

Validation of a modified Egner–Riehm–Domingo (AL) method for determination of plant-available phosphorus in soil

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0.2

LOD

mg/100 g P₂O₅

1.0

LOQ

mg/100 g P₂O₅

1–100

Working range

mg/100 g P₂O₅ (400 with 10× dilution)

0.26 %

Repeatability RSD

n = 10, BIPEA 9/24

±2.74 %

Measurement uncertainty

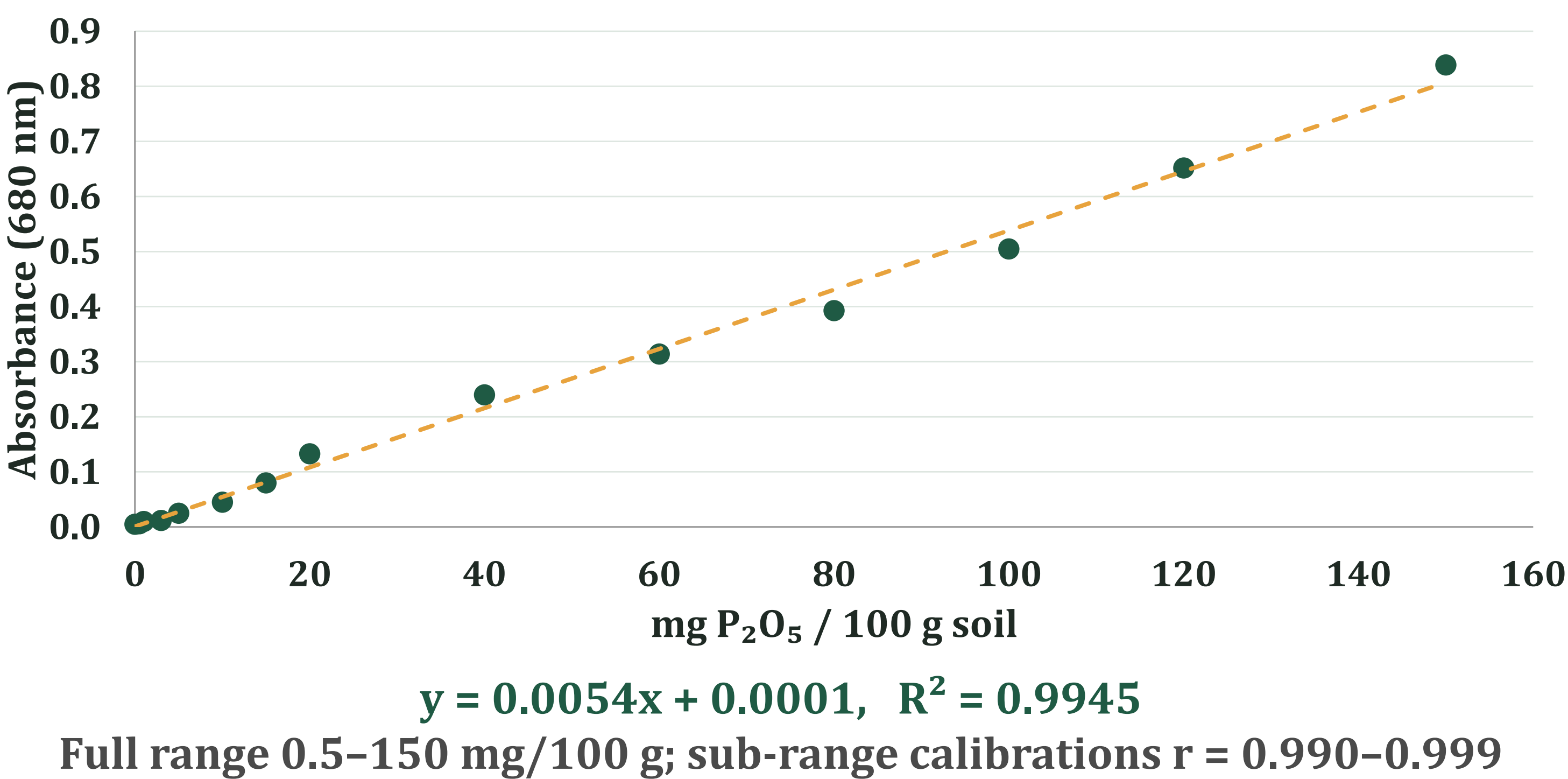
95 % confidence level

Background and objective

Plant-available phosphorus is fundamental to agrochemical soil testing, fertilization planning and high yields in all crops. The Egner–Riehm–Domingo (AL) method extracts soil with ammonium lactate–acetic acid solution. A modified AL procedure was adopted for routine use instead of the original standardized method, so its performance required formal validation.

Objective: to validate the modified AL method for plant-available P (UV-Vis spectrophotometry, 680 nm) and confirm its suitability for routine laboratory use.

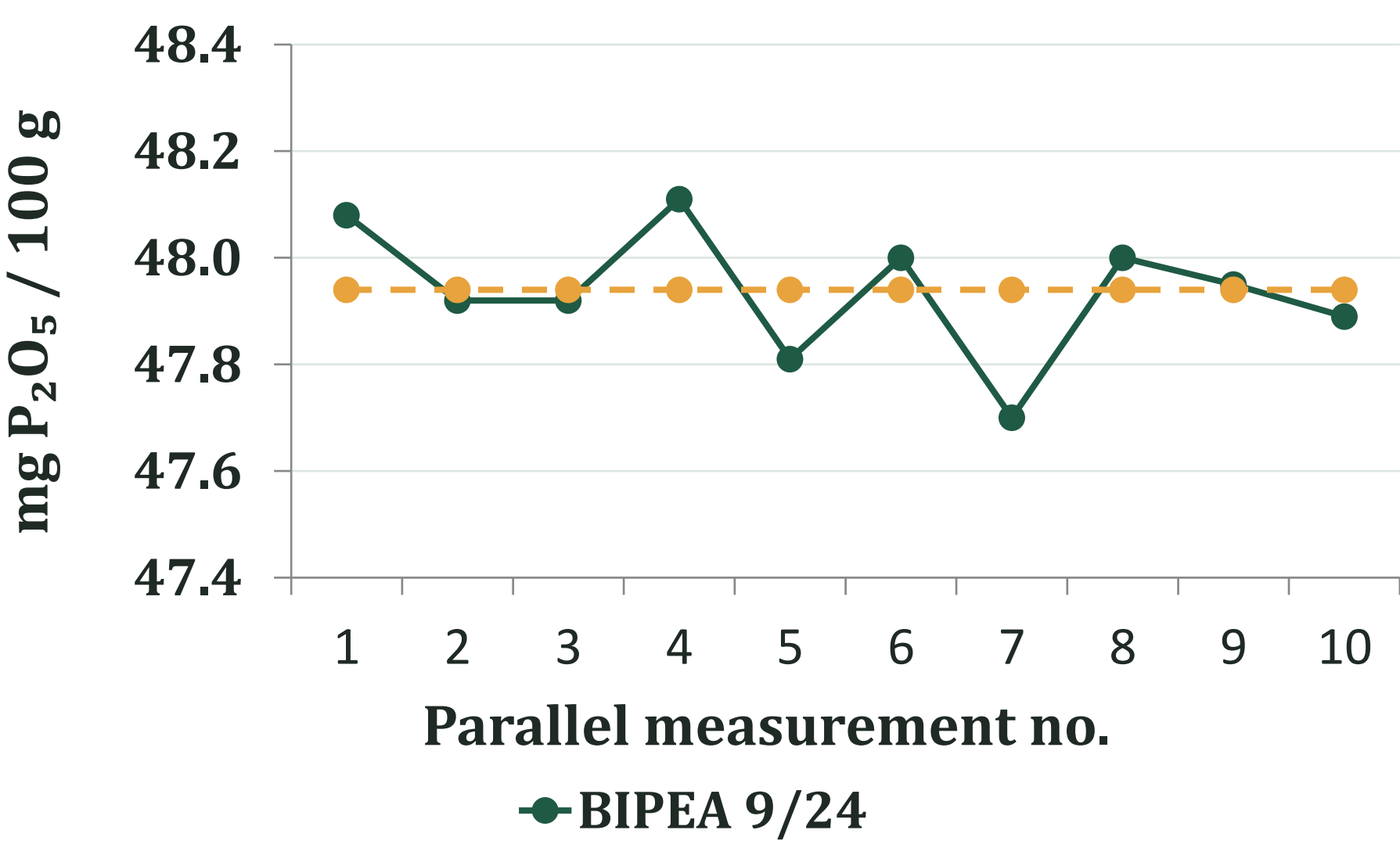
Calibration curve



Materials and methods

- Calibration**
≥ 5 KH₂PO₄ standards, ≥ 3 replicates, 680 nm (Jenway 6715).
- LOD and LOQ**
10 blank readings: LOD = mean + 6·SD; LOQ = mean + 9·SD.
- Linear and working range**
From LOQ to the top linear standard; richer samples diluted up to 10×.
- Precision**
Repeatability: 10 parallel measurements of BIPEA 9/24. **Reproducibility:** periodic re-preparations.
- Recovery**
Sigma-Aldrich certified P standards and AL-extracted control soil.
- Accuracy**
Proficiency test (z-score), interlaboratory and instrument comparison (UV-Vis vs ICPE 8200).
- Measurement uncertainty**
MU = 2 × total error (95 %), incl. precision, bias, reagent purity, balance and glassware uncertainty.

Repeatability



Conclusions

- The modified AL method for plant-available phosphorus in soil was successfully validated against internal laboratory quality criteria.
- Accuracy, precision, working range and measurement uncertainty all meet the pre-defined acceptance criteria.
- The 10× dilution step extends applicability to higher-content soils (up to 400 mg/100 g) without losing linearity.



Validation results

Parameter	Result	Criterion	Met
Linearity	r = 0.997	r > 0.995	Pass
Working range	1.0–100 mg/100 g (400 with dilution)	1.0–100 mg/100 g	Pass
Repeatability	RSDr = 0.26 %	RSDr < 10 %	Pass
Reproducibility	RSDR < 10 %	RSDR < 10 %	Pass
Recovery	97.4–104.6 %	90–110 %	Pass
Accuracy (PT)	z = 0.56	z-score ≤ 2.0	Pass
Uncertainty	±2.74 %	95 % confidence	Pass

Recovery: certified P standards (1 mg/l) 97.4–101.4 %;
AL-extracted control soil 98.0–104.6 %.