DEPARTMENT OF
**PLANT AND SOIL SCIENCES**

# Impact of No-Till and Sample Handling on Soil Test Results

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## No-till = No Mix…

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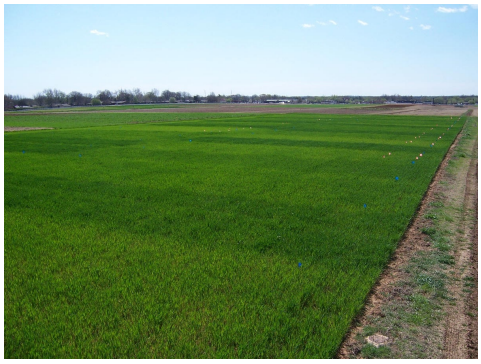
# Long-term Fertility Trials.

Numbered long-term (NPK) soil fertility studies established by Dr. Billy Tucker 50 years ago.

In the late 2000's most were converted to No-till.

In Summer of 2019 three trials were intensively sampled.



**222 – Stillwater, Est 1968, No-till 2010**
Kirkland Silt Loam

**502 – Lahoma, Est 1971, No-till 2010**
Grant Silt Loam

***702 – Perkins, Est 1996, No-till 2005**
Konawa Fine Sandy Loam

*702 – Established by Dr. Bill Raun. N&P study.

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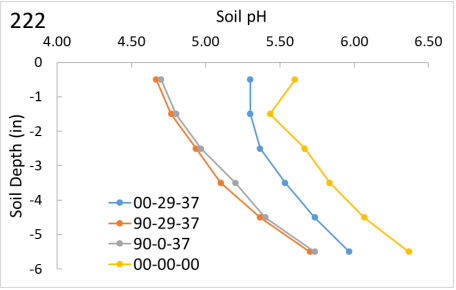
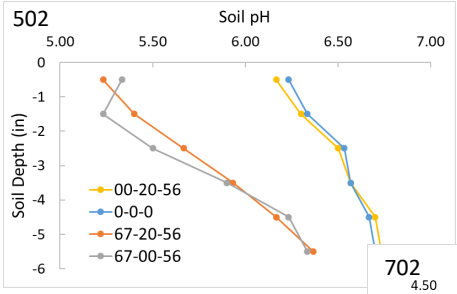
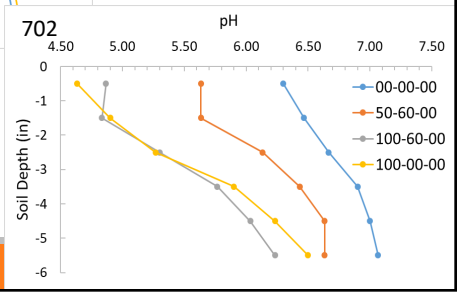
# Let's take it one Component at a time. Soil pH.




Each point is the average of four samples, 1 per rep.




pH is driven completely by N.

At 222, 502, and 702, Mass Balance 60 lbs (67 Kg) is a neutral balance
This means N applied is equal to N removed.

At N rates above this level Acidification is Increased.

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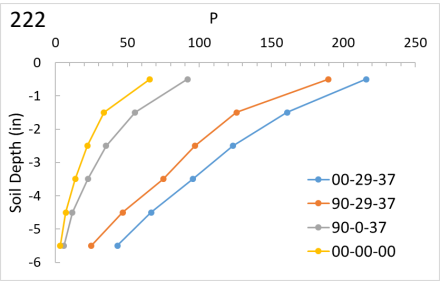
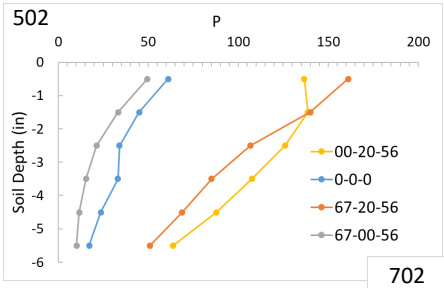
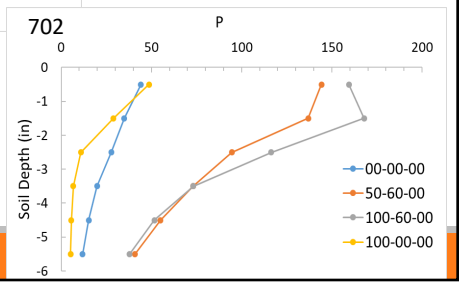
# Phosphorus




SHOCKING NEWS
The Addition of P increases Stratification.

The addition of N without P increased intensity of Strat above Check.

The addition of N with P did not significantly change Strat.

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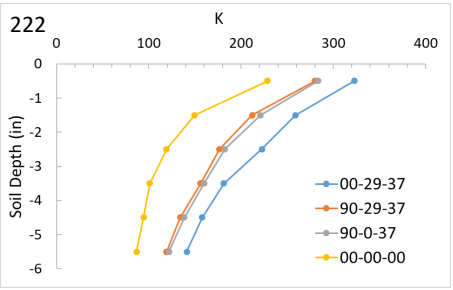
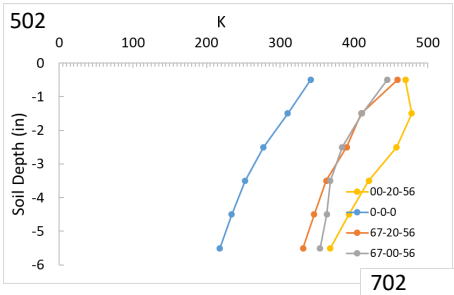
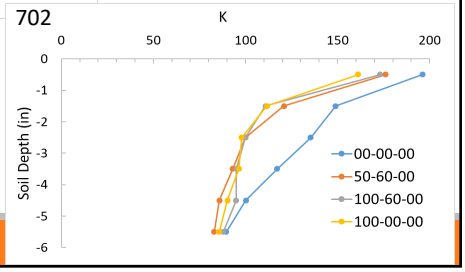
# Potassium




Potassium heavy stratification even at the check.

502 may be showing K saturation in the surface 1" at a ppm of 475. As increase in K at 2"

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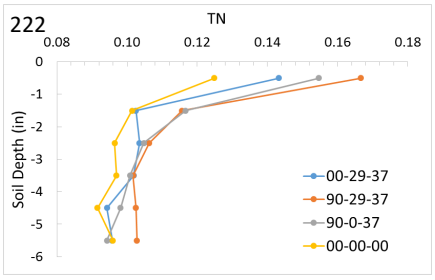
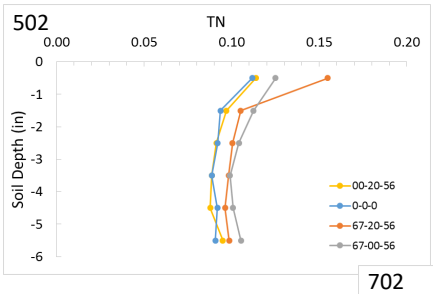
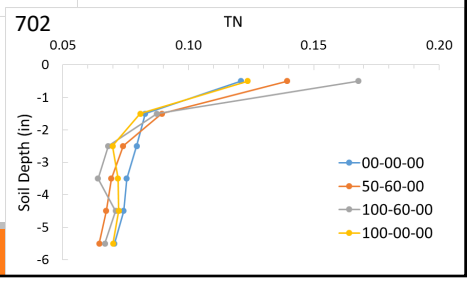
# Total Nitrogen




At all three locations total N is increased with the addition of N down to 2" deep.

Addition of limited nutrients, P, increases Total N.

Do not see significant increase in Total N at depth even with 100 lbs.

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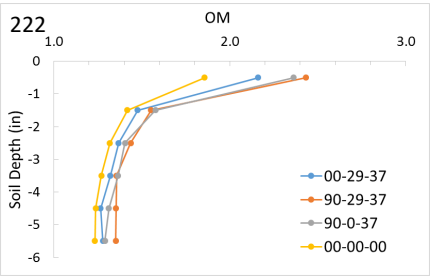
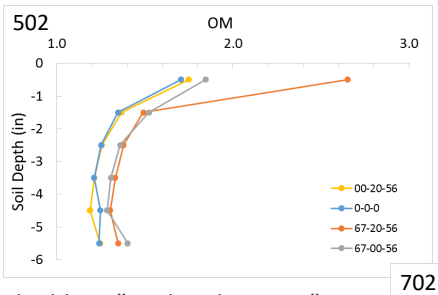
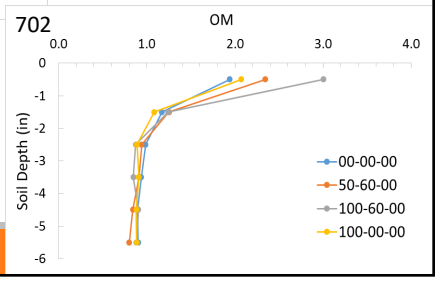
# Total Organic Matter




OM accumulated in the top 1" with little build in 2" and nothing in 3".

OM built by adding most limiting nutrient. Note how N+P is the greatest.

Even check has an increase of 0.5 – 1.0% in top inch.

Remember 222 and 502 no-till initiated in 2010 and 702 in 2005.

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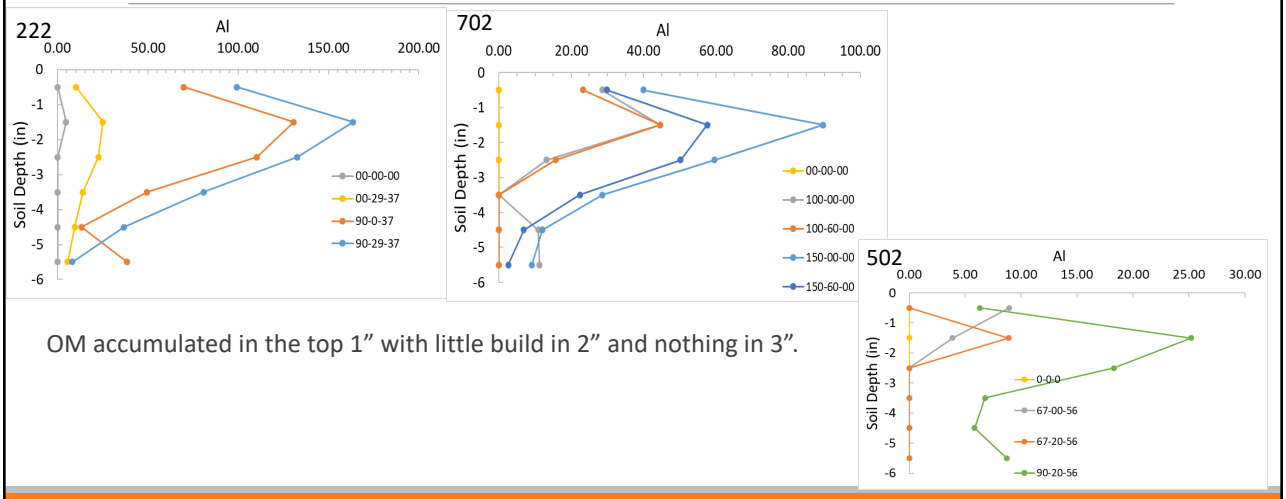
# KCl Extractable Al

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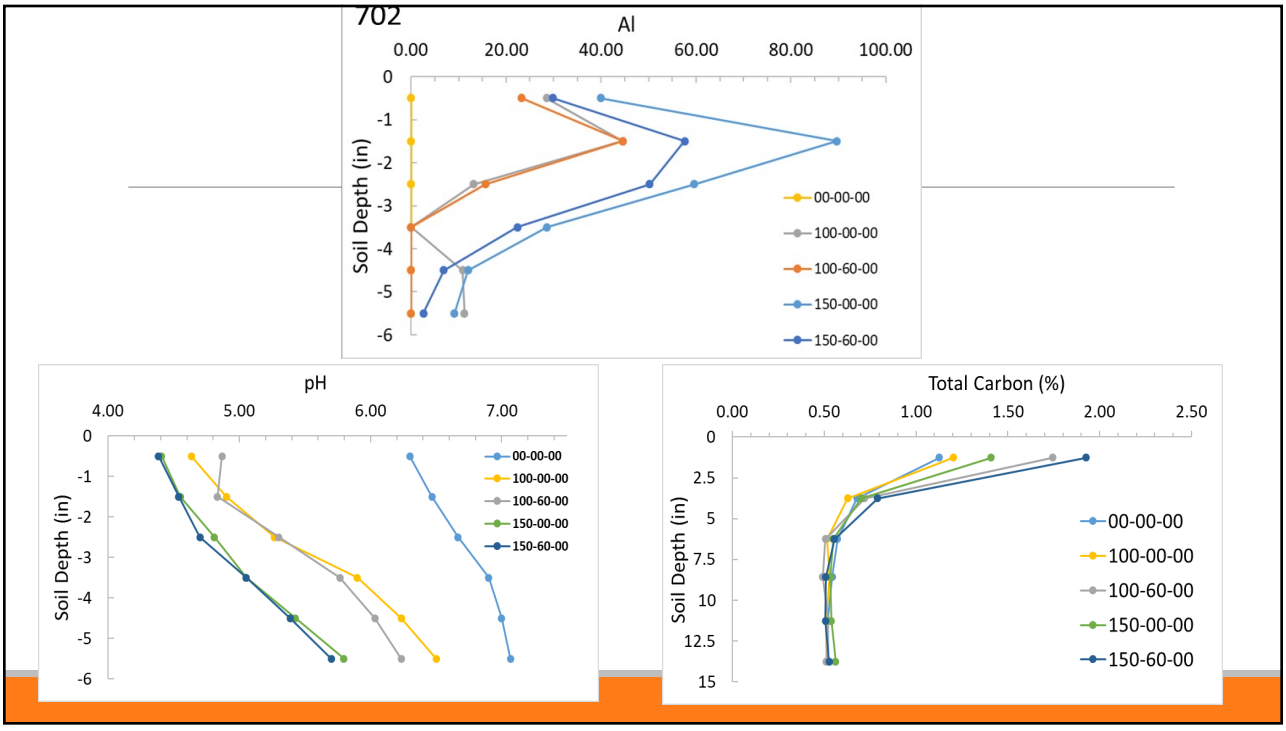
9

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# 502 Mass Balance in last 10 years.

Wanted to show:

That even with Significant negative nutrient balance All nutrients concentrations increased in the top 1-2".

Interesting N balance of 60 lbs of N is near zero after 10 years.

| 2009-2018 | T1 | T2 | T5 | T8 |
|---|---|---|---|---|
| 10 yrs | 0-0-0 | 0-40-60 | 60-40-60 | 60-0-60 |
| N Applied | 0 | 0 | 600 | 600 |
| P Applied | 0 | 400 | 400 | 0 |
| K Applied | 0 | 600 | 600 | 600 |
| Yield Bushel | **240** | **244** | **417** | **392** |
| N Uptake | 360 | 365 | 625 | 589 |
| P Uptake | 120 | 122 | 208 | 196 |
| K Uptake | 84 | 85 | 146 | 137 |
| N Balance | -360 | -365 | -25 | 11 |
| P Balance | -120 | 278 | 192 | -196 |
| K Balance | -84 | 515 | 454 | 463 |

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# Depth of Sample and P Recs..

| **702** | **M3P** | | | **222** | **M3P** | | | **502** | **M3P** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| inches | 00-00-00 | 50-60-00 | 150-60-00 | inches | 00-00-00 | 00-29-37 | 90-29-37 | inches | 0-0-0 | 00-20-56 | 67-20-56 | 90-20-56 |
| 0-1 | 44.2 | 144.3 | 107.1 | 0-1 | 65.6 | 215.8 | 189.7 | 0-1 | 61.09 | 136.62 | 161.03 | 84.74 |
| 1-2 | 35.0 | 136.9 | 110.3 | 1-2 | 33.8 | 160.8 | 125.8 | 1-2 | 44.98 | 138.76 | 140.04 | 59.82 |
| 2-3 | 27.8 | 94.6 | 83.1 | 2-3 | 22.2 | 123.3 | 96.9 | 2-3 | 33.94 | 125.95 | 106.68 | 39.61 |
| 3-4 | 19.9 | 73.1 | 61.2 | 3-4 | 13.8 | 95.5 | 75.0 | 3-4 | 33.08 | 107.57 | 85.13 | 26.95 |
| 4-5 | 15.3 | 55.1 | 46.0 | 4-5 | 7.3 | 66.5 | 46.7 | 4-5 | 23.61 | 87.79 | 68.78 | 25.51 |
| 5-6 | 11.9 | 41.0 | 22.1 | 5-6 | 3.5 | 43.1 | 24.9 | 5-6 | 17.18 | 63.85 | 50.92 | 19.95 |
| **0-6** | **26.0** | **61.2** | **51.6** | **0-6** | **22.6** | **105.2** | **89.4** | **0-6** | **32.79** | **104.92** | **104.77** | **37.94** |
| **0-5** | **28.44** | **100.81** | **81.54** | **0-5** | **28.52** | **132.39** | **106.79** | **0-5** | **39.34** | **119.34** | **112.33** | **47.33** |

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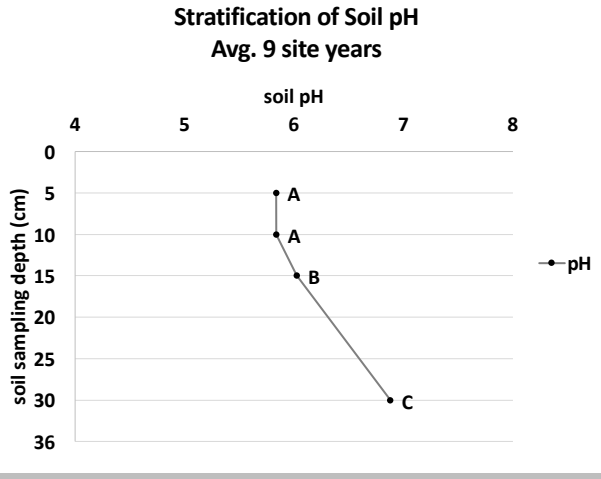
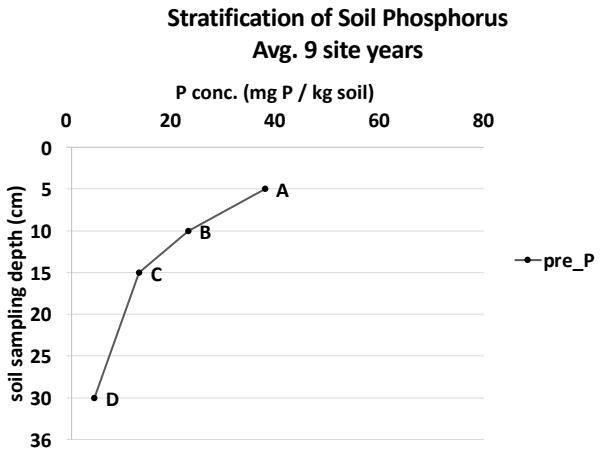
# Watkins et al.

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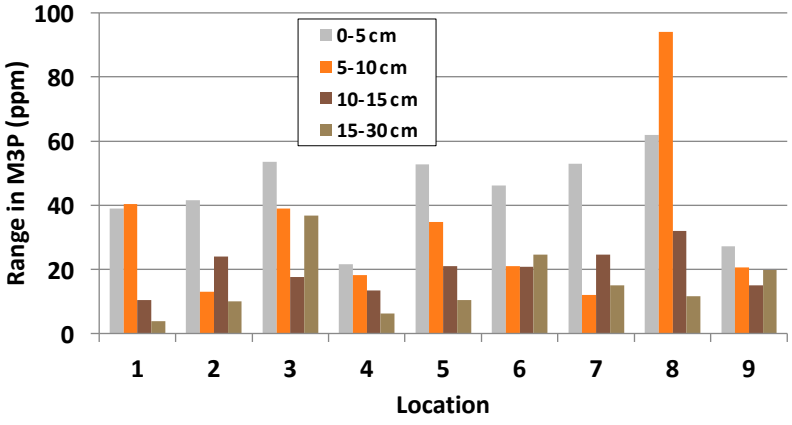
# 3-D Variability




| Location | Sampling Depth | Mehlich III Extractable P | | | Soil pH | | |
|---|---|---|---|---|---|---|---|
| | | Min | Max | Ave | Min | Max | Ave |
| | cm | Mg P kg$^{-1}$ | | | | | |
| **Stillwater** | 0 -5 | ***2.2*** | ***41.1*** | 11.8 | ***5.9*** | ***8.1*** | 6.9 |
| | 5 -10 | ***2.9*** | ***43.3*** | 7.3 | ***6.3*** | ***8.2*** | 7.3 |
| | 10 -15 | 2.3 | 12.7 | 4.9 | 6.2 | 5.2 | 7.3 |
| | 15 -30 | 1.5 | 5.3 | 2.7 | 6.6 | 9.1 | 7.8 |

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# No-Till Wheat Recs

| Year | Location | County | Soil Type | Initial Soil Mehlich III P 0-15 cm depth mg P / kg soil | Soil pH | OSU Rate kg P $ha^{-1}$ |
|---|---|---|---|---|---|---|
| 2014 | Stillwater | Payne | Huska silt loam | 1 | 6.6 | 36.2 |
| | Red Rock 1 | Noble | Bethany silt loam | 10.13 | 5.3 | 19.5 |
| | Red Rock 2 | | Kirkland silt loam | 18.5 | 4.6 | 11.3 |
| | Red Rock 3 | | Bethany silt loam | 20 | 5.4 | 10.2 |
| | Waukomis 1 | Garfield | Port silt loam | 34 | 4.8 | 0 |
| | Waukomis 2 | | Grant silt loam | 10 | 5.7 | 19.6 |
| 2015 | Stillwater | Payne | Huska silt Loam | 5 | 6.8 | 29.4 |
| | Garber | Garfield | Kirkland silt loam | 39 | 5.5 | 0 |
| | Waukomis | | Grant silt loam | 23 | 5.1 | 7.4 |

* OSU rate does not include the P adjustment for acidic soil conditions

Minimum of 10 years in a no-till management system.

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# Purdue

Nutrient stratification has not been a problem in most situations. However, there is some indication that in some long-term no-till fields, under drought stress, nutrient deficiencies can occur if the lower portions of the old plow layer have become nutrient deficient.

**Therefore, you may want to monitor nutrient status in the 4- to 8-inch deep zone in these fields, especially for K.**

If the K level in this zone drops into the deficient range, tillage to re-mix the nutrients in the surface or deep placement of K fertilizers could be used. Recent work in Minnesota has shown that deep placement of K is an effective means of overcoming this weather-related problem.

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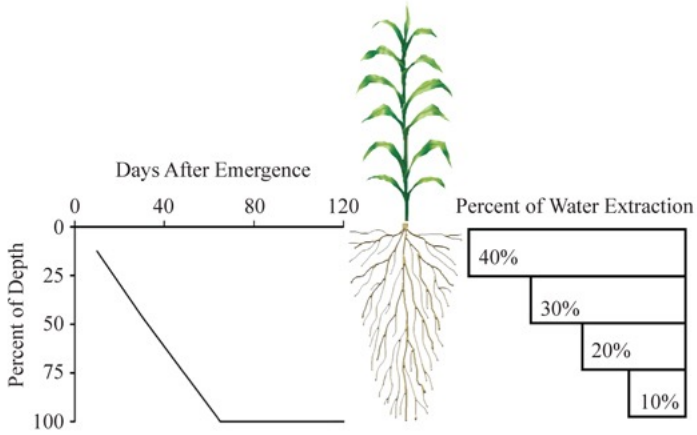


Figure 2. Root zone soil water extraction and plant root development patterns.

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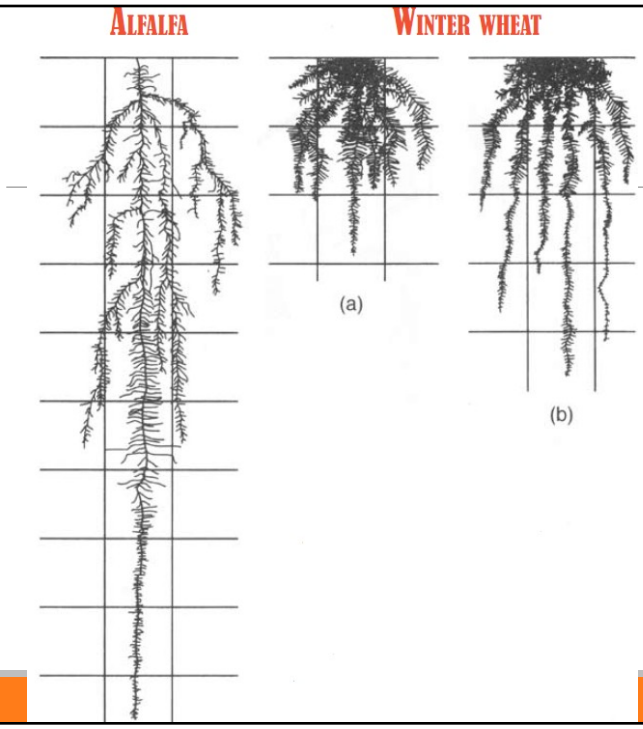


Mature root systems for alfalfa and winter wheat for dryland (a) and irrigated (b) systems. Grid lines are 1 foot apart.
(From Havlin et al., 1999).

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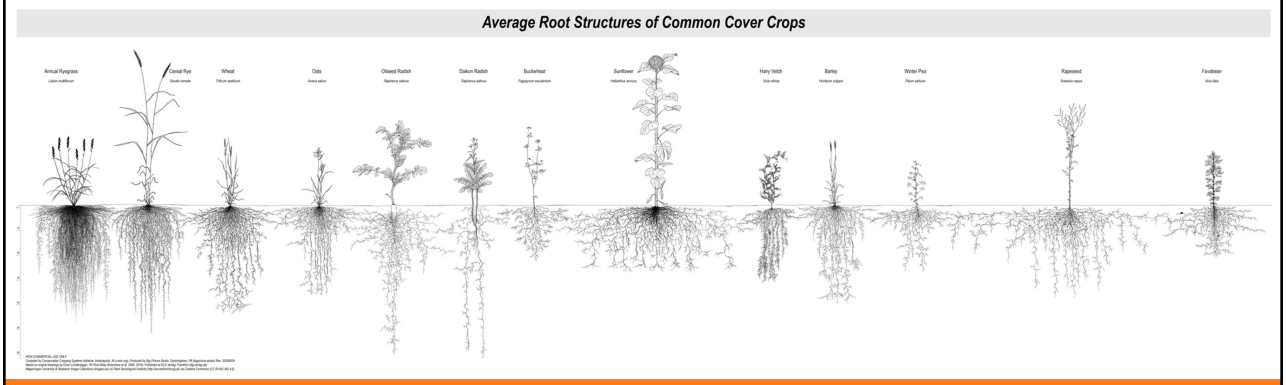


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# Impacts

Nutrient availability in dry environments

Surface Soil Acidity and Lime

Herbicides…….

- Surface pH
- Surface OM

Strategic Tillage …..

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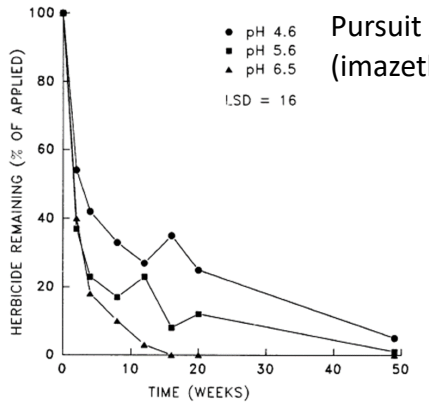
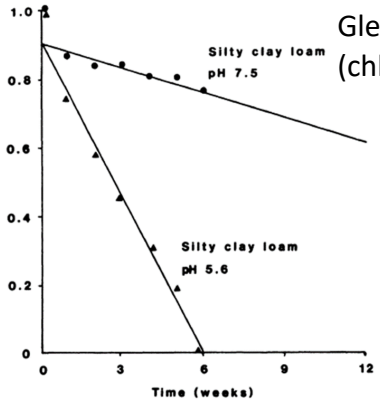
# Impacts: Herbicide Efficacy Group 2s




Pursuit (imazethapyr)




Glean (chlorosulfron)

Loux and Reese, Weed Tech. 7:452-458

Frederickson and Shea, Weed Sci. 34:328-332

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## Metribuzin

| Depth of soil sample | Days to half-life 0-2” | 2-4” | 4-8” |
|---|---|---|---|
| pH=4.6 | 74 days | 180 days | 171 days |
| pH=5.6 | 70 days | 76 days | 122 days |
| pH=6.7 | 55 days | 122 days | 136 days |

Metribuzin was more persistent in acidic conditions

Ladlie et al., Weed Science , Sep., 1976, Vol. 24, No. 5 (Sep., 1976), pp. 508-511

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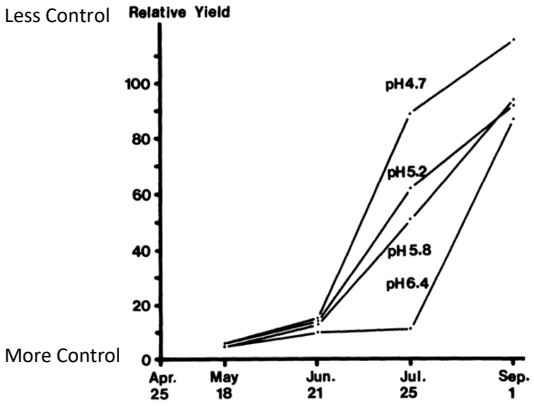
# Impacts: Herbicide Efficacy Atrazine




Hiltbold and Buchanan, Weed Sci. 25:515-520

- Atrazine control decreases more quickly in acidic conditions
- Several universities have implemented stratified sampling procedures to address stratification of pH, OM, and nutrients. (KSU, Wisc. NDSU, Ore. St.)

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# Impacts: Herbicide Efficacy

PULL HERE TO OPEN

**RESTRICTED USE PESTICIDE**
**(GROUND AND SURFACE WATER CONCERNS)**

FOR RETAIL SALE TO AND USE ONLY BY CERTIFIED APPLICATORS OR PERSONS UNDER THEIR DIRECT SUPERVISION, AND ONLY FOR THOSE USES COVERED BY THE CERTIFIED APPLICATOR'S CERTIFICATION.
THIS PRODUCT IS A RESTRICTED-USE HERBICIDE DUE TO GROUND AND SURFACE WATER CONCERNS. USERS MUST READ AND FOLLOW ALL PRECAUTIONARY STATEMENTS AND INSTRUCTIONS FOR USE IN ORDER TO MINIMIZE POTENTIAL FOR ATRAZINE TO REACH GROUND AND SURFACE WATER.

BRAWL II ATZ herbicide

TENKÖZ

**Herbicide**

*For weed control in corn and grain or forage sorghum*

| *Active Ingredients:* | |
|---|---|
| Atrazine (CAS No. 1912-24-9) | 33.0% |
| Atrazine related compounds | 0.7% |
| S-metolachlor (CAS No. 87392-12-9) | 26.1% |
| *Other Ingredients:* | 40.2% |
| Total: | 100.0% |

*Brawl II ATZ contains 3.1 lbs. atrazine + relateds per gallon and 2.4 lbs. S-metolachlor active ingredient per gallon.*

**Table 3: Brawl II ATZ – Preplant Surface, Preplant Incorporated, or Preemergence – Corn**

| Soil Texture | Broadcast Rate Per Acre: Less Than 3% Organic Matter | Broadcast Rate Per Acre: 3% Organic Matter or Greater |
|---|---|---|
| COARSE Sand, loamy sand, sandy loam | 1.3 qts. | 1.6 qts. |
| MEDIUM Loam, silt loam, silt | 1.6 qts. | 2.1 qts. |
| FINE Sandy clay loam, silty clay loam, clay loam, sandy clay, silty clay, clay | 2.1 qts. | A. 2.1 qts.<br>B. 2.1-2.58 qts.* |
| Muck or peat soils (more than 20% organic matter) | DO NOT USE | |

*For cocklebur, yellow nutsedge, and velvetleaf control on fine-textured soils above 3% organic matter: Apply 2.58 qts. of Brawl II ATZ per acre.

A. Do not exceed this rate on highly erodible land with less than 30% plant residue cover. Control of certain weeds may be reduced and a tank mix partner or an application of a postemergence herbicide may be needed.

B. Use this rate for all other applications.

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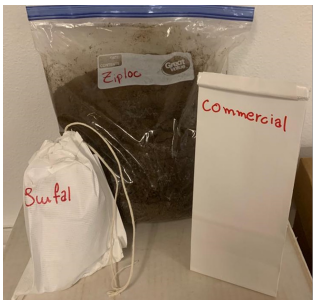
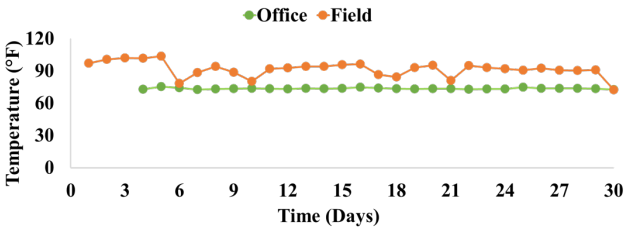
# Soil Bags and Sample Handling

Soil was homogenized, placed in SWFAL, Commercial, or Ziploc bags.
Those bags placed in a parked van (in August) or indoors

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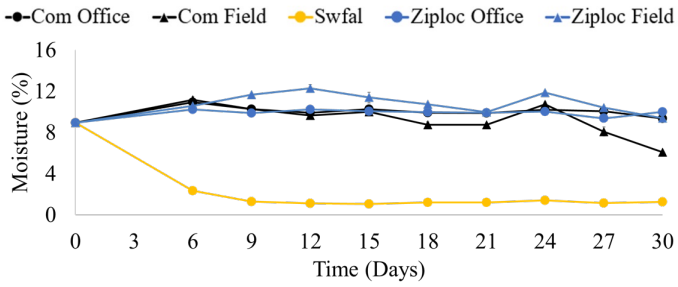
# Soil Bags and Sample Handling.

Moisture difference was obvious.
See the soil color in the picture.





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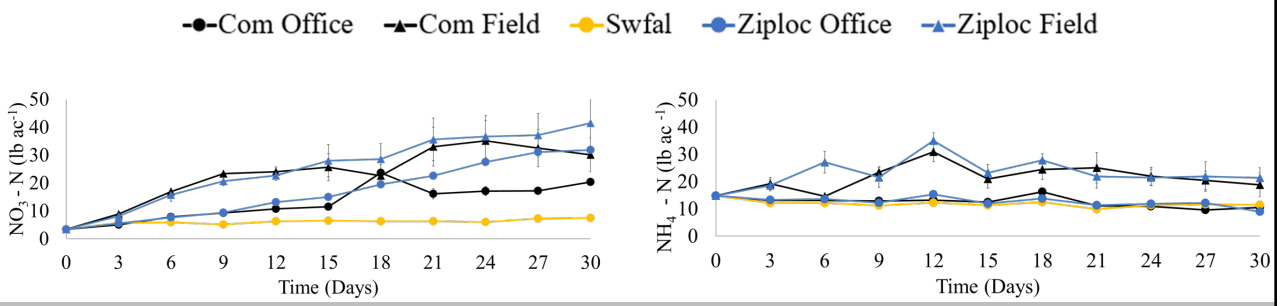
# Soil Bags and Sample Handling.

Basically, the sealed Ziploc and the sealed (folded) commercial bag made a little greenhouse. The N and C cycle roared!!!

In some samples after six days N values increased by 40 lbs.. FYI our fields are not green houses

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# Soil Bags and Sample Handling

- In some samples soil test N was over 10x the original day of sampling values.
- If we assume 0.8 lb. N per bushel of corn we will be essentially losing 8 bu. yield per day when samples are mishandled.
- Sampling season maybe different but can still induce a greenhouse effect.

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