTK masih perlu dikembangkan untuk mendukung pertanian presisi, khususnya pemupukan presisi. Perubahan yang dapat dilakukan misalnya menambahkan ekstrak P Mechlich 1 yang terbukti cocok dengan tanaman sayuran. Selain itu dapat pula dikembangkan metode untuk kuantifikasi hasil analisis PUTK agar hasil rekomendasi pemupukannya lebih presisi lagi.

Kata kunci: pertanian presisi, pemupukan presisi, Perangkat Uji Tanah Kering, fertigasi



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Thesis
as a requirement for a degree of
Master of Science in
Agronomy and Horticulture Study Program

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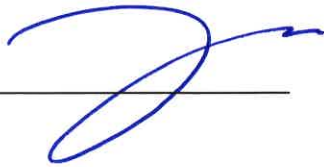
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FOREWORDS

I would like to express my gratitude to Allah SWT because only through His grace and blessings can this thesis entitled " Phosphorus Fertilizer Rate Based on PUTK Soil Analysis for Polyethylene Mulched Tomato Fertigation" be finished properly. One limitation for Indonesia in developing precision fertilization is the availability of Soil Testing Laboratories. Not to mention the analysis time is taking too long, so farmers are not interested in soil testing. Soil testing is one way to estimate the amount of nutrients available for plants so that it can be known how much nutrients need to be added through fertilization. In the cultivation process, when there are ample nutrients present in the soil, farmers don't have to apply additional fertilizers. However, due to a lack of knowledge about it, farmers still apply fertilizers, leading to waste, inefficiency, and even lower yields. In soil with high P availability, it is crucial to refrain from adding phosphorus fertilizers when practicing tomato fertigation. This practice will optimize nutrient utilization and improve overall plant production. I would also strongly recommend further development of the PUTK to enhance support for precision agriculture in horticultural crops, particularly tomatoes, for increased precision and effectiveness. Part of this research has been published in a scientific paper "Evaluation of Phosphorus Fertilizer Rate Based on Upland Soil Test Kit Analysis for Tomato Fertigation" in the Indonesian Journal of Agronomy, Volume 52 (2), August 2024.

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Finally, I hope this thesis can be useful for its readers and parties who wish to develop precision agriculture, especially the Upland Soil Test Kit.

Bogor, October 2024

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