SOIL SAMPLING TIMING AND POSITION SHAPE PHOSPHORUS AND POTASSIUM GUIDANCE FOR ROW CROP PRODUCTION

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ABSTRACT

Soil-test phosphorus (STP) and potassium (STK) concentrations are commonly used to guide fertilizer recommendations; however, soil sampling timing and position, rotational crops, and tillage practices may influence measured nutrient concentrations and resulting fertilizer decisions. Field experiments were conducted in Louisiana (2022-2025), Arkansas (2024-2025), and Missouri (2025) to characterize spatial and temporal variation in STP and STK under corn (*Zea mays* L.)-soybean (*Glycine max* L. Merr.), rice (*Oryza sativa* L.)-soybean, and cotton (*Gossypium hirsutum* L.)-soybean rotations. Treatments included no-tillage and conventional tillage, with soil samples collected in fall and spring from the top-of-the-bed and the middle-of-the-furrow at a 0-6-inch depth and analyzed for Mehlich-3-extractable nutrients. Soil-K was more sensitive than P to sampling time, sampling position, rotational crop, and tillage. Across Louisiana and Arkansas sites, STK increased from fall to spring by an average of 31.2 ppm following corn and 30.6 ppm following rice, compared with 16.6 ppm following cotton and 8.5 ppm following soybean. Corresponding changes in STP were smaller and less consistent, averaging 7.1, 7.4, 10.6, and 5.4 ppm, respectively. These results demonstrate that soil sampling protocols can materially affect STK interpretation and subsequent fertilizer recommendations, particularly following high-residue crops. The larger K increases following corn and rice likely reflect the rapid release of soluble K^+ from their greater quantities of vegetative residue during rainfall and weathering. For consistent nutrient management, fall sampling under suitable soil moisture and temperature conditions is recommended, with sampling after soybean providing the most suitable opportunity for assessing soil fertility within soybean-based rotations.

Keywords: Soil-test phosphorus; soil-test potassium; spatial and temporal sampling variability; residue nutrient cycling; fertilizer recommendations; tillage; variable-rate fertilization.