INTISARI

Kebutuhan gula semakin meningkat seiring bertambahnya jumlah penduduk, pada tahun 2018 hingga 2022 produksi gula mengalami peningkatan namun tidak dapat mencukupi kebutuhan gula nasional. Diperlukan upaya untuk meningkatkan produksi gula nasional salah satunya yaitu melalui manajemen pemupukan presisi terutama untuk hara Kalium (K). Penelitian ini bertujuan untuk mengembangkan model *Decision Support System* (DSS) sebagai penduga serapan dan dosis rekomendasi pupuk K tanaman tebu yang presisi berbasis foto udara multispektral UAV. Penelitian lapangan telah dilaksanakan di Sleman, D.I. Yogyakartaa, Sidoarjo, Jawa Timur dan Lampung Utara, Lampung pada Oktober 2023 - Desember 2024. Percobaan lapangan di setiap lokasi disusun menggunakan rancangan lingkungan acak kelompok lengkap (RAKL) dengan 5 perlakuan yaitu 100% pupuk NPK dosis 850 kg/ha (P1), 80% (680 kg/ha) dosis pupuk NPK (P2), 60% (510 kg/ha) dosis pupuk NPK (P3), 40% (340 kg/ha) dosis pupuk NPK (P4) dan 20% (170 kg/ha) dosis pupuk NPK (P5) dan 3 blok sebagai ulangan. Data yang diperoleh selanjutnya dianalisis menggunakan algoritma *machine learning* berbasis *Random Forest* (RF) dan *Stepwise Multiple Linear* (SML) MINITAB untuk menghasilkan model penduga serapan dan dosis rekomendasi pupuk K tanaman tebu. Hasil penelitian memberikan informasi bahwa model penduga serapan dan dosis rekomendasi pupuk K tanaman tebu yang dibangun menggunakan algoritma RF tingkat akurasinya lebih tinggi jika dibandingkan dengan model penduga yang dihasilkan oleh algoritma SML MINITAB, jika jumlah *data set* yang dipergunakan sedikit, pada penelitian ini sebanyak 90 *data set*. Pendekatan algoritma RF meghasilkan model penduga serapan K tanaman tebu dengan nilai R^2 sebesar 0,50 (50%) sedangkan SML hanya mampu menghasilkan nilai 0,25 (25%). Model penduga serapan K tanaman tebu hasil algoritma RF mampu mengontrol serapan K aktual tanaman tebu sebesar 55,9% sedangkan model yang dikembangkan menggunakan SML hanya mampu mengendalikan serapan K aktual tanaman tebu sebesar 24,8%. Model penduga serapan K tanaman tebu yang dihasilkan yaitu: 848 – 1182 NDVI + 966 NDRE + 504 SAVI – 22,8 SR. Sedangkan model penduga dosis rekomendasi pupuk K tanaman tebu yaitu: – 299,81 + 1165,33 NDVI – 952,38 NDRE – 496,89 SAVI + 22,49 SR.

Kata kunci: kalium, PF, UAV, multispektral, DSS, indeks, prediksi, RF, SML

ABSTRACT

The need for sugar is increasing along with the increasing population, in 2018 to 2022 sugar production has increased but cannot meet national sugar needs. Efforts are needed to increase national sugar production, one of which is through precision fertilization management, especially for Potassium (K) nutrients. This study aims to develop a Decision Support System (DSS) model as an estimate of absorption and recommended doses of K fertilizer for sugarcane plants that are precise based on UAV multispectral aerial photography. Field research has been carried out in Sleman, D.I. Yogyakarta, Sidoarjo, East Java and North Lampung, Lampung in October 2023 - December 2024. Field trials at each location were arranged using a complete randomized block design (RAKL) with 5 treatments, namely 100% NPK fertilizer dose of 850 kg/ha (P1), 80% (680 kg/ha) NPK fertilizer dose (P2), 60% (510 kg/ha) NPK fertilizer dose (P3), 40% (340 kg/ha) NPK fertilizer dose (P4) and 20% (170 kg/ha) NPK fertilizer dose (P5) and 3 blocks as replications. The data obtained were then analyzed using a machine learning algorithm based on Random Forest (RF) and Stepwise Multiple Linear (SML) MINITAB to produce a model to estimate the absorption and recommended dose of K fertilizer for sugarcane plants. The results of the study provide information that the sugarcane plant K absorption and recommended dose estimation model built using the RF algorithm has a higher level of accuracy when compared to the estimation model produced by the MINITAB SML algorithm, if the number of data sets used is small, in this study there were 90 data sets. The RF algorithm approach produces a sugarcane plant K absorption estimation model with an R2 value of 0.50 (50%) while SML is only able to produce a value of 0.25 (25%). The sugarcane plant K absorption estimation model resulting from the RF algorithm is able to control the actual K absorption of sugarcane plants by 55.9% while the model developed using SML is only able to control the actual K absorption of sugarcane plants by 24.8%. The sugarcane plant K absorption estimation model produced is: 848 - 1182 NDVI + 966 NDRE + 504 SAVI - 22.8 SR. Meanwhile, the model for estimating the recommended dose of K fertilizer for sugarcane plants is: – 299.81 + 1165.33 NDVI – 952.38 NDRE – 496.89 SAVI + 22.49 SR.

Keywords: potassium, PF, UAV, multispectral, DSS, index, prediction, RF, SML