

Evaluation of Soil Test Methods to Assess Potassium Response in Soybean



Diego Charbonnier and Dorivar Ruiz Diaz, Kansas State University

Introduction

Soil testing is one of the best tools to identify responsive soils to K fertilizer. However, traditional methods have shown poor correlation for certain soils, and more research is needed to determine the most appropriate method for Kansas soils.

Objective:

Compare different soil test K (STK) methods and evaluate the correlation to soybean yield and K uptake response in low K testing soils.

Materials and Methods

- Field research was conducted at five locations during 2019 and 2020 in Kansas.
- The experiments were a RCB design with 4 replications.
- Treatments included a control (no K) and a maximum rate of 168 kg K₂O ha⁻¹.
- Composite soil samples were collected at pre-plant before fertilization. Fertilizer was broadcast applied using KCl.
- Measurements collected:
 - Plant biomass and tissue K concentration at R6 growth stage.
 - Grain yield

Table 1. Potassium soil test results for the 0-15 cm sampling depth.

Location	NH ₄ OAc dry	NH ₄ OAc moist	Mehlich-3 dry	Mehlich-3 moist	CaCl ₂ dry	CaCl ₂ moist	Resin K	NaBPh ₄
----- mg kg ⁻¹ -----								
1	94	57	102	39	40	16	62	157
2	120	50	134	49	34	7	49	146
3	60	46	89	33	34	17	51	93
4	34	16	46	24	12	3	23	59
5	66	25	66	23	22	3	40	47

Results

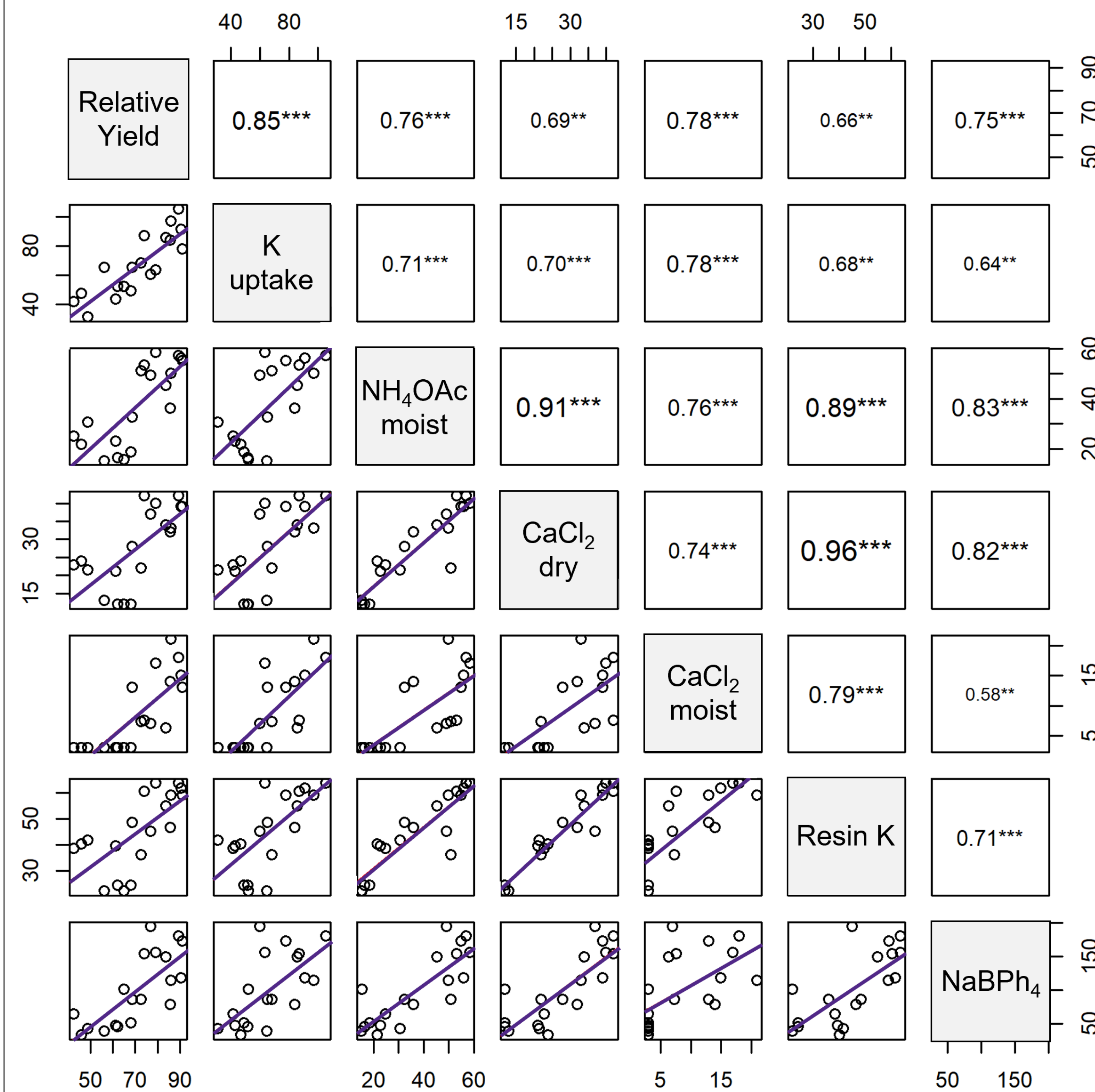


Figure 1. Correlation between relative yield, K uptake at R6, and selected (best correlated) soil test methods for potassium.

Summary

- Among all evaluated methods, the CaCl₂ dry and moist, NH₄OAc moist, Resin K, and NaBPh₄ tests showed the best correlation to relative yield and K uptake.
- CaCl₂ dry is one of the less time-consuming and low-cost tests, also having a consistent correlation coefficient (around 0.70 for both variables).
- CaCl₂ dry might be an alternative to the NH₄OAc moist test because of the high correlation (r=0.91).
- Overall, the NH₄OAc moist test was one of the best methods to estimate K availability in low testing soils.
- Other non-conventional tests like CaCl₂ dry might perform similarly to NH₄OAc moist but without the common disadvantages associated with field moist tests.