ANALISIS PERTUMBUHAN TANAMAN CABAI DAN MODEL PREDIKSI EMISI GAS RUMAH KACA METANA (CH_4) PADA LAHAN BUDIDAYA CABAI (*Capsicum annuum* L.) DENGAN PERLAKUAN PUPUK DAN MULSA DI KABUPATEN SLEMAN

INTISARI

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Penelitian ini bertujuan mengevaluasi pengaruh kombinasi perlakuan pupuk dan mulsa terhadap pertumbuhan tanaman cabai, emisi gas metana (CH_4), serta memodelkan fluks metana menggunakan *Artificial Neural Network* (ANN) pada dua lokasi di Kabupaten Sleman, yakni Pakem dan Mlati. Di lokasi Pakem, perlakuan jenis pupuk tidak memberikan pengaruh signifikan terhadap pertumbuhan maupun hasil cabai, namun perlakuan mulsa terutama mulsa plastik secara signifikan meningkatkan tinggi tanaman, jumlah daun serta bobot buah. Di Mlati, seluruh perlakuan tidak menunjukkan pengaruh signifikan. Emisi metana terendah dicapai oleh kombinasi pupuk organik dan mulsa daun bambu (P1M1) sebesar 0,487 mg CH_4 m^{-2} d^{-1}, sedangkan tertinggi pada perlakuan tanpa pupuk dengan mulsa daun bambu (P0M1) sebesar 0,800 mg CH_4 m^{-2} d^{-1}. Fluks metana di masing-masing lokasi dipengaruhi oleh kombinasi faktor iklim dan tanah, dengan korelasi positif dan hubungan cukup dari radiasi matahari (r = 0,49), curah hujan (r = 0,50), dan suhu udara maksimum (r = 0,46), serta korelasi negatif dengan hubungan cukup dari kelembapan relatif (r = –0,47), tekanan udara (r = –0,50), dan EC tanah (r = –0,40). Kandungan air tanah (VWC) menunjukkan korelasi positif yang lebih kuat di Pakem. Model ANN memiliki performa prediksi moderat (R^2 = 0,525; RMSE = 0,52; NSE = 0,525), dengan variabel radiasi matahari (r = 0,49), curah hujan (r = 0,50), suhu udara maksimal (r = 0,46), suhu udara rata-rata (r = 0,38), kandungan air tanah/VWC (r = 0,35), kelembapan udara rata-rata (r = -0,37), dan tekanan udara (r = -0,44) sebagai faktor paling berpengaruh.

Kata kunci: *artificial neural network*, cabai, emisi metana (CH_4), mulsa, pupuk, pertanian berkelanjutan

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ANALYSIS OF CHILI PLANT GROWTH AND PREDICTION MODEL OF METHANE (CH_4) GREENHOUSE GAS EMISSIONS ON CHILI (Capsicum annuum L.) CULTIVATION LAND WITH FERTILIZER AND MULCH TREATMENTS IN SLEMAN DISTRICT

ABSTRACT

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This study aims to evaluate the effect of a combination of fertilizer and mulch treatments on chili growth, methane gas (CH_4) emissions, and methane flux modeling using Artificial Neural Network (ANN) in two locations in Sleman, namely Pakem and Mlati. In Pakem, fertilizer type had no significant effect, but plastic mulch increased plant height, number of leaves, and fruit weight. In Mlati, all treatments showed no significant effect. The lowest methane emission was found in the combination of organic fertilizer and bamboo leaf mulch (P1M1) at 0.487 mg CH_4 m^{-2} d^{-1}, the highest in the treatment without fertilizer and bamboo leaf mulch (P0M1) at 0.800 mg CH_4 m^{-2} d^{-1}. Methane flux was influenced by a combination of climatic and soil factors, with moderate positive correlations from solar radiation (r = 0.49), rainfall (r = 0.50), maximum temperature (r = 0.46), and moderate negative correlations from air humidity (r = -0.47), air pressure (r = -0.50), and soil EC (r = -0.40). Soil water content (VWC) showed a stronger positive correlation in Pakem. The ANN model had moderate prediction performance (R^2 = 0.525; RMSE = 0.52; NSE = 0.525), with the most influential factors including solar radiation (r = 0.49), rainfall (r = 0.50), maximum temperature (r = 0.46), average temperature (r = 0.38), VWC (r = 0.35), average humidity (r = -0.37), and air pressure (r = -0.44).

Keywords: *artificial neural network, chili, fertilizer, methane emission, mulch, sustainable agriculture*

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