

**PEMODELAN KARAKTERISTIK FISIKA KIMIA TANAH DAN
PRODUKTIVITAS KUBIS (*Brassica oleracea* var. *capitata* f. *alba*)
MENGUNAKAN PENDEKATAN *STRUCTURAL EQUATION MODELING* –
PARTIAL LEAST SQUARES (SEM-PLS)**

INTISARI

Oleh:

Raditya Rizki Yulianta

21/474177/TP/13085

Kesehatan tanah berperan penting dalam mendukung produktivitas dan keberlanjutan pertanian. Penelitian ini menganalisis parameter fisika-kimia tanah dan produktivitas kubis di beberapa lokasi sentra pertanian di Kabupaten Karanganyar (Kalisoro, Somokado, Blumbang, dan Kemuning). Parameter yang diuji meliputi tekstur tanah, kadar lengas, berat jenis, berat volume, porositas, pH, C-organik, N-total dalam tanah, serta residu pestisida pada tanaman. Data dianalisis melalui uji normalitas dan homogenitas ($p > 0,05$), dilanjutkan dengan uji *Independent T-test* ($p < 0,05$), serta pemodelan SEM-PLS menggunakan *SmartPLS*. Hasil menunjukkan perbedaan signifikan antara *cultivated land* dan *reference land* pada kadar lengas ($p = 0,006$), berat volume ($p = 0,003$), berat jenis ($p = 0,002$), porositas ($p = 0,000$), pH ($p = 0,001$), C-organik ($p = 0,008$), dan N-total ($p = 0,042$). Model SEM-PLS mengidentifikasi korelasi kuat antara pH tanah ($r = 0,827$) dan N-total ($r = 0,730$) terhadap produktivitas kubis. Residu pestisida yang terdeteksi meliputi *Cypermethrin* (0,08 mg/kg) di Kalisoro serta *Methidation* (0,087 mg/kg di Kalisoro dan 0,070 mg/kg di Somokado). Hasil ini menegaskan pentingnya pengelolaan tanah dan pemantauan residu pestisida dalam mendukung sistem pertanian berkelanjutan.

Kata Kunci: kesehatan tanah, produktivitas lahan, *Brassica oleracea*, residu pestisida, pertanian berkelanjutan

MODELING OF SOIL PHYSICAL CHEMICAL CHARACTERISTICS AND CABBAGE (*Brassica oleracea* var. *capitata* f. *alba*) PRODUCTIVITY USING STRUCTURAL EQUATION MODELING – PARTIAL LEAST SQUARES (SEM- PLS)

ABSTRACT

By:

Raditya Rizki Yulianta

21/474177/TP/13085

Soil health plays a crucial role in supporting agricultural productivity and sustainability. This study analyzes the physical-chemical soil parameters and cabbage productivity in several major farming areas in Karanganyar Regency (Kalisoro, Somokado, Blumbang, and Kemuning). The parameters evaluated include soil texture, moisture content, particle density, bulk density, porosity, pH, organic carbon, total nitrogen, and pesticide residues in cabbage plants. Data were analyzed using normality and homogeneity tests ($p > 0.05$), followed by an Independent T-test ($p < 0.05$), and Structural Equation Modeling – Partial Least Squares (SEM-PLS) using SmartPLS. The results showed significant differences between cultivated and reference lands in terms of moisture content ($p = 0.006$), bulk density ($p = 0.003$), particle density ($p = 0.002$), porosity ($p = 0.000$), pH ($p = 0.001$), organic carbon ($p = 0.008$), and total nitrogen ($p = 0.042$). The SEM-PLS model identified strong correlations between soil pH ($r = 0.827$) and total nitrogen ($r = 0.730$) with cabbage productivity. Detected pesticide residues included *Cypermethrin* (0.08 mg/kg) in Kalisoro and *Methidation* (0.087 mg/kg in Kalisoro and 0.070 mg/kg in Somokado). These findings highlight the importance of integrated soil management and pesticide residue monitoring as part of sustainable agricultural strategies.

Keywords: soil health, land productivity, *Brassica oleracea*, pesticide residues, sustainable agriculture