

MID-ATLANTIC SOIL AND PLANT ANALYSIS WORKSHOP

MINUTES OF 1983 MEETING

Richmond, Va. Feb. 23 - 24, 1983

Attendance:

Charles Robinson	Agrico	Paul Chu	A @ L
Joseph B Will	Southern States	Alan H. Hatfield	NCDA
James R. Woodruff	Clemson, S.C.	James Friederichs	VPI
Donald Stover	Agrico	Steven J. Donohue	VPI
David R. Parker	U of D	Joseph Buel	U of Md.
Charles Mitchell	Clemson, S. C.	Darryl DeBolt	Agrico
Roy L. Flannery	Rutgers, N. J.	Adolph H. Mehlich	NCDA
Frederick Cox	NCSU	John Axley	U of Md
Tom Sims	U of D	Norman Jones	A @ L
Maywood Synder	A @ L	Leo J. Cotnoir	U of D

Chairman Steve Donohue called meeting to order at 8:30 A.M. Joe Will extended welcome to the group on behalf of Southern States. Steve asked that form he had sent out asking for information on sulfur and micronutrients for corn, soybeans and wheat be filled out and returned soon. Steve will compile and circulate the results of the questionnaire. Steve asked that anyone with soil testing or plant analysis materials such as copies of report forms, compilations of recommendations, etc. please place them in designated area so that those interested could take copies. Steve circulated an addendum of topics for discussion based on survey of the group at last years meeting and assigned discussion leaders for the various items to be cover.

Note: I have tried in the following notes to quote some of the statements and remarks made during the various discussions in order to convey some of the flavor and tone of the discussions. I hope I have accurately reflected the various comments made. Obviously, some misinterpretations or misquotations are possible. I hope the errors are minimal.

SAMPLE EXCHANGE Dave Parker

Dave circulated the results of the 1983 sample exchange and lead a discussion of the results.

Steve Donohue and Al Hatfield pointed out that shaking rate should be over 180 strokes per minute.

All but S. C. use soil volume as basis for pH and lime calculation. S. C. uses 16.5 ccm of soil and assumes a weight of 20 grams.

pH and Lime: pH values agree well. John Axley pointed out importance of proper electrode calibration. There was some discussion of optimal pH used to calculate lime requirement and of lime for 0 to 2" or 0 to 3" surface samples in no-till systems for proper herbicide activity.

Phosphorus: Generally good concurrence between laboratories on analytical results

- N. C. Mehlich III generally 2.5 x to 3.0 x higher than Mehlich I and also slightly higher than Bray I
- VPI Sample A: P_2O_5 recommendation should be 10 lbs. rather than 60 lbs. Banding is assumed.
- Dela. Rates given in table are for broadcast applications. Recommendations are currently made on the basis of banded applications and a value of about $\frac{1}{2}$ of the broadcast rate is used (corn)
- Md. Recommendations given incirculated results are for 125 bu. corn. Reduce given values by 50 lbs. for 100 bu.
- Agrico Find that Mehlich III and Bray I agree about 70% of the time. Believe that differences that occur are due to P determination of the extract rather than extraction differences.
- Agrico Va. Appears to be some reduction in P levels in 1981 compared to earlier years.
- S. C. Some trend for decreased P in 1981-1982 (62% VH down to 55% VH)
- N. C. About 1% per year decrease in number of VH P samples in last 10 years.

Potassium: Analytical values are in good agreement.

Mehlich III values (0.25 N NH_4 , pH 2.5) are slightly higher than Mehlich I, while NH_4AcO values (1 N NH_4 , pH 7.0) are slightly lower.

John Axley: Questions fixation effects using NH_4 . Does not believe NH_4 is good extractant for K

A. Mehlich: Extracted soils incubated with added K. For most soils, NH_4 (Mehlich III) fully recovered added K.

Dela. Lower K rates recommended than other states. Reflects inability to get K responses on Delaware soils even at relatively low K test levels.

Mehlich III removes about 1.25x more K than Mehlich I

Samples E and F: 50 lbs. K recommended by Md., N. J. and Va. are for maintenance. No response expected.

Calcium and Magnesium: Good analytical agreement. Variations occur mostly at VL and VH levels.

J. Axley: Do Calcium and Magnesium determinations mean anything in terms of availability in a strong acid extractant?

Dela. May pick up some residual limestone. High Calcium values are used to correct lime recommendation as determined by pH alone, i.e., lime recommended at a given pH would be reduced for a sample with a H or VH Calcium compared to that at same pH with L to M Calcium.

A. Mehlich: In answer to question, indicated that CEC based on sum of cations is used in calculating lime requirement, hence, highly influenced by extracted Calcium.

Mehlich III approximately 1.3 X higher than Mehlich I in results reported for exchange samples. N. J. reports 5 to 10% higher values for Mehlich III compared to Mehlich I

Sulfur: All S determinations reported were turbidometric

Agrico: Compared furnace and turbidometric methods in plant analysis. Results very good.

A @ L No problems in plant materials. Color in soil extracts causes some problems.

Agrico: Run S on all plant samples. Find very few low values.

S. C.: Make blanket recommendation of 10 lbs. S. See deficiencies on corn and wheat. 50% of samples on seedling plants are under the 0.2% S level considered critical.

Agrico: Have used prilled sulfur. Find intact sulfur prills following year. One company (Woolk Chem. ??) has product which slakes rapidly. Chemical Enterprises also has good product.

Allied Chemical hopes to market $(\text{NH}_4)_2\text{SO}_4$ in mid-Atlantic region at competitive price.

10:00 Break and Photo

Boron

S. Donohue: Tennessee made blanket B recommendation but no longer recommends Boron.

J. Woodruff: Some responses under irrigation at 200 bu. yields.

C. Robinson: What are Boron soil test criteria?

S. C. : 0.1 ppm cut-off

N. J. : 0.35 ppm cut-off

VPI: Dave Martens has student working on B methodology. Recommend some B on irrigated corn.

- Dela.: response when not irrigated, dry conditions (35-40 bu.)
not very exciting.
- N. J. Over past 10 years, B response of 15 to 20 bushels at 125 - 150
bu. level. Hot water B values were 0.15 to 0.30.
- A @ L : Cut-off point depends on yield goal. 100 bu., no boron,
125 bu. start recommending B, increase with increasing yield goal.
- Md. : Recommend 1 lb. banded
- N. J. : Don't like to band more than $\frac{1}{4}$ lb.

Manganese: Analyses variable, but fairly comparable ratings.

- N. J.: Higher Mn values reported because of 50 min. shaking time.
- Agrico: No response up to 200 lbs.. In 1983, try 18-20 mesh granules thru
pesticide box. Banded, recommend 5 to 15 lbs., foliar, $\frac{1}{2}$ to
2 lbs.
- Va.: Recommend 40 lb. broadcast, 8 lb. banded. Cox, NCSU, recommends
only $\frac{1}{2}$ that amount.
Use soil test to flag possible deficiencies, recommend waiting
for symptoms to appear, than use foliar spray.
- Cox: Agrees that you get good results if you wait for symptoms to appear
and use spray. Can go as low as 0.1 lbs./acre.
Net residual effect detected, can be assayed and measured.
- Va.: No response on corn on soils very deficient for soybeans.
- Cox: In a long - term rotation, symptoms appeared on corn on plots
that gave good response on soybeans, but obtained no response
on corn.

Hatfield: Variability in product: all products labeled Manganese sulfate
may not be.

Zinc: Fairly good analytical agreement

Agrico: Zn recommendation based on under 20 ppm in plant rather than
on soil test.

Copper: Mehlich III uses EDTA for copper extraction. Find it as good as DPTA
Find that plastic ware absorbs Copper. Mehlich III removes more
copper than Mehlich I. Shaking time is critical.

N. J. : Copper recommended on muck soils for onions, other vegetables.

Nitrate: J. Axley suggests we may be using NO_3 test more widely in futur.
Problems with subsoil samples. Pa. uses N level of 8 - 12"
plant as criteria for further N applications.

Organic Matter: Good agreement between labs using Wakely-Black and titration,

How does N.C. organic matter determination compare with Wakely-Black?
Appears to agree fairly well if Fe, Al or Mn are not high.
How is N.C. organic matter interpreted for herbicide rates.
Seems to be as well related as Wakely-Black according to Weber (NCSU)
More work is in progress.

Plant Analysis: Generally good agreement between laboratories that ran the one plant sample circulated.

Futur Exchange: Agrico tentatively agreed to lead next years exchange.

SUBSOIL CONTRIBUTION TO SOIL TEST RECOMMENDATIONS. Charles Mitchell

Charles Mitchell and Jame Woodruff presented the following summary of work in South Carolina.

- I. S. C. soils groups based on depth to argillic (B) horizon
 - Group 1. sandy soils, greater than 40" to B horizon (examples: Grossarenic, Paleudults, Entisols)
 - Group 2. Coarse loamy soils, 20 to 40" to B horizon (example: Arenic paleudults)
 - Group 3. Fine loamy soils, less than 20" to B horizon. (examples: Typic paleudults)
 - Group 4: Clayey soils, clay on the surface. example: most Piedmont soils)
 - Group 5: Subsoil samples, top 3 to 6" of argillic horizon, preferably taken with a Group 3 plow layer sample.
- II. Subsurface horizons contribute to S nutrition of sorghum plants in a greenhouse study when grown in simulated profiles of an Orangeburg fine sandy loam and a Norfolk fine sandy loam (Ultisols) but not in simulated Lakeland sand (Entisol) or Myokka fine sand (Spodosol). Extractable sulfate-S in the argillic horizon of the two ultisols seemed to suggest adequate subsoil S, above 15 ppm. This supports the currently used break point of 20 ppm extractable sulfate-S from subsoils associated with group 3 soils in the South Carolina soil testing program.
- III. However, recommending subsoil sampling for S, K or any other nutrient is complicated by:
 1. Variable depth to argillic horizon within a given area
 2. Difficulty in taking subsoil samples
 3. Problem of getting a true subsoil sample from growers. (Only 25% of the subsoil samples from S. C. growers were really samples from the true argillic horizon.)
- IV. A survey of soil nutrient levels for corn and soybeans in five physio-graphic regions in S. C. indicated:

1. Large accumulation of K and S occurred only in samples from the Middle Coastal Plain
2. Subsoil Mn levels were lower in the Coastal Plain subsoil than in the Piedmont subsoils
3. Coastal Plain subsoils tend to be more acidic than Piedmont subsoils. This may contribute to Mn availability on these soils. (Especially soybeans, since they seem to draw nutrients from subsoil horizons more than corn)

Adjourn for lunch

Some discussion of the influence of variety and plant population on micronutrient uptake followed.

What states are looking at subsoil fertility, especially K

Va.: Some indication that subsoil K should be considered.

N. C. No plans to use subsoil samples because of difficulty of getting good samples. NCSU is looking at the problem.

S.C. See page 25, Circ. 476. Mg, K and S are reduced when the subsoil is high in these nutrients. Use subsoil samples only for S

Md. No subsoil work

Agrico: 8 or 10 of their representatives will take subsoil samples. Subsoil values show up in plant analysis

A @ L Plow sole samples only. Not convinced we know what the subsoil contribution is in the early growth stage (first 45 days).

Va. Report by Jim Friedericks on study of plowsole applications of lime for alfalfa. Alfalfa yields and rooting depths increased with plowsole lime applications. After ten years, pH increased in the plowsole layer and Al decreased.

Dela: Evidence of considerable subsoil K. Would like to take subsoil K in consideration in recommendations but reluctant because of sampling problem.

N.J. Subsoil samples are used for special trouble shooting problems.

Md. J. Axley: $(\text{NH}_4)_2\text{SO}_4$ applied to surface acidified subsoil. Problems in getting root growth in the subsoil of Coastal Plain soils. Obtained responses in green house when crops were grown on treated subsoils. Field plots in which subsoil was treated gave increases in soybeans. Are well limed subsoils of value?

Dela.: Parker and Sparks are looking at subsoil K

CALIBRATION OF MEHLICH III EXTRACTANT WITH YIELD AND NUTRIENT UPTAKE BY
CORN AND SOYBEANS Roy Flannery

N.J. Correlated Mehlich I and III. r^2 values between 0.92 and 0.98, all except Mn. good correlation between Mehlich I and III for Mn but correlation between Mehlich III and DPTA only 0.60

Agrico: good correlation between Mehlich III and NH_4AcO and Bray I .
Adjust Cu and Mn values for pH, OM and Plant Cu and Mn

Va. Determined correlation between Bray I, Olsen, Mehlich I and Mehlich III on plots to which P applications of 0, 96, 192 and 288 lbs. were made. This was newly cleared land on Coastal plains at two sites both with Kempsville soils. Correlations between Bray, Mehlich I and Olsen were good (over 0.90), not as good with Mehlich III (0.80-0.90)

N.C. Zinc critical level of 1 mg/dm^3 with Mehlich III established on four fields. Soil tests in range of 0.4 to 0.8 mg./dm^3 gave yield increases of 6 to 15 bushels with Zn.

N.C. F. Cox reported on experiment on new land P additions. Mehlich I x 2 = Mehlich III. Mehlich I and III both gave good results with copper. Reported work correlating Mehlich I + pH and Mehlich III + pH to Manganese responses. Mehlich III was a little better than Mehlich I

N. C. A. Mehlich proposes model for corn yields and critical NPK levels.

A @ L Mehlich III correlated well with NH_4AcO for Ca, Mg and K and with Bray I for P but correlations with micronutrients were variable.

Agrico Using Mehlich III for 8 elements

Summary: Flannery feels we need more data before a final decision is made to change to Mehlich III. Available data should be compiled and more data obtained this year and see if we can arrive at a decision to make a change next year.

SHOULD YIELD LEVELS BE CONSIDERED IN CALIBRATION OF SOIL AND PLANT ANALYSIS DATA
John Axley

Soil Test:

N.C. Hatfield: doubts that increased nutrients as yields increase are needed if fertility is good.

NCSU: Cox: does not see great need to increase nutrient rates at increased yields

S.C. Mitchell: Management, subsoil fertility, water are probably more critical factors

S.C. Woodruff: Some data which he believes suggests higher Boron rates at higher yields (200 bu. corn)

N.C. Mehlich: Critical values presented apply only to Mehlich III

Agrico: Robinson questions yield potential concept

A @ L: Jones: Must look at history on a given field. Management is an important factor. Need to look at plant tissue values thru the whole season

Thursday, Feb. 24

Chairman Donohue expressed thanks to Joe Will and Southern States on behalf of the group for use of the Southern States facilities for the meeting and for the hospitality hour sponsored by Southern States on the evening of Feb. 23.

The previous day's discussion of yield goals and soil test calibration was continued.

SS Joe Will: Yield goals and their relation to management is a problem

VPI: Varieties must be considered

Dela. Cotnoir: Calibration of the soil test should be the same regardless of the yield goal, but recommendation will vary considerably due to yield goal.

N. J. Mixed feelings. May need revisions at high yield levels

Agrico: More long term test plots needed.

ELECTION OF CHAIRMAN FOR 1984

A nominating committee chaired by J. Woodruff proposed that the chairman to be elected serve a two year term. Unanimously approved.

The nominating committee proposed Charles Mitchell (Clemson, S.C.) and Charles Robinson (Agrico) as the new chairman.

Charles Mitchell was elected to serve as chairman for the 1984 and 1985 meetings.

The group thanked Steve Donohue for the excellent work he did as chairman of the first 10 meetings of the Mid-Atlantic soil and plant analysis workgroup.

NITROGEN CREDITS FOR COVER CROPS AND LEGUMES Paul Chu

Chu: Pa. credit for 125 bu. corn: Alfalfa, 60#/A, Clover, 40#/A. Fox at Pa claims residual N effect of alfalfa and clover lasts 2 to 3 years. A @ L adjusts alfalfa credit around 50 to 60 lbs. downward depending on the fertility level. If fertility level is low, alfalfa is likely poor and N residual also low.

VPI: Soybeans, 20 lb., peanuts, 30 lb., alfalfa, 80 lb., Red clover hay, 60 lb., grass clover, at least 25% clover, 30 lb., native clover pasture, at least 25% clover, 30 lb.
Above nitrogen allowances are adjust for yield of the previous crop: high yield: 100%, ave. yield, 75%, low yield, 50%.
Winter annuals: 80 lbs./A, 40 to 50 lbs. if planted late.

NC: Soil test note gives legume N allowances

SC: Appears that the further south you go, the less response you get from residual N

Md.: Alfalfa, 50 lbs. for 75% stand, 80 lbs. for good stand
Ladino clover, 60 lbs., Vetch, 60 lbs. Crimson clover, 50 lbs.
Trefoil, 40 lbs. Grass-Clover, 40 lbs.

Agrico: Cover crop confounds what you are trying to do with N

Joe Will: Timely topic. Especially with set aside land, what cover crops should be recommended?

Dela: Vetch and Austrian winter peas, 50 to 100 lbs. based on amount of growth at knock-down. Alfalfa, 50 to 75 lbs., clovers, 50 to 0 lbs.

N.J. :Alfalfa, Vetch, 50 to 100 lbs. depending on growth in spring. Plots show 100 to 150 lbs. if growth is very good, but use maximum 100 lb. allowance. 15 lb. allowance for soybean stubble.

NEW ITEMS OF INTEREST

NC, Hatfield: Contamination problems: used $AlCl_3$ (2 g./l) to remove Zn and Cu from plastic. Keep away from soft polyethylene. Clear PVC bottles work well. Most of the contamination came from tap water. Critical level for Cu reduced from 1.0 to 0.5 mg./dm³ after contamination was eliminated. Use good grade acid washed paper. Others contribute Cu

J. Fredericks: Roger's custom service in Wisconsin folds any brand of paper.

A. Mehlich: Recommends medium porosity paper, i.e., Whatman #1. P may be refixed if filtration is too slow.

A. Hatfield: substitute linear polyethylene funnels and tubing for Tygon if Cu and Zn are run.

F. Cox: Kamprath has been measuring residual effect of P and K. Measured rate of P and K decrease for 7 years on three soils: rates are very slow.

F. Cox: Mn response curve developed on three sites
15 lbs. actual Mn broadcast needed for response, 20 to 25 lbs. on severely deficient sites.
Sources: $MnSO_4$ and $MnOSO_4$ equally good. No response from MnO
 $MnOSO_4$ is MnO treated with H_2SO_4 and appears to be a variable product.
Mn banded at 2 sites, 5lb./A² needed. Appears to be about 1 to 3 ratio between broadcast and banded.
 NH_4 in band with N increases uptake
Foliar applications at two sites, 0.1 lb. applied when symptoms appeared. In another experiment, 0.1 lb. was as good as 1.1 and 2.2 pounds. One spray of 0.1 lb. gave good response, a second spray of 0.1 pounds gave a further, but smaller increase, but a third spray gave no further increase. When the deficiency symptoms were severe, a second application was needed whether 0.1 or 1.0 pounds were used in the first spray. The evidence appears to be that there is no yield reduction if a spray application is made immediately after the first symptoms appear. 10% losses appear to occur for every 2 week period after symptoms appear. The sulfate, nitrate and chloride of Mn, DPTA-Mn, Lignosulfate-Mn, EDTA-Mn were equally good at 0.1 lbs. Mn.
At 10 lb. and 40 lb. applications, per year, Mn soil test went up in proportion to amount Mn added.

- J. Woodruff: Not concerned with micronutrients in Piedmont
- A. Mehlich: Would like for the workgroup to circulate soils on which yield data is available
- C. Robinson: Has a computer program for lime for use on small hand computer.
- J. Fredericks: Showed slides of automated pH device. About 2 to 3 times faster than conventional method, about 800 samples in 3 to 4 hours.
- P. Chu: Replaceable ceramic plug electrode from Corning works very well
- D. Parker: Brought attention to revised recommendations and reporting procedures at Dela.
- D. DeBolt: Constant checks are essential
- C. Mitchell: 1960 - 1980, 14 to 15% samples with pH over 6.5. This increased to 24-25% in 1980-1981. Appears to be by farms. Why?
- J. Axley: Urea losses reduced by mixing with $\text{Ca}(\text{NO}_3)_2$. A 1:1 mixture of urea and KCl reduced N losses from 45% to 4%. A 1:0.6 ratio also gave good protection. In the field, urea gave a yield of 122 bu. corn. The same amount of urea mixed with KCl gave 140 bu.
- N. Jones: Firm in Texas produces KCl coated urea.

END OF FORMAL PROGRAM

Charles Mitchell assumed chairmanship. Dates for 1984 meeting were set for
February 22 (Wednesday) and February 23 (Thursday) 1984
Meeting will be at same location (Southern States Building)