# NITROGEN APPLICATIONS AND RESIDUE DECOMPOSITION

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# Objectives

- Determine the influence of pre-season (fall) N fertilization at low rates (30 and 100 lb N/acre) on corn residue decomposition in no-till corn production.
- Monitor the effects of pre-season (fall) N treatments and residue chopping on residue quantity, carbon and nitrogen composition, and soil temperature.

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# Treatments

- Times and rates of N (UAN and ammonium sulfate)
- Sulfur as gypsum applied to equalize sulfur
- Residue fall chopped or not chopped.

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# Measurements

- Soil nitrate (Fall, PPNT, PSNT)
- Residue quantity and composition
- Soil temperature, 4 in. depth
- Corn silage and grain yield

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# Treatments
# N timing, source, & rate (lb N/a)

| Fall | Spring | Total |
|---|---|---|
| 0 | 0 | 0 |
| 30 UAN | 0 | 30 |
| 30 AS | 0 | 30 |
| 100 AS | 0 | 100 |
| 0 | 100 AS | 100 |
| 30 UAN | 160 UAN | 190 |
| 30 AS | 160 AS | 190 |
| 0 | 190 UAN | 190 |
| 0 | 190 AS | 190 |
| 100 AS | 90 UAN | 190 |

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# Nylon mesh bag for residue quantity & composition measurements

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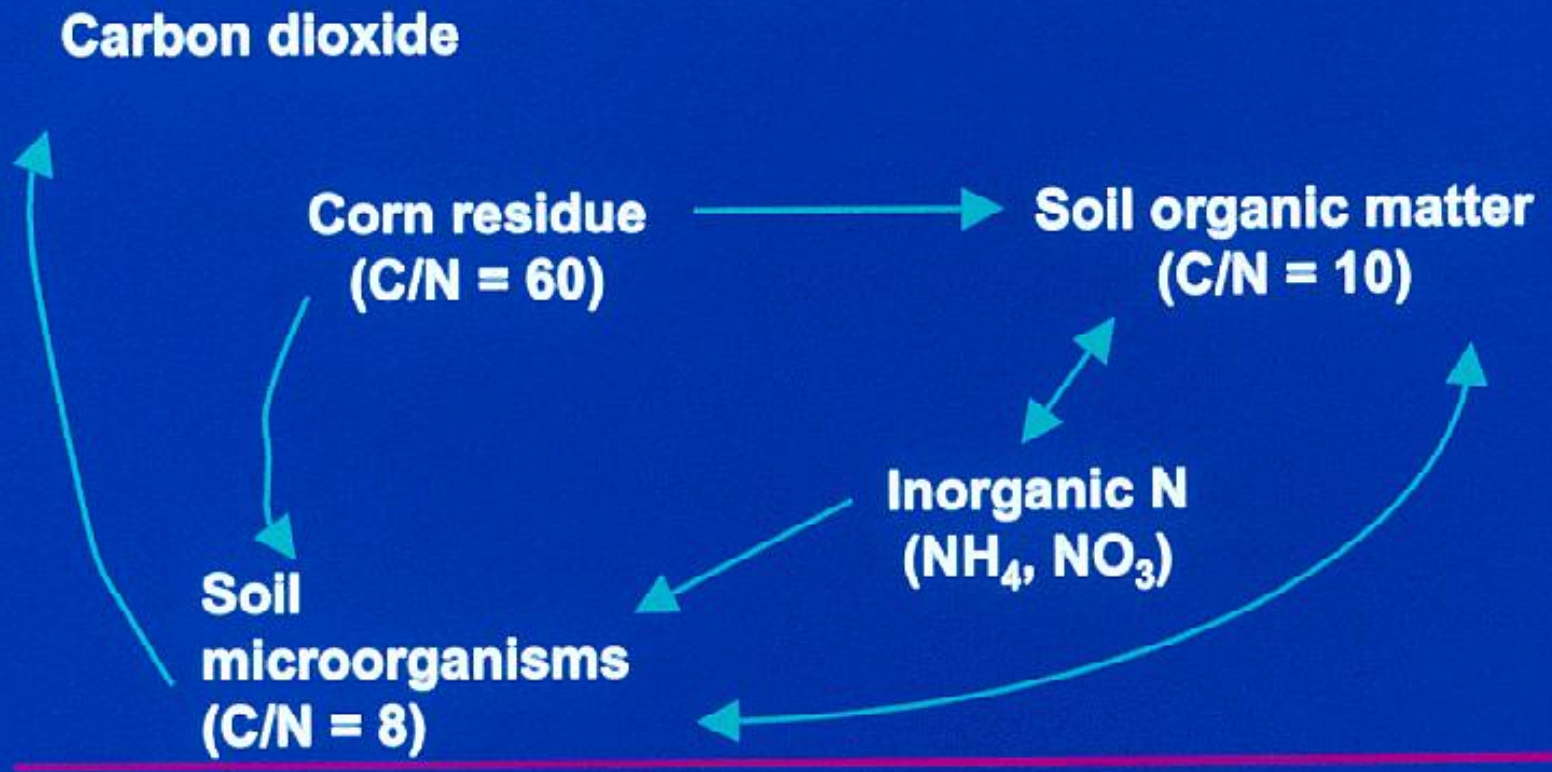
# Carbon and nitrogen transformations in corn residue decomposition



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# Soil nitrate-N content at preplant and PSNT, Arlington, 1999.

| | PPNT | PSNT |
|---|---|---|
| Treatment | Apr 99 | Jun 99 |
| - lb N/acre - | -- Nitrate-N, lb/acre (0-3 ft) -- | |
| 0 | 156 | 96 |
| 30 UAN | 160 | 92 |
| 30 AS | 180 | 92 |

April – June rainfall = 5.4 inches over normal

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# Soil nitrate-N content at preplant and PSNT, Arlington, 2000.

| | PPNT | PSNT |
|---|---|---|
| Treatment | 14 Apr 00 | 19 Jun 00 |
| - lb N/acre - | -- Nitrate-N, lb/acre (0-3 ft) -- | |
| 0 | 131 | 40 |
| 30 UAN | 115 | 44 |
| 30 AS | 100 | 56 |

April – June rainfall = 10 inches over normal

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# Preplant soil nitrate-N content Arlington, WI, 1999-2001

| Treatment | Apr 99 | 14 Apr 00 | 30 Apr 01 |
|---|---|---|---|
| - lb N/acre - | -- Nitrate-N, lb/acre (0-3 ft) -- | | |
| 0 | 156 | 131 | 49 |
| 30 UAN | 160 | 115 | 70 |
| 30 AS | 180 | 100 | 58 |

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# Dry matter amounts at several times in the chopped residue treatment, Arlington, WI 1998-2001

| Sampling time | ---- Residue (lb dry matter/acre) ---- | | |
|---|---|---|---|
| | 1998-99 | 1999-2000 | 2000-2001 |
| November | 7030 | 5667 | 6023 |
| April | 6121 | 5102 | 4958 |
| June | 5417 | 4724 | 4799 |
| September | --- | 1890 | 3621 |

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# Effect of N treatment on corn residue decomposition, Arlington, 1998-1999.

| | Date | | |
|---|---|---|---|
| Fall N | 17 Dec 98 | 4 Apr 99 | 28 Jun 99 |
| -lb N/acre- | -- % residue remaining -- | | |
| 0 | 94 | 88 | 80 |
| 30 UAN | 95 | 87 | 73 |
| 30 AS | 95 | 86 | 79 |
| 100 AS | 97 | 87 | 76 |

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# Effect of N treatment on corn residue decomposition, Arlington, 1999-2000.

| | Date | | |
|---|---|---|---|
| Fall N | 30 Apr 00 | 27 Jun 00 | 26 Sep 00 |
| -lb N/acre- | -- % residue remaining -- | | |
| 0 | 92 a | 87 | 31 |
| 30 UAN | 94 a | 90 | 29 |
| 30 AS | 97 a | 79 | 35 |
| 100 AS | 76 b | 78 | 35 |

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# Effect of N treatment on corn residue decomposition, Arlington, 2000 -2001.

| | Date | | |
|---|---|---|---|
| Fall N | 24 Apr 01 | 29 Jun 01 | 13 Sep 01 |
| -lb N/acre- | -- % residue remaining -- | | |
| 0 | 79 | 88 a | 73 |
| 30 UAN | 87 | 85 a | 56 |
| 30 AS | 84 | 71 b | 49 |
| 100 AS | 79 | 75 b | 62 |

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# Carbon/nitrogen ratio and N content of corn residue at various dates, Arlington, WI, 1998-1999.

| | | N content |
|---|---|---|
| Date | C/N ratio | -- lb N/acre -- |
| 17 Nov 98 | 45 | 67 |
| 17 Dec 98 | 32 | 88 |
| 20 Apr 99 | 60 | 48 |
| 28 Jun 99 | 51 | 47 |

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# Carbon/nitrogen ratio and N content of corn residue at various dates, Arlington, WI, 1999-2000.

| | | N content |
|---|---|---|
| Date | C/N ratio | -- lb N/acre -- |
| 10 Nov 99 | 74 | 33 |
| 30 Apr 00 | 47 | 48 |
| 27 Jun 00 | 37 | 45 |
| 26 Sep 00 | 28 | 22 |

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# Carbon/nitrogen ratio and N content of corn residue at various dates, Arlington, WI, 2000 - 2001.

| | | N content |
|---|---|---|
| Date | C/N ratio | -- lb N/acre -- |
| 15 Nov 00 | 88 | 28 |
| 24 Apr 01 | 62 | 30 |
| 29 Jun 01 | 57 | 26 |
| 13 Sep 01 | 42 | 21 |

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# Nitrogen timing, source, & rate effects on corn grain yield, Arlington, 1999-2001

| N timing & rate (lb N/acre) | | Yield 1999 | Yield 2000 | Yield 2001 |
|---|---|---|---|---|
| Fall | Spring | ---------- bu/acre ---------- | | |
| 0 | 0 | 167 b | 63 e | 105 e |
| 30 UAN | 0 | 180 b | 60 e | 126 d |
| 30 AS | 0 | 178 b | 66 e | 126 d |
| 100 AS | 0 | 209 a | 112 d | 175 c |
| 0 | 100 AS | 216 a | 128 cd | 171 c |
| 30 UAN | 160 UAN | 219 a | 146 abc | 191 b |
| 30 AS | 160 AS | 220 a | 158 a | 202 ab |
| 0 | 190 UAN | 219 a | 148 ab | 194 b |
| 0 | 190 AS | 216 a | 160 a | 208 a |
| 100 AS | 90 UAN | 220 a | 136 bc | 207 a |

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# Conclusions

- Time and source of N application and residue chopping did not influence N mineralization rates or soil temperature.
- In 2001, residue decomposition measured in June was increased by fall N treatments.
- This response was not seen in the two previous years.

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# Conclusions

- Preplant soil nitrate and residue N content were also lower in 2001.
- The extent of residue decomposition was lower in 2001.
- Fall N applications in 2000 may have furnished N to stimulate residue decomposition in an otherwise N deficient environment.

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# Conclusions

- About 60 to 70% of corn residue decomposed during the subsequent growing season.
- C/N ratio of residue usually decreased from the initial November value through the following September.
- Most of this change was due to carbon loss.

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# Conclusions

- N rate affected yield, and responses to N timing and source treatments suggested N loss from fall additions and ammonia volatilization from UAN.
- Yields were not improved by fall N additions compared to similar rates of spring N.
- Fall N did not influence soil temperature or N mineralization

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# Conclusions

- For production, fall N additions to promote residue decomposition do not appear to be justified.
- Improvements in yield or other agronomic benefits were not observed in this study.
- Fall N can increase potential for over winter N loss.
- Ammonium sulfate provided more consistent crop responses than UAN solution.

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# Preplant soil nitrate-N content Arlington, WI 2001.

| | PPNT | PSNT |
|---|---|---|
| Treatment | 30 Apr 01 | 20 Jun 01 |
| - lb N/acre - | -- Nitrate-N, lb/acre (0-3 ft) -- | |
| 0 | 49 | |
| 30 UAN | 70 | |
| 30 AS | 58 | |

April – June rainfall = 2.89 inches over normal

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# N timing, source, & rate effects on corn grain yield, Arlington, 1999 and 2000

| N Timing and rate (lb N/acre) | | Yield 99 | Yield 00 |
|---|---|---|---|
| Fall | Spring | bu/acre | |
| 0 | 0 | 167 b | 63 e |
| 30 UAN | 0 | 180 b | 60 e |
| 30 AS | 0 | 178 b | 66 e |
| 100 AS | 0 | 209 a | 112 d |
| 0 | 100 AS | 216 a | 128 cd |
| 30 UAN | 160 UAN | 219 a | 146 abc |
| 30 AS | 160 AS | 220 a | 158 a |
| 0 | 190 UAN | 219 a | 148 ab |
| 0 | 190 AS | 216 a | 160 a |
| 100 AS | 90 UAN | 220 a | 136 bc |