Minutes of 1984
Mid-Atlantic Soil Test Work Group
February 22-23, 1984
Southern States Building
Richmond, VA

Wednesday, February 22

8:30 AM - INTRODUCTIONS

The meeting was opened by Chairman Charles Mitchell. Joe Will announced arrangements for break, group photo, social hour, and dinner at the Chesapeake House.

The group agreed to draft a letter of sympathy to Dr. Adolph Mehlich's family and express our appreciation in memory of his many contributions to soil testing in our region.

9:00 AM - SOIL SAMPLE EXCHANGE (Don Storer, Agrico)

pH - Water pH - good agreement; lime recommendations varied; SMP buffer not suitable for low C.E.C. coastal plain soils; target pH still varies from lab to lab although most use 6.5

N recommendation - N rates for corn fairly uniform assuming same yield goal. Bandel suggested group study N recommendations for 1985. Are we too high? Is 120 lb/A sufficient for dryland corn? Delaware concerned about ground water contamination. Suggested N rates:

1.3 lb N/bu with 30 lb/A residual
1.3-1.4 lb N/bu with yields above 150 lb/A
1.0 lb N/bu up to 100 bu/A
1.5 lb N/bu greater than 150 bu/A

Storer suggested that next year's exchange concentrate on a specific topic or area of concern such as N rates.

Phosphorus - Storer noted that plasma sometimes results in 2X as much P as the molybdenum blue colorimetric procedure. This seems to be more of a problem with mid-western soils - possibly due to organic P. Hawkins noted considerable variation in P on sample F. With 156 soils, a correlation coefficient of 0.91 was found between Bray P1 and Mehlich III for P. Cotnoir: 30 lb/A DAP as a starter gave yield increase 30% of time. DE, NY, and PA use starter all time for corn. Lochman: 100 lb/A MAP as starter gave 15 bu/A increase on 200 bu check plot.

Potassium - Exchange indicated fairly good agreement on soil test K. Cotnoir and Parker: produced 185 bu/A corn with no K and no appreciable change in soil test K. Flannery: removed stover and lost 50% of soil K and 50% of yield on corn and sorghum after 10 years. Bandel: produced 140-150 bu/A/yr corn with 80 lb/A K_2O;

after 10-11 years, the soil test K was constant. Mitchell: S. C. plant analysis indicates 40% of corn samples up to 12" had K concentration greater than 4.00%; 80% of corn ear leaf samples had K conc. greater than 2.25%; 30% of soybean leaf samples had K conc. greater than 2.50%; and 30% of peach leaf samples had K conc. above 3.00%. At the same time, 74% of the soil samples from the Ap horizon indicate a need for additional K.

10:10 AM - BREAK

The discussion of the soil sample exchange was interrupted by a break. Southern States arranged to have a group photo made. Discussion continued after the break.

Calcium and Magnesium - Little discussion of Ca and Mg results. Lockman concerned about Ca:Mg ratio and response to Mg. The comment was made that Ca:Mg ratio is not effective unless Mg is very low anyway. Flannery: getting over 300 bu/A corn with a leaf Mg concentration of 0.15%.

Sulfur - Few labs routinely determine S. Considerable differences were reported among labs which ran S in this exchange.

Boron - Axley: Hot water B not very good. NaOAc appears to work quite well. Donohue: Dave Martens has a student working on a new B test. Out of a large number of sites in VA since 1967, Martens has had a response on only 2 or 3 sites.

Manganese - Ray Tucker noted differences in sources of Mn and solubilities yet label may be the same.

Nitrate-N - Lockman: Produced 60 bu/A corn the 4th year after no N application on a deep, silty clay loam in Ohio. Three to four feet deep in the profile he found 45-50 ppm NO_3-N.

Organic Matter - Storer: High results on sample C (cecil clay loam) using Agrico's combustion procedure may be due to hydrated minerals in the sample.

PLANT SAMPLE EXCHANGE

Good agreement between labs on plant samples. Storer and Lockman noted lower K on dry ash versus wet ash. It was suggested that dropping oven temperature from 550 C to 450 C would recover more K.

11:10 AM - SOIL SAMPLING AND SOIL TEST INTERPRETATION FOR NO-TILL AND MINIMUM TILL SITUATIONS (discussion led by Alan Bandel)

Bandel noted that 60% of the corn in MD was no till and presented data illustrating that acid surface soils result in loss of triazine herbicides through adsorption. He also presented data correlating pH at 2.5 cm and depth of sampling.

sampling depth (cm)	r^2	
0-5	.95	0-4" good correlation
0-7.5	.93	
0-10	.92	
0-15	.85	0-8" not as good
0-20	.84	

Bandel suggests sampling to 0-2" depth to insure accurate indication of surface pH. Flannery: What to do when N is banded? Bandel: Can predict pH drop of 6.2 to 5.7 or so. Lime recommendation should be based on two-inch layer. No problem above 6.2. Small grain could be damaged from triazines if lime is applied after corn where triazines were added.

Soil P and K is also higher in the top 2 inches under no-till situations. Predicted P and K in 0-8 inches based on 0-2 inch sample were not as good as predicted pH (r^2 = 0.78 and 0.80, respectively).

Conclusion:

(1) Sample no deeper than 7.5 cm for pH in no-till situations.

(2) Adjust current soil test ranges for P and K.

Plank: Georgia recommends 0-4 inch sample for no-till. Weber: We need to emphasize soil testing more for herbicide use as well as for soil fertility in our educational programs. Proper liming based on soil test could save grower $10 to $20 per acre in herbicide cost. Donohue: Virginia has used a 3-4 inch depth for lime and fertilizer recommendations for past 10 years.

At what minimum soil pH could we get by with using triazines? Weber: many factors to consider but maybe 5.8. At pH 3.0, the half life of atrazine is 3 hours. At pH 8.0, atrazine has lasted 2 years in a field experiment and killed small grain.

12:00 - LUNCH BREAK

1:00 PM - MEASUREMENT AND INTERPRETATION OF ORGANIC MATTER/HUMIC MATTER IN SOILS (Discussion led by Al Hatfield, NCDA)

Hatfield: NC uses colorimetric method for estimating extractable humic matter in soils. A soil of known O.M. is used to calibrate. Hatfield introduced Dr. J. B. Weber of NCSU who presented data on soil organic matter and herbicide rate recommendations.

Weber: Indicated a need for more full-time research in soil test calibration and herbicide rate adjustments. Weber showed that no matter which technique used, an increase in soil "organic matter" was highly correlated with selected herbicidal effectiveness as measured by I_{80} (inhibition of 80% of weeds over check plot).

Lab technique	Correlation of O.M. vs I_{80}
Peroxide digestion	.987
Dichromate digestion	.962
NaOH extraction	.941
Ashing	.890

Correlation was better when soil was measured on a volume basis rather than weight basis. The following papers dealing with this subject were discussed:

Weed Science Vol. 24, 1976
Weed Science Vol. 34, 1981
Weed Science Vol. 35, 1982
Weed Science Vol. 36, 1983
Soil Sci. Vol. 136, 1982

Weber emphasized the need for better accuracy, reproducibility, and consistency among labs so proper herbicide recommendations can be made. Some herbicides are applied at rates as low as 0.5 oz. per acre. Recommends NaOH extraction technique as used by NCDA. Dichromate digestion is being abandoned because of ordinances against introducing chromium into sewer systems.

Don Storer (Agrico) noted that at one time their waste water was chromate color when running large numbers of samples. All samples are tested for O.M. Agrico has adopted dry ashing technique. Ashing samples at less than 550°C is supposed to minimize CO_3 breakdown. A $1cm^3$ sample is ashed at 500°C for 4 hours. For all samples, Storer found the following relationship between Walkley-Black O.M. (WB) and percent weight loss by dry ashing (Ash).

$$WB = 0.81 \text{ (Ash)} - 1.47 \qquad R = 0.98$$

Assuming a soil B.D. of 1.2 g/cm^3, the following regression was observed for actual Walkley-Black O.M. and calculated Walkley-Black O.M. from weight loss.

$$\text{Actual} = 1.03 \text{ (calculated)} - 0.09 \quad R = 0.87$$

Agrico can process up to 1500 samples in 3.5 hours by having 2 electronic balances interfaced with computer to speed up weighing. Samples are dried at 105°F before grinding in NASCO Aspline grinder (morter and pestle type).

Each representative was asked to comment on their position regarding analysis of soils for organic matter and the importance of the test.

3:00 PM - BREAK

SC (Mitchell): Less than 500 samples tested annually by request only for herbicide rate adjustment; no dichromate problem. W-B method used.

VA (Donohue): 5,000 to 7,000 samples tested for herbicide rate adjustment.

NYDHIC (Eshelman): Inquired about peroxide method. Others noted that the procedure is acceptable but quite tedious.

AGRICO (Storer): 140,000 to 150,000 per year - every sample.

NJ (Flannery): W-B method used only as a special test.

GA (Plank): W-B on request.

A & L (Chu): All samples run on regular basis.

WV (Ghazi): On request only.

DE(Parker): 200-300 samples per year optional.

Weber concluded by noting that eventually EPA is going to select a standard method of determining soil O.M. and will require that this method be used.

Mitchell suggested that the sample exchange include each lab determining O.M. by different methods for the purpose of evaluating the techniques on different soils.

4:00 PM - USE AND CALIBRATION OF MEHLICH III EXTRACT (discussion led by Roy Flannery, Rutgers University)

Flannery: Finds that Mehlich III extracts more P from acid soils, but as pH rises, the values get closer together.

Extractable P MI x 1.65 = MIII (wide pH range)
MI x 2.00 = MIII (pH 4.5-5.5)
MIII x Bray-Kurtz P1 R^2 = 0.99 (values almost same)

At pH 6.5+, MIII extracts less P than MI (Parker found similar results from soil samples throughout U.S.).

Extractable K MI x 1.16 = MIII (no pH effect)
MI x 1.25 = MIII (wide range of soils)
(Hatfield reporting Mehlich's data)

Extractable Mg MI x 0.95 = MIII (n = 200) r^2 = 0.95

Extractable Ca MI x 0.73 = MIII (n = 200)

MIII Ca decreases at high soil Ca levels i.e. around 1100 mg/dm^3.

Ext. Cu	DTPA vs MIII	r^2 = 0.94	slope ~ 1
Ext. Zn	DTPA vs MIII	r^2 = 0.92	slope ~ 1.5
Ext. Mn	DTPA vs MIII	r^2 = 0.60	

This work was done to see how previous values would compare to MIII if a change in extractants is made. Oklahoma has already made the shift.

Mitchell: What are the reasons for switching to MIII?

Flannery: MIII is more flexible; less problems with corrosion in lab equipment.

Cox: MIII does a better job of extracting Mn on some soils.

Lockman: Use Mn index for correlating soil Mn and pH with plant Mn.

Motto: If we lime soils to pH 6.5+, MI gets out too much P. At lower pH's, this is no problem.

Cox: MIII still does not distinguish between high and low P fixation, and therefore, we must interpret results differently. It is a big step to change extractants, because most data is with MI in the S.E.

Hatfield: NC has established sufficiency levels for MIII and will share them with the group.

Flannery: Proposed that we all change to MIII within three years.

Hawkins and Donohue: Virginia could change within a year.

Mitchell and Woodruff: Will look at MIII and discuss possibilities with others involved. Have a large number of soil samples with MI and plant analyses. Should get some data.

Plank: Need three years data and committee approval.

Bennett: Must look at MIII.

The proposal by Flannery was ammended to resolve that members of the M-ASTWG work toward adopting the MIII extractant for their respective labs for reasons of uniformity among labs and because it has been shown to be better suited for a wide range of nutrients. There was unanimous agreement to adopt this proposal.

Southern States hosted a social hour in the Days Inn Hotel at 5:30 PM. The entire group dined at the Chesapeake House Restaurant afterwards.

Thursday, February 23

8:30 AM - Mitchell opened the meeting with a request for topics for the 1985 meeting. He also read the letter which will be sent to Dr. Mehlich's wife and family.

8:45 AM - USING COMPUTERS FOR SOIL TESTING AND PLANT ANALYSES (discussion led by Steve Donohue, VPI & SU)

Donohue: Discussed Virginia's computer use in soil testing. Most processing handled by micros in lab; no instrument interface yet; most Co. Ext. offices have terminals to main frame but no local computing capability. The switch to computers did not speed up lab operation; is well pleased with the increased capability.

Mitchell: Uses SAS and batch submission of data to main frame for soil testing and nematode assay. Overnight summaries very simple with this system; no instrument interfacing with computer.

Buriel: Maryland has a micro computer in lab and program to collect data from Technicon instruments. The data is processed, printed and sent to County Agents for recommendations. All counties will get microcomputer which will be interfaced with the lab. Annual soil test summaries written by students in FORTRAN. A disadvantage of micros is that a service contract is needed. Use of main frame removes this responsibility.

Parker: Delaware first computerized in 1976; have used batch entry and main frame; notes that batch entry is a thing of the past. They are purchasing an IBM microcomputer which will allow more in-house data processing at a fraction of the cost. Cost of micros have been going down and quality up each year. One can't ignore this advantage.

Cotnoir: Delaware had to rewrite their soil test program when computer center switched to an IBM system. This cost about $4,000. Emphasized the necessity of having someone who has the final word on recommendations that go into the computer because every shop has someone who will never agree on anything. Noted that one doesn't make mistakes ". . . he has a learning experience."

Hatfield: NCDA uses batch entry on floppy disks with computer located downtown. Reports picked up in AM. No interface of instruments with computer. Farmer gets a number for record of year. Program is FORTRAN. Hatfield passed out updated recommendations for NC. Noted that only one number change in the program is needed to change recommendations for a crop.

Flannery: New Jersey is not on computer but uses a production guide which goes to each farmer every year (cost $3.00). The farmer is sent results and he formulates his own recommendation from the guide. The guide includes insect control, varieties, etc.

Plank: Georgia has 53 microcomputers in county offices presently and plan to have them in all 159 counties next year. Used both mainframe and micros to process 135,000 soil samples, 25,000 plant, 12,000 feeds, and 4,000 water samples in 1983. Plasma used for P, K, Ca, Mg, Zn, Mn, B, and Cu on all soil samples. Data stored on cassette tape and transferred to disks. Grower information and results sent by modem to computer center for printing. The county offices have Apple computers but are switching to IBM. The county secretary can log on the

Athens computer using "CROSSTALK" and request data for (1) soil, (2) plant, (3) feed, or (4) water. Raw data is sent to the county computer and recommendations made on local micro from program on diskette. Fertilizer recommendations are on 10 pound increments based on an equation. If change in recommendation is needed, simply change equation number. DRIS is not used for plant analysis because if one or two elements are below critical level, indices for other elements may be thrown off. Has a two-day turnaround time for soil samples. Plank hired a systems programmer to accomplish this task.

Robinson: Uses a hand computer (IBM) in the field to generate recommendations from soil test data.

Will: Uses a word processor with no memory; has capability to communicate with dealers but need memory for quick transfer at night and later printing. Long distance cost too much.

Bennett: W. Virginia processes about 15,000 soil samples per year; no computer yet.

Lockman: Data processed by computer in Tulsa, OK. Plans are to connect instruments with main frame. The computer prints comments highlighting possible causes of problems on plant analysis report.

New Items of Interest

Cox: Calibration for Cu published: Makarin and Cox. 1983. Evaluation of the need for copper with several soil extractants. Agron. J. 75: 493-496.

Cox presented data for MI and MIII calibration for Mn on soybeans and corn. The following prediction equations had the highest coefficients of determination (R^2 significant at P = 0.01) for soybeans.

$$\Delta Ym = -4370 + 865\ pH - 174\ M1Mn \quad R^2 = 56.4$$
$$\Delta Ym = -4600 + 913\ pH - 225\ M3Mn \quad R^2 = 58.8$$

$$\text{Leaf Mn} = 66.9 - 9.40\ pH + 2.39\ M1Mn \quad R^2 = 44.8$$
$$\text{Leaf Mn} = 69.2 - 9.78\ pH + 2.81\ M3Mn \quad R^2 = 42.6$$

Critical leaf Mn for corn was found to be 11 ppm. Work by Miner and Tucker has shown that at least one-third of soil applied Mn must be in water soluble form in order to supply adequate Mn where a deficiency exists. Cox also reported on a pH adjustment for soil test Zinc interpretation. Data was presented indicating a need to shift current P_2O_5 recommendations at low soil test P based on soil type.

1.6 to 1.8 x MI P = MIII P

Donohue: VA recommending S for deep sands for corn and soybeans.

Axley: Reported on poultry manure research. Found less yield of small grain if application split. Three ton/A fall and 3 ton/A spring not as good as 6 ton/A fall or 6 ton/A spring or 3 ton/A fall or 3 ton/A spring. Noted S problems in small grain and corn in wet spring. Early response to S did not show in yield.

Hawkins: No response to S on small grain but did get response on soybeans.

Snyder: We will be seeing more need for plant analysis on early growth of crops. Need data for interpretation.

Conclusion

A sheet was circulated for suggestions for next year's discussions. Chairman Mitchell announced that the 1985 meeting will be held on February 20-21, 1985. Joe Will and Southern States were thanked for hosting the meeting and for providing refreshments, pictures, and arrangements. The meeting was adjourned on schedule.

Minutes prepared by J. R. Woodruff and C. C. Mitchell, Jr.

MID-ATLANTIC SOIL TEST WORK GROUP
1984 MAILING LIST

A & L EASTERN AGRICULTURAL LABS

7621 Whitepine Road
Richmond, VA 23234
(804) 743-9401

Dr. Paul Chu*
Mr. Norman Jones
Mr. Maywood Snyder*

AGRICO CHEMICAL COMPANY

Box 7031
Wilmington, DE 19803

Mr. Charles W. Robinson*

Agronomic Service Lab
Box 639
Washington Ct. Hse., OH 43160

Mr. Ray B. Lockman*
Dr. Don Storer*

BROOKSIDE FARMS LABORATORY ASS'N INC

New Knoxville, OH 45871

Mark A. Flock, Agronomist

DELAWARE

Plant Science Department
University of Delaware
Newark, DE 19711
(302) 451-2531

Mr. Leo Cotnoir, Jr.*
Mr. David Parker*
Dr. Tom Sims*

GEORGIA

University of Georgia
Cooperative Extension Service
Athens, GA 30602
(404) 542-2692

Dr. Owen Plank*

MARYLAND

Agronomy Department
University of Maryland
College Park, MD 20742
(301) 454-3721

Dr. John H. Axley*
Dr. V. Allan Bandel*
Mr. Joe F. Buriel*

NA-CHURS PLANT FOOD COMPANY

817-D West Whitehall
State College, PA 16801

Mr. Martin Campfield

NEW JERSEY

Soils and Crop Department
Rutgers University
New Brunswick, NJ 08903

Dr. Roy L. Flannery*
(201) 932-9452

Dr. Harry L. Motto*
(201) 932-9755

NEW YORK DAIRY HERD IMP. COOP.

730 Warren Road
Ithaca, NY 14850
(607) 257-1272

Mr. Richard M. Eshelman*
Soil Lab Manager

NORTH CAROLINA

Soil Science Department
North Carolina State University
Raleigh, NC 27607
(919) 737-2388

Dr. Fred R. Cox*
Dr. G. S. Miner

Weed Science Center
3123 Ligon Street
Raleigh, NC 27607

Dr. J. B. Weber*

Agronomic Division, NC Dept. of Agric.
Blue Ridge Road Center
Raleigh, NC 27611
(919) 733-2655

Dr. D. W. Eaddy*
Dr. Alan L. Hatfield*
Dr. M. R. Tucker*

PENNSYLVANIA

Agronomy Department
Penn. State University
University Park, PA 16802

Mr. Doug Beegle

SOUTH CAROLINA

Extension Agric. Service Lab
Cherry Road
Clemson, SC 29631
(803) 656-2068

Dr. Charles C. Mitchell, Jr.*

Agronomy & Soils Department
Clemson University
Clemson, SC 29631
(803) 656-3102

Dr. James R. Woodruff*

SOUTHERN STATES COOPERATIVE, INC.

P. O. Box 26234
Richmond, VA 23260

Mr. Joe B. Will*
Mgr., Fertilizing Merchandizing

U. S. TESTING COMPANY

3765 Premier Cove
Memphis, TN 38118

Dr. Roger Hanes

VIRGINIA

Agronomy Department, VPI & SU
Blacksburg, VA 24061
(703) 961-6486

Dr. Steve J. Donohue*
Dr. Jim Friedricks
Dr. G. W. Hawkins*

WEST VIRGINIA

Division of Plant Sciences
University of West Virginia
Morgantown, WV 26506
(304) 293-6258

Dr. W. A. van Eck
Dr. Hussein E. Ghazi*
Dr. Larry G. Bennett*

*Present at 1984 meeting