DETERMINING NUTRIENT NEED

GOAL IS DEFINE SOME LEVEL OF NUTRIENT SUFFICIENCY

IT CAN BE DONE IN A NUMBER OF WAYS EACH HAS BENEFITS AND LIMITATIONS

1. WINDSHIELD (VISUAL) SURVEY

   + EASY TO SEE PROBLEMS
   - ONLY SEE DEFICIENCIES
   - NOT QUANTITATIVE

2. ON-FARM FERTILIZER TRIALS

   + VERY SPECIFIC TO A SITE
   - EXPENSIVE, TIME CONSUMING
   - NOT TRANSFERABLE OFF FARM

3. GREENHOUSE CALIBRATION

   + COMPARE MANY TREATMENTS CHEAPLY
   - SPECIALIZED FACILITY NEEDED
   - NOT DIRECTLY TRANSFERABLE TO FIELD

4. PLANT ANALYSIS

   + CAN IDENTIFY IF NUTRIENTS WERE SUFFICIENT OR DEFICIENT
   - TOO LATE TO MAKE CORRECTION
5. SOIL TESTING

+ RAPID, INEXPENSIVE
+ PRIOR TO PLANTING
- DANGER OF OVER INTERPRETATION

PROBABLY USE A COMBINATION OF ALL BUT SOIL TESTING IS THE MOST ACCEPTED AND RELIABLE

SOIL TESTING IS THE ONLY DIAGNOSTIC TOOL AVAILABLE PRIOR TO PLANTING

OVER 200,000 SAMPLES ANALYZED IN WIS./YEAR

- RESULTS GUIDE ~ $200 MILLION OF FERTILIZER AND LIME APPLICATION EACH YEAR IN WISCONSIN

- A REAL RANGE OF IMPLEMENTATION -- SOME CONSIDER IT A GIMMICK TO SELL FERTILIZER WHILE OTHERS SEE IT AS AN EXACT SCIENCE

- TWO STATE OPERATED LABS SET PROTOCOL, RUN CHECK SAMPLE PROGRAM, AND PROVIDE UNBIASED RECOMMENDATIONS

- SEVERAL PRIVATE LABS TEST WISCONSIN SOIL SAMPLES. ONLY THREE PROVIDE WIS. RECOMMENDATIONS

- USE OF LOCAL LABS IS SUGGESTED TO OBTAIN RECOMMENDATIONS CALIBRATED FOR WISCONSIN CONDITIONS
WHAT EXACTLY IS SOIL TESTING

- CHEMICAL EXTRACTION OF A NUTRIENT FROM A VERY SMALL AMOUNT OF SOIL (~1 t)

- EXTRACTANTS ARE CORRELATED TO APPROXIMATE WHAT IS PLANT AVAILABLE

- EXTRACTANTS VARY BY REGION BECAUSE OF DIFFERENCES IN THE NATURAL CHEMISTRY OF SOILS

- MOST LABS DO A GOOD JOB OF SOIL TESTING. GOOD LAB PROCEDURE. CHECK SAMPLES.

- DISAGREEMENT COMES FROM THE RECOMMENDATION PROGRAM

THE WISCONSIN RECOMMENDATION PROGRAM

- GOAL IS TO PROVIDE AN ADEQUATE NUTRIENT SUPPLY THROUGHOUT THE GROWING SEASON

- ECONOMICALLY SOUND

- ENVIRONMENTALLY SAFE

- RESULTS SHOULD BE INTERPRETED AS AN INDEX OF AVAILABILITY, NOT ABSOLUTE SOIL CONCENTRATIONS

- CATEGORIES RANGE FROM VERY LOW TO EXCESSIVELY HIGH
IDEALIZED SOIL TEST CALIBRATION CURVE

RELATIVE SOIL NUTRIENT SUPPLY

- OPTIMUM RANGE IS 90-95% OF THE MAXIMUM YIELD

- GOAL SHOULD BE TO MAINTAIN SOIL TEST IN OPTIMUM RANGE

- FERTILIZER RATE IN OPTIMUM RANGE APPROXIMATES CROP REMOVAL

- SOIL TESTS BELOW THAT WOULD RESULT IN REMOVAL PLUS “CORRECTIVE” TO BUILD SOIL TEST

- “CORRECTIVE” FERTILIZERS AFFECTED BY SOIL BUFFERING (18 P2O5; 7 K2O)
SOIL TESTS ABOVE THAT RESULT IN RATES LESS THAN REMOVAL

LOGIC BEHIND SOIL TEST INTERPRETATIONS (TABLE 12.3)

<table>
<thead>
<tr>
<th>SOIL TEST LEVEL</th>
<th>POTENTIAL FOR $$ $$ RESPONSE</th>
<th>FERTILIZATION DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>VERY LOW</td>
<td>&gt; 90 %</td>
<td>BUILD TO OPTIMUM IN 5-8 YR.</td>
</tr>
<tr>
<td>LOW</td>
<td>60-90 %</td>
<td>BUILD TO OPTIMUM IN 2-4 YR.</td>
</tr>
<tr>
<td>OPTIMUM</td>
<td>30-60 %</td>
<td>ECONOMIC AND ENVIRONMENTAL OPTIMUM. MEET CROP REMOVAL</td>
</tr>
<tr>
<td>HIGH</td>
<td>5-30 %</td>
<td>APPLY HALF REMOVAL</td>
</tr>
<tr>
<td>EXCESSIVELY HIGH</td>
<td>&lt;2 %</td>
<td>NO FERTILIZER EXCEPT MINIMAL STARTER</td>
</tr>
</tbody>
</table>

REMOVALS FOR COMMON FIELD CROPS (TABLE 12.5)

<table>
<thead>
<tr>
<th>CROP</th>
<th>YIELD</th>
<th>N</th>
<th>P2O5</th>
<th>K2O</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALFALFA</td>
<td>4 TON</td>
<td>240</td>
<td>52</td>
<td>240</td>
</tr>
<tr>
<td>CORN (gr.)</td>
<td>150 BU</td>
<td>120</td>
<td>55</td>
<td>40</td>
</tr>
<tr>
<td>CORN (stover)</td>
<td>51</td>
<td>14</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>OAT</td>
<td>90 BU</td>
<td>60</td>
<td>30</td>
<td>90</td>
</tr>
<tr>
<td>SOYBEAN</td>
<td>50 BU</td>
<td>190</td>
<td>45</td>
<td>50</td>
</tr>
<tr>
<td>WHEAT</td>
<td>65 BU</td>
<td>85</td>
<td>45</td>
<td>25</td>
</tr>
</tbody>
</table>
WORKINGS OF THE WISCONSIN RECOMMENDATIONS

SOIL TEST P AND K INTERPRETED ACROSS SIX CROP DEMAND LEVELS

1. FIELD CORN
2. SOYBEAN, LOW DEMAND FIELD CROPS
3. ALFALFA, IRR. FIELD CROPS, LOW DEMAND VEG. CROPS
4. RED CLOVER, MEDIUM DEMAND FIELD CROPS
5. HIGH DEMAND VEG. CROPS
6. POTATO

SIX SUBSOIL FERTILITY GROUPS WITHIN EACH DEMAND LEVEL

GROUP A: SOUTHERN FORESTED SOILS
GROUP B: SOUTHERN PRAIRIE SOILS
GROUP C: EASTERN RED SOILS
GROUP D: NORTHERN FORESTED SOILS
GROUP E: SANDS
GROUP O: ORGANIC SOILS
GROUP X: HIGH pH SOILS (P ONLY)
NITROGEN RATE RECOMMENDATION BASED ON SEVERAL FACTORS (CROP SPECIFIC)

**CORN**

MRTN
YIELD POTENTIAL OF THE SOIL
IRRIG. STATUS OF SANDY SOIL
SOIL ORGANIC MATTER CONTENT

**POTATO**

SOIL ORGANIC MATTER CONTENT
YIELD GOAL

**OTHER NON-LEGUMES**

SOIL ORGANIC MATTER CONTENT

ADJUST (REDUCE) N RATE BASED ON LEGUME AND MANURE CREDITS

MICRONUTRIENT NEED DETERMINED BY:

1. A SOIL TEST
2. PLANT ANALYSIS
3. DEFICIENCY SYMPTOM
4. KNOWN HISTORY OF RESPONSE

RELATIVE NEED VARIES BETWEEN CROPS

SEVERAL SHOULD NEVER BE DEFICIENT IN WISCONSIN
GOOD RECOMMENDATIONS RELY ON GOOD SOIL SAMPLING

- ROUTINE TEST (pH, OM, P, K)

   OTHERS EXTRA (Ca, Mg, S, B, Zn, Mn)

-WHEN TO SAMPLE

   ANYTIME A GOOD SAMPLE CAN BE TAKEN
   FALL IS TYPICAL

-SAMPLE ONCE IN THE ROTATION (4-5 YR.), OR

   EVERY FOUR YEARS IN C/Sb
   EVERY TWO YEARS ON SANDS

-AVOID

   1. UNUSUAL AREAS
   2. DEAD/BACK FURROWS
   3. HEADLANDS
   4. NEAR GATES
   5. ERODED KNOLLS
   6. WHERE MANURE OR STALKS WERE Piled
   7. IN OLD CORN ROWS

-SAMPLE CORRECT DEPTH

   PLOW DEPTH
   3/4 CHISEL DEPTH
   6-7" IN NO-TILL

-MIX SAMPLE WELL BEFORE BAGGING
CORRECTLY LABEL BAG AND FILL OUT INFORMATION SHEET

SINGLE-RATE FERTILIZATION

- ONE SAMPLE FOR EVERY 5 ACRES
- FEWER SAMPLES FOR EH TESTING FIELDS

ZIG-ZAG PATTERN OF 10 CORES

VARIABLE-RATE FERTILIZATION

- NUMBER DEPENDS ON GRID SIZE

- SAMPLE FROM SMALL AREA AROUND LAT/LON POINT

PLANT ANALYSIS

- USUALLY DONE WHEN PROBLEMS OCCUR OR VISIBLE SYMPTOMS ARE OBSERVED

- SAMPLE CORRECT PLANT PART AT CORRECT TIME (CRITICAL LEVELS ESTAB.)

CORN: EARLEAF AT SILKING
ALFALFA: TOP SIX INCHES AT LATE BUD
SOYBEAN: FIRST TRIFOLIATE AT FLOWERING
SEE INFORMATION SHEET AFTER P. 154 FOR OTHER TIMES/CROPS

- SAMPLING AT OTHER TIMES OK, BUT FURTHER INTERPRETATION OF RESULT IS NEEDED
INCLUDE A SOIL SAMPLE (PART OF FEE)

PLANT SAMPLING TECHNIQUE

1. AVOID DISEASED OR INJURED TISSUE
2. DUST OFF SOIL-CONTAMINATED TISSUE
3. TAKE SEPARATE SAMPLES FROM GOOD AREA AND BAD AREA
4. COLLECT IN CLEAN PAPER BAG
5. AIR DRY BEFORE MAILING
6. COMPLETE INFORMATION SHEET

OTHER SOIL DIAGNOSTIC TESTS

-PREPLANT NITRATE TEST (PPNT)

MEASURES RESIDUAL OR CARRYOVER NITRATE. TEST USUALLY TAKEN IN APRIL

USEFUL IN CONTINUOUS CORN ON MTS/FTS FIELDS WITH AN UNCERTAIN N MGT. HISTORY

TAKE SOIL CORES IN ONE FT. INCREMENTS TO 2 FT. ANALYZE EACH SEPARATELY MODEL ESTIMATES NITRATE IN TOP 3 FT.

ADJ. N RATE (lb N/a) = N REC. - (PPNT - 50)

-PRESIDEDRESS NITRATE TEST (PSNT)

MEASURES N MINERALIZED IN EARLY SEASON. TAKEN IN CORN AT V3-V6
USEFUL IN CORN FOLLOWING LEGUMES OR WHERE THERE IS A MANURE HISTORY

TAKE SOIL CORES TO ONE FT. ONLY WHEN CORN IS 6-12” TALL

PSNT BASED N RECOMMENDATIONS (lb N/a TO APPLY)

<table>
<thead>
<tr>
<th>PSNT RESULT</th>
<th>H/VH YIELD POT.</th>
<th>L/M YIELD POT.</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;21</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>18-20</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>15-17</td>
<td>100</td>
<td>40</td>
</tr>
<tr>
<td>13-14</td>
<td>125</td>
<td>80</td>
</tr>
<tr>
<td>11-12</td>
<td>150</td>
<td>80</td>
</tr>
<tr>
<td>&lt;11</td>
<td>160</td>
<td>120</td>
</tr>
</tbody>
</table>