Comparisons of Bray P1 and Mehlich 1 for Soil P and Ammonium Acetate and Mehlich 1 for Soil K, Ca, and Mg Determinations

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Introduction

Soil tests provide tremendous assistance to reduce guesswork in fertilizer application. However, to have dependable information regarding a fertilizer program, soil test results have to be calibrated, standardized, and well-understood.

Objective

Compare two different methods of testing soils for P and two methods of soil testing for K, Ca, and Mg.

Materials & Methods

Soil samples were collected at 15-cm increments to a depth of 165 cm from 32 sites in citrus groves located in Lake and Orange counties of Florida. Two extraction procedures were used for P: (1) Mehlich 1 and (2) Bray P1. Two extraction procedures were used for K, Ca, and Mg: (1) Mehlich 1 and (2) Neutral, one-normal ammonium acetate.

Conclusions

The Bray P1 method was less effective than Mehlich 1 for the extraction of P from soil samples relatively high in organic matter. Mehlich 1 generally extracted more K, Ca, and Mg than ammonium acetate. Because of the relatively high organic matter content in the top soil, the top 15 cm of soil should be considered separately from the subsoil when soil test values are converted from one analytical procedure to another.

Depth (cm)	Equation	R^2
1 (0-15)	y = 70.44 + 0.25 x	0.71**
2 (15-30)	y = 19.35 + 1.50 x	0.77**
3 (30-45)	y = 13.48 + 2.00 x	0.82**
4 (45-60)	y = 18.81 + 1.89 x	0.71**
5 (60-75)	y = 15.66 + 1.97 x	0.71**
6 (75-90)	y = 15.28 + 1.79 x	0.87**
7 (90-105)	y = 15.35 + 1.86 x	0.88**
8 (105-120)	y = 20.72 + 1.52 x	0.71**
9 (120-135)	y = 21.17 + 1.48 x	0.84**
10 (135-150)	y = 25.19 + 1.32 x	0.59**
11 (150-165)	y = 23.83 + 1.58 x	0.74**
All depths	y = 49.17 + 0.43 x	0.45**

Table 1: Correlation equations between Mehlich 1 (x) and Bray P1 (y) for P

For 27 of the 32 sites, the Bray P1 procedure extracted less P than Mehlich 1 from the top 6 inches of soil (depth 1). For the remaining depths, more P was extracted by Bray P1 than by Mehlich 1. Equations describing the correlation between Mehlich 1 and Bray P1 with the coefficient of determination (R2) for each soil depth are presented in Table 1. Bray P1 was less effective than Mehlich 1 for the extraction of P from soil samples relatively high in organic matter. This result reduced the R2 value when the data for all depths were combined.

Depth (cm)	Equation	R^2
1 (0-15)	y = -1.36 + 0.79 x	0.79**
2 (15-30)	y = -5.17 + 1.09 x	0.93**
3 (30-45)	y = -3.49 + 1.79 x	0.80**
4 (45-60)	y = -5.68 + 1.15 x	0.77**
5 (60-75)	y = -5.17 + 1.06 x	0.82**
6 (75-90)	y = 2.89 + 1.08 x	0.93**
7 (90-105)	y = -5.08 + 1.00 x	0.77**
8 (105-120)	y = -4.14 + 0.94 x	0.77**
9 (120-135)	y = -5.17 + 1.03 x	0.76**
10 (135-150)	y = -7.02 + 1.19 x	0.87**
11 (150-165)	y = -5.57 + 1.09 x	0.85**
All depths	y = -4.11 + 0.98 x	0.83**

Table 2: Correlation equations between Mehlich 1 (x) and ammonium acetate (y) for K

Depending on the site and soil depth, Mehlich 1 generally extracted more K than ammonium acetate, with the exception of few cases where the two procedures extracted similar amounts of K. Mehlich 1 is therefore more aggressive than ammonium acetate in extracting soil K. Correlation equations between Mehlich 1 and ammonium acetate with the R2 for each soil depth are listed.

Depth (cm)	Equation	R^2
1 (0-15)	y = 625.91 + 0.17 x	0.47**
2 (15-30)	y = 147.34 + 0.46 x	0.61**
3 (30-45)	y = 58.82 + 0.55 x	0.65**
4 (45-60)	y = 6.23 + 0.82 x	0.81**
5 (60-75)	y = 35.77 + 0.43 x	0.73**
6 (75-90)	y = 18.66 + 0.64 x	0.78**
7 (90-105)	y = 46.50 + 0.42 x	0.50**
8 (105-120)	y = 48.85 + 0.34 x	0.46**
9 (120-135)	y = -7.76 + 0.96 x	0.91**
10 (135-150)	y = 6.67 + 0.88 x	0.88**
11 (150-165)	y = -2.72 + 1.00 x	0.95**
All depths	y = 88.46 + 0.36 x	0.79**

Table 3: Correlation equations between Mehlich 1 (x) and ammonium acetate (y) for Ca

From the 15 cm of soil (depth 1), Mehlich 1 extracted two to three times more Ca than ammonium acetate. For the remaining depths, Mehlich 1 extracted 10 to 60% more Ca than ammonium acetate with very few exceptions where Mehlich 1 extracted slightly less than the ammonium acetate. Correlation equations between Mehlich 1 and ammonium acetate with R2 for each soil depth are presented.

Depth (cm)	Equation	R^2
1 (0-15)	y = 79.48 + 0.07 x	0.23*
2 (15-30)	y = 23.09 + 0.32 x	0.42**
3 (30-45)	y = 9.74 + 0.45 x	0.64**
4 (45-60)	y = 3.58 + 0.63 x	0.65**
5 (60-75)	y = 0.88 + 0.70 x	0.84**
6 (75-90)	y = 5.74 + 0.49 x	0.45**
7 (90-105)	y = 1.64 + 0.82 x	0.82**
8 (105-120)	y = 4.84 + 0.44 x	0.61**
9 (120-135)	y = -0.10 + 0.78 x	0.75**
10 (135-150)	y = -2.60 + 0.95 x	0.92**
11 (150-165)	y = -2.21 + 0.89 x	0.92**
All depths	y = 18.58 + 0.15 x	0.54**

Table 4: Correlation equations between Mehlich 1 (x) and ammonium acetate (y) for Mg

From the first soil depth (0 to 15 cm), Mehlich 1 extracted four to 10 times more Mg than ammonium acetate. The R2 for this depth was significant only at the 5% level. For the other depths, Mehlich 1 extracted 5 to 100% more Mg than ammonium acetate. Correlation equations between Mehlich 1 and ammonium acetate with the R2 for each soil depth are listed.