

MINUTES

Mid-Atlantic Soil Test and Plant Analysis Work Group
February 19-20, 1992 Annual Meeting
Southern States Building, Richmond, Virginia

Attendance:

Delaware:	Karen Gartley Tom Sims	Univ. of Delaware Univ. of Delaware
Indiana:	Bill Shakal	Countrymark Coop. Inc.
Louisiana:	Clayton Cooper Jr.	Na-Churs Plant Food Co
Maryland:	Joe Buriel Charles Robinson	Univ. of Maryland AgTech Agronomics
New Jersey:	Joe Heckman	Rutgers
North Carolina:	M. Ray Tucker C. Ray Campbell Gordon Miner	N.C. Dept. of Agric. N.C. Dept. of Agric. NCSU
Ohio:	Mark Flock Janet Weiss Sorrels	Brookside Laboratories Agrico Chemical Co.
Pennsylvania:	Doug Beegle Ann Wolf	Penn State Penn State
South Carolina:	Bob Lippert Jim Woodruff	Clemson Univ. U.S. Borax
Virginia:	Paul Chu George Hawkins Steve Heckendorn Dave Martens Tom Simpson Houston Staton	A & L Laboratories Virginia Tech Virginia Tech Virginia Tech Virginia Tech Southern States

Wednesday, February 19

8:33 AM Welcome

Chairman Bob Lippert called the meeting to order, welcomed newcomers, introduced Southern States' host Houston Staton, gave instructions for the meeting, and announced that Owen Plank is now on a teaching position at the University of Georgia and is no longer an Extension Specialist.

Sample Exchange

8:40 AM Soils - handout

Paul Chu presented the results of the sample exchange. The six soil samples originated from Omaha, NE; Lubbock, TX; Memphis, TN; Ft. Wayne, IN; Ft. Wayne, IN; & Richmond, VA for samples 1-6, respectively. The need to revise a summary of methods being used by laboratories was mentioned throughout the review of the results.

Organic Matter - Those labs using Walkley-Black and those using an ashing method is about half & half. Talk of distinguishing between ashing procedures of weight vs. volume basis, temperatures, and modifying to give W-B equivalent values.

pH - Despite the range in electrodes used, (each lab seemed to have their favorite) and differences in some proceeds, such as, rinsing the electrode between samples or not, and degree of stirring and automation; pH results remain in good agreement between labs. Sample # 3 which normally gives A&L labs a pH reading of 6.0-6.1 raised the most concern.

P - Sample # 3 again raised the most interest in how M1 extracted significantly more phosphorus than M3 for this soil at pH 6.4. No one had an explanation and it remained a mystery to the group.

K - U. of Maryland's data has a calculation error. The results in the handout should be multiplied by 5.

Rating abbreviations: G-good, P-poor, S-satisfactory, L-low, E-excessive

Ca - Na-Churs results are probably in lb/A.

Are Ca levels used by labs for Lime Recommendations? Most - no, just Mg.

Zn - Main interest - sample # 4, M3 10 X > M1.

Cu - Main interest - M3 vs. M1 values which led to talk of switching from M1 to M3 and interpretation. Delaware and Virginia ran samples both with M1 & M3 and are thinking about switching to M3. Discussion on how results are reported and their pros & cons, (Index values, ppm, or lb/A). CONCERN on who is interpreting data, an ag consultant OR various kinds of software with values being entered by someone with TOTAL disregard to units.

Mn - Sample # 5, M1 extracted more than M3. Sample # 4 with a pH of 8.0 and M3 >> M1. Delaware & Virginia rate low using M1, while M3 users rate as medium to very high.

B - A & L's Indiana lab is using M3. Virginia experienced trouble in getting stable ICP readings for M3 boron and not for M1 boron; it was suggested that Virginia check its water and/or use "outside" boron check standards.

S - Bill Shakal--No correlation between M3 & turbidimetric sulfur.

Brookside--reports as S not SO₄-S. Uses M3 sulfur measured with ICP. Finds that M3 S on ICP is about the same as Turbidimetric on Low CEC soils. Also,

M3 S on ICP > Turbidimetric on higher CEC soils. Mark Flock--Since there are no responses at higher CEC, then it doesn't matter, but maybe no responses observed because the turbidimetric method didn't get all the sulfur. A subsoil test is needed to give a sulfur recommendation.

9:55 AM Plants

The plant samples used are A & L check samples and were corn, whole plant at 6 week growth stage and alfalfa, top one-third at one-tenth bloom. Labs doing plant analysis stated their methods and instrumentation used. (The secretary suggests that a summary of test methods along with instruments used, be newly summarized and accompany next year's exchange results).

Corrections - 3 handouts

Joe Heckman handed out two pages with corrections for last year's M1 soil results for P, K, Mg, & Ca. He also passed out the 1991 Mehlich-3 Soil Sample Exchange Results for the Northeast Coordinating Committee on Soil Testing, (NEC-67). (The 1991 sample exchanges for NEC-67 and MASTWG used the same soils and were both conducted by Dr. Heckman.)

10:00 AM Automated Lab Method for Soil pH Test

Mark Flock gave a slide presentation showing Brookside's new automated method for reading seven pHs at once. Orion junction box solves the problem of electrical cross-talk between the electrodes which Virginia Tech had experienced years ago when it tried a similar system. The system includes a foot switch, individual calibration for the 7 electrodes, no rinsing of electrodes between samples, bubbling at bottom of electrodes during readings for agitation, 40 seconds for electrode equilibration then all read at once, connected PC that shows 49 samples on its screen, and a human operator for trouble shooting. The system looks promising, is being used on water pHs only, should save about 3-4 hours of labor per day, and may be used routinely this spring.

Mark also stated that he gets about 4 good electrodes out of 10 received.

10:?? AM BREAK and group photo taken outside on the front steps of the Southern State building. Both courtesy of Southern States.

10:50 AM Summary and Statistical Analysis of MASTWG Exchange Data: 1980-1991

Tom Sims had not completed the 15-16 year summary of exchange data since he found that it is not easily done, and needed to discuss some problems and concerns with the group. Missing years 1979-81. Would the group like to publish the results and if so, what kind of publication, (regional, technical or popular article). Data may look good or bad. What about consent and confidentiality of participating labs? Use just a certain number of long time participating "core" labs. Use means; show a reduction in error rate & decreased standard deviation? What about: outliers, mistakes, typos, different extractants (in 1984 NC went to Mehlich 3), dilutions made or not made on higher testing samples? Summarize just pH, (N), P & K? Summarizing

the lab data is difficult but possible; summarizing the recommendations is very difficult. Despite our talk of electrode problems, we do a good job with pH. When it comes to lime recommendations, we have used different pH goals. P_2O_5 - need to address scale -- what is an acceptable range that is not to be considered as a significant difference? (Are recommendations of 40 & 60 not a significant difference?) N recs - 100 to 200 lb/A for last 7-8 years.

Think about for future exchanges - use same crop & yield goals every year.

Next year, have a recommendations exchange with "fake", made up data?

Would need to be very specific. Have each lab verify their own data.

Agrico handles Sample Exchange next year.

11:35 AM Mehlich-Buffer Acidity. How and Why it Works. - 2 handouts

Ray Tucker presented some background to the Mehlich buffer that he thought might not be found anywhere else. See the main handout entitled, "MEHLICH-BUFFER ACIDITY. MASTWG MTG"... "1992". Reference # 3 in the same handout was said to be excellent. (Van Lierop, W. 1990. Soil pH and Lime Requirement Determination. in SSSA Book Series #3, Soil Testing and Plant Analysis, Chapter 5, pp. 73-126.) Talk of fungal growth in the Mehlich buffer after a period of time. The buffer reagent contains Barium Chloride which is partly to serve as a preservative against fungal and bacterial growth during prolonged storage periods. North Carolina gives a lime credit that reduces by 8% per month for mineral soils and by 16%/month for mineral-organic and organic soils.

12:00 PM LUNCH provided by Southern States

1:00 PM Effect of Soluble Salts on pH Depression

Steve Heckendorn reviewed how water pHs will cycle through a year. pHs drop in late spring and summer when salts accumulate with drier weather plus additions through fertilization, and addition of newly generated acidity with increased microbial activity & fertilizer reactions. Soil pH usually rebounds back up in the late fall through early spring with crop removal and rains. The concern is following extra dry seasons, soil pH does not "rebound" before a bulk of commercial samples are sent to the lab. This could cause a lab to over recommend lime. Several labs indicated that this concern is a problem following droughts and over fertilization. Large normal seasonal depressions of pH have been observed sometimes causing toxicity problems, especially with certain crop sequences, such as soybeans following potatoes.

What can be done?

- a) Test in 0.01M $CaCl_2$ solution -- study by Grant Thomas showed that a salt pH was worth while
- b) Lime requirement test not as affected by salts as pH in water. -- A&L, still a problem with buffer pH.
- c) Make corrections using a salt test. If salts are greater than a certain level, then reduce the lime recommendation by 0.5 to 1.0 ton/A. Steve believed that Leo Cotnoir, Delaware-retired, reduced lime rates when both Ca & Mg levels tested excessive in order to compensate for seasonal fluctuations of water pHs.

No lab mentioned using a set procedure to adjust lime recs but rather delt

with this situation on a case by case basis through Ext. Agents or consultants.

1:30 PM Potassium Deficiencies and NPK Interactions on New Cotton Cultivars

Clayton Cooper gave a slide presentation on new developments in cotton fertilization. A printed version of his talk is available from either Clayton or Steve Heckendorn. Clayton discussed cotton's production, nutrient requirements, changing potassium deficiency symptoms (which differ from classic K-deficiency symptoms), and how the cotton plant is a perennial which is usually grown as an annual. During the period of time from the first flowering through boll filling, the demand for potassium greatly increases. Last year K deficiencies were rampant on the Delta. Clayton reviewed work with K rates and row placement, and foliar-applied K including its timing and piggy-backing with insecticide applications. Studies were done at Mississippi SU, Arkansas State, Alabama and Louisiana. Most studies showed economic responses to application of potassium with peaks at nearly double the previously recommended rates for soils that test low to medium in K.

2:10 PM Soil Test Evaluation of Cu and Zn on Sludge Amended Soils - handout

Gordon Miner shared results of soil test levels (M3, DTPA and EDTA) from sludge applications. Should laboratories "flag" high levels of metals? His work is still preliminary and he hasn't drawn conclusions yet, but he described his plot research and sludge fields. Table 7 - extracted metal doesn't reflect what has been put on, some higher & some lower, (sludge worse than manure on applied variability); pH increased and caused some masking. Table 11 - dashed lines, "--", indicate a lost crop; Swiss chard sucks up Zn. Tables 13, 14 & 15 are stepwise multiple regression models of Cd, Cu, and Zn concentrations in Swiss chard, lettuce, and tobacco, respectively, on linear forms of Cd, Cu and Zn applied to soil and extracted by M3, DTPA and EDTA, and on soil pH, CEC, OC and clay content. Table 26's R^2 values look almost too good. Last three figures are M3 extractable metal with depth, some sludge was injected.

2:30 PM Soil Test Evaluation of Cu and Zn on Sludge Amended Soils - overheads

Dave Martens discussed field experiments using Cu rich hog manure and Zn & CuSO_4 on three soils (pHs ≥ 6.5) with diverse properties from 1978-1990. The purpose of the research was to determine long-term effects on: crop growth and metal concentration, DTPA extractable metal in soil, and downward movement in soils. Easy to contaminate subsoil samples during sampling from higher surface soil. Corn which is less sensitive to Cu toxicity was used. Cannot compare metal sludges with equivalent metal sulfate. Manure increased organic matter, soil P & changed soil properties. What is toxic, any decrease in early season growth? Need long, long-term (100 year) studies. This research will be presented at the next annual ASA meetings.

Sims - need to either landfill or land apply sludge - how is soil testing to monitor? Sims handed out two related reprints: 1.) Sims, J.T., E. Igo, and Y. Skeans, 1991. Comparison of Routine Soil Tests and EPA Method 3050 as

Extractants for Heavy Metals in Delaware Soils. Commun. In Soil Sci. Plant Anal. 22:1031-1045., and 2.) Sims, J.T., G.V. Johnson. 1991. Micronutrient Soil Tests (2nd ed.). In: J.J. Mortvedt (ed.). Micronutrients in Agriculture. American Society of Agronomy, Madison, WI.

?:?? PM BREAK - refreshments courtesy of Southern States

3:30 PM Current Developments with Boron - folder full of handouts

Jim Woodruff reviewed some U.S. Borax supported research for corn, canola, etc. including foliar application of boron on soybeans. Good correlation between leaf B vs. soil B (hot water soluble) with cotton in Louisiana. Boron available vs. OM and pH in Alabama. Boron deficiencies mainly where rainfall is high and some local conditions which correlate with soil types. Do you need Boron depends on: crop requirement & yield, low OM, sandy texture, and too wet or too dry. Jim summarized recommendations of boron applications for various crops, and sufficiency levels for Hot Water Soluble B for all states, (see handouts). Generally, higher sufficiency levels for increased CEC and increased OM levels, see map handout. Recently six state labs showed that the Mehlich 1 or M3 extractants can be substituted for the hot water extraction. See handout and the publication, (Shuman, L.M., V.A. Bandel, S.J. Donohue, R.A. Isaac, R.M. Lippert, J.T. Sims, and M.R. Tucker, 1992. Comparison of Mehlich-1 and Mehlich-3 Extractable Soil Boron with Hot-Water Extractable Boron. Commun. Soil Sci. Plant Anal., 23:1-14).

4:00 PM Environmental Concerns with Excess Soil Phosphorus

Bob Lippert - South Carolina rarely considers P & K limiting factors in sludge amended fields. see handout.

Tom Sims - Delaware's concern, the poultry industry. Delaware doesn't have to worry much about erosion but is P leaching? Need to define where P loading is a problem. Is testing and reporting soil test P levels as Low, Medium, High, enough? Probably not, Delaware will do more and has started measuring actual P levels and not cutting off measurement after a certain level. As more labs acquire ICPs, then the easier it is to report higher levels of P. Tom presented a very preliminary development of an "Phosphorus Loss Rating Index" from an SCS group dealing with manure. The Index would be a weighted average that might include: Site Characteristics, Soil Erosion, Soil P Test, P Fertilization Application Rate, P Fertilization Application Method, Organic Nutrient Sources, and a Runoff Index.

Penn State & Delaware - How define Excessive P; what does it mean?

Steve Heckendorn - Virginia handles waste amended fields on a case by case basis through nutrient management plans developed by agencies such as Soil & Water Conservation. Handed out reprints of a, The Impact of the Poultry Industry on Water Quality, Symposium paper, (Thomas W. Simpson, 1990. Agronomic Use of Poultry Industry Waste).

4:30 PM Miscellaneous "housekeeping" items, Bob Lippert & adjournment for the day

5:30 PM Catered Happy Hour sponsored by Thermo Jarrell Ash

6:45 PM Dinner at Stake & Ale courtesy of U.S. Borax

Thursday, February 20

8:00 AM The meeting was opened by Chairman Bob Lippert.

8:15 AM Chemical Properties of Virgin and Cultivated New Jersey Soil Profiles

Joe Heckman shared some slides with figures comparing native and cultivated soils. Summary of New Jersey Commercial Fields: P levels, 56% Very High, 15.6% High, 10.8% Medium, 17.7% Low; K levels, 18.7% Very High, 36.8% High, 27.9% Medium, 16.7% Low. Compared to native soil fertility levels at one site with P as Very Low, K as High, Ca & Mg as Low, and pH of 4.4. Joe sampled a Native Soil Site at 10 cm increments to a depth of 2 meters to show how P & K compare to cultivated profiles. On sandy coastal plain soils and below 30 inches, uncultivated soils are about the same as cultivated soils with regards to P. Clay layer at 25 to 30 inches. pH, Ca & Mg were greater in cultivated soil. In native soil, Ca & Mg had moved down to about 50 inches; pH < 5.0 above 50", and pH > 5.0 below 50". At an Ohio site from 1 to 6 inches:

Site	--	Woods	Corn Field
pH	--	5.6	6.5
P lb/A	--	60	507
K lb/A	--	179	672

New Jersey State Report - Rutgers' lab has a new location on the Cook College campus. New equipment, a DCP that can measure 17 elements. Will start doing more Plant Analysis; didn't use to do grower samples. Plan on changing to Mehlich 3 extract, adding the Mehlich Buffer Method and calculating the CEC. Routine Test will consist of pH, Lime Requirement, CEC calculated, P, K, Ca, Mg, B, Cu, Zn, & Mn. The charge will go from \$6.50 to \$7.50-or-up-to-10.00 for routine soil sample; plant charge from \$10 to \$12.50. Will have new information and report forms. Samples sent directly to lab with payment; computer recommendations; report with recommendation sent directly to customer; goal: cut turn-around-time. Will hire a new, full-time lab supervisor and another person capable of operating current equipment.

8:35 AM Virginia Agronomic Land Use Evaluation System, (VALUES) - many handouts!

Tom Simpson and George Hawkins presented their work so far on the VALUES project that has the purpose to increase profitability in crop production while incorporating water quality considerations into soil test recommendations.

Inputs for VALUES:

1. Soil Map Unit Information
2. Cropping Plan and Field History
3. Soil Testing Results

Outputs for VALUES:

1. Nutrient Management Recommendation
2. Alternative Crop Management Recommendation
3. Liming Recommendation
4. Water Quality Notes

Project End Products:

1. Incorporate VALUES into VA Tech Soil Testing Program
2. Develop Microcomputer Software to Generate VALUES Recommendations from Existing Soil Test Data

Major educational effort needed to make use of soil map unit information; however, most growers, especially Coastal Plain growers, already have or will have a nutrient management plan which has Soil Map Information.

Soil Management Groups (SMG) were developed using about 3,500 high management yield data, predominantly for corn and soybeans. Average annual yield and yield distribution over time was used to establish groups. Every soil series mapped in the State was placed in a SMG; soils with little or no yield data were placed in SMG based on soil properties.

5 to 9 Productivity Groups were developed from about 39 SMG. Virginia has used Productivity Groups since 1966.

Development of Realistic Yield Expectations should not be based on long term average yield. Assumptions made:

Years used, 1968 to 1988, are an acceptable sample of weather;

N appl. - 1 lb N (from all sources) per bushel of anticipated yield;

Corn - nitrogen price ratio of 10 to 1;

Nitrogen carryover sufficient to produce at least 20 bushels of corn.

Need to determine the realistic yield goal to manage for every year that will maximize net income.

Tom Sims - where is the water quality and how is it factored in?

Using VALUES as a nutrient management tool will improve water quality. If farmer lowers present yield goal, then that's an improvement. (If the grower has 5 yrs. of average yield data on a field, then that will supersede general data. Use of their data will factor in individual management skills). Going with an average yield is asking the farmer to lose money some years with no subsidy. Will it work? Probably will work with education as to why & how the Realistic Yield Expectations came about, and because of the fear of regulation. The biggest resistance so far is from sludge applicators. On high cash crops, such as tobacco, there might not be a decreased use on N but improvement with more specific management practices.

VALUES recommendations will include:

- (1) fertilizer & lime recs for specific crops grown on specified soils;
- (2) recs on time & method of fertilizer applications for specific crops grown on specified soils;
- (3) recs for other crop management practices, such as stand levels and cropping sequence, when a crop is being grown on a specified soil;
- (4) Suitability of a given soil for use in the production of a given crop. (Nicely say that one does not want to grow this crop on this soil or that it will require maximum management.)

10:?? AM BREAK

10:45 AM State Reports

South Carolina - handed out their new schedule of fees

As of December 2, 1991 the S.C. Extension Service began charging \$5.00 per sample for our standard soil test which includes P, K, Ca, Mg, Zn, Mn, pH, buffer pH, and recommendations. As predicted, our sample load so far has dropped to about half. The county offices keep 20% of the fees collected to use for their own budgetary needs. The 20% is especially intended to cover trouble-shooting or demonstration trial samples. As we run the sample results through the mainframe program to generate the reports, a separate program keeps tally of the types of analyses run for each county and assigns fees accordingly. At the end of each quarter, an itemized bill is automatically sent to each county through the electronic mail system. The total is multiplied by 80% and that is the amount due at the bursar's office.

Our ICP arrived in December. A Thermo-Jarrell Ash model 61E. It has a vacuum chamber so sulfur can be easily run simultaneously with the other elements. We have had minimal problems with it so far and excellent support from the company. Currently, samples are being run on it for plant, feed, irrigation water, and animal waste. We hope to incorporate soil extracts soon. The cost, fully loaded, plus tax and shipping was \$128,000.

We also bought two Brinkman Kjeldahl units with automatic titrators. We're still working the bugs out. Cost = \$40,000 for both units.

A loan from the state has allowed us to buy this new equipment. The monies generated by our new fee structure is suppose to enable us to pay off the loan.

Our roof still has severe leaking problems. The cost of asbestos removal plus reroofing will be about \$95,000. This will be done in the spring out of absolute necessity but the administrators are still trying to determine the source of funds.

Talk about deficit spending!

We have two positions frozen open and we'll lose another employee in June due to retirement. This should all work out OK due to the decrease in sample load and the integration of the new ICP.

Leonard Parks retired this last December. As I understand, no one will be hired to cover soil fertility responsibilities. Some of the specialists will handle fertility problems for crops which they have been assigned.

Rutgers - (Also see Joe Heckman's report earlier in the day under "Chemical Properties of Virgin and Cultivated New Jersey Soil Profiles.") Joe

reported (3 handouts) the frequent misuse of a research paper by Firman Bear. Various organic farming and health-food newsletters have reported that organically grown vegetables are significantly superior in minerals and trace elements than conventional, commercially grown vegetables by referring to this article, (Bear, et al., Variation in Mineral Composition of Vegetables. Soil Science Society Proceedings 1948.).

Agrico - Don Storer left his position at Agrico and is teaching at a community college. Janet Weiss Sorrels has taken his place.

Penn State - Ann Wolf - The Plant Analysis, Environmental, and Soil Testing Labs have combined into one laboratory under the name of Agricultural Analytical Services Lab. Its lovely acronym was noted. {Secretarial note -- that makes Ann the Head AASL.} The combining of labs should allow for more efficient use of people, clerical operations and equipment. Switched to Mehlich 3 extractant on August 1. New ICP will take the place of colorimeter & AA. Purchased the same type of ICP as Clemson, a Thermo-Jarrell Ash model 61E. Not doing any micronutrients yet with Mehlich 3.

Doug Beegle - Nitrogen soil test: generally went well, dry year; last year N read high and was high; greater than 1,000 samples/year; good with manures; backing off following a legume, especially using No Till (temperature & aeration); Error Rate 12%.

Delaware - Steve Heckendorn left his position at UD in October. Karen Gartley is the new Soil Testing Program Coordinator as of February 1. Karen - Delaware has been able to completely drop hand texturing of samples by continuing to use the Adams-Evans buffer to measure buffering capacity, and by starting to use a Vol/Wt value (which comes from LOI OM routine procedure) and using county of sample (which corresponds with physiographic region). The Vol/Wt + County is used to estimate the max. economic yield goal. Plan to add the Pre-Sidedress Nitrate Soil Test. Have a grant to obtain an ICP by September. Will switch to Mehlich 3 when ICP is in operation. Copies of the Recommended Soil Testing Procedures for the Northeastern United States are available from Delaware.

A & L - Last winter, started new building addition which will double lab space. Will move in during spring. Runs soil samples for North Carolina with Mehlich 3 JUST FOR heavy metals. Soil Zn content correlates well with heavy metal, Cd, Ni, Pb, content.

NaChurs - Judy Mason has been seriously sick and will not be able to return to a laboratory work environment. (The group expressed hope that she'll get well soon.) Only major change, switched to LOI method for OM.

North Carolina - Ray Tucker - Last year processed 236,000 soil samples, a record high. Schedule to get new building is on hold. Looking at DCP (output/hour!) for Soil's Lab. Would get three with one serving as a backup.

Ray Campbell - We are seeing significant increases in the use of waste and solution services. Cotton samples have also increased significantly. We discovered a water quality problem concerning the production of greenhouse tobacco transplants during the past year. This is in part responsible for the increase in solution samples. Funding for our laboratory programs

continues to be tight. Will be serious if more cuts. We may be seeing some stability now. The legislature will consider releasing funds for our new facility this spring or summer.

Virginia - George Hawkins - look at our VALUES program and please relate any concerns to us. Steve Heckendorn replaced David Aho as the lab manager. David and his wife are teaching in China for a year. Since we started charging for analyses, our sample load has dropped from over 100,000 to a little over 30,000 for the last calendar year. We hope to get approximately 40,000 soil samples in for this fiscal year since around that number is where we'll cover our operating budget and all salaries + benefits for laboratory personnel. Plan to add a sulfur test, switch to Mehlich 3, and add a buffer pH, in that order. Dr. Lucian Zelazny was near death last December with a pneumonia similar to one that killed Jim Henson, the Muppettier. He is out of danger, but it will be quite some time before he completely recovers.

11:37 AM Meeting Adjourned
Next Year's Meeting on Wed. & Thurs., February 17 & 18, 1993.

Secretarial Note: I'm certain that I speak for the whole group in expressing appreciation for Bob Lippert's efforts while serving as this group's chairperson for the past two years!

Minutes taken and prepared by Steve Heckendorn, Virginia Tech.
Any errors should be brought to the attention of the secretary.