NO-TILL SWEET CORN

Presented at
Fruit & Vegetable Growers Association of Delaware
Processing Vegetable Session
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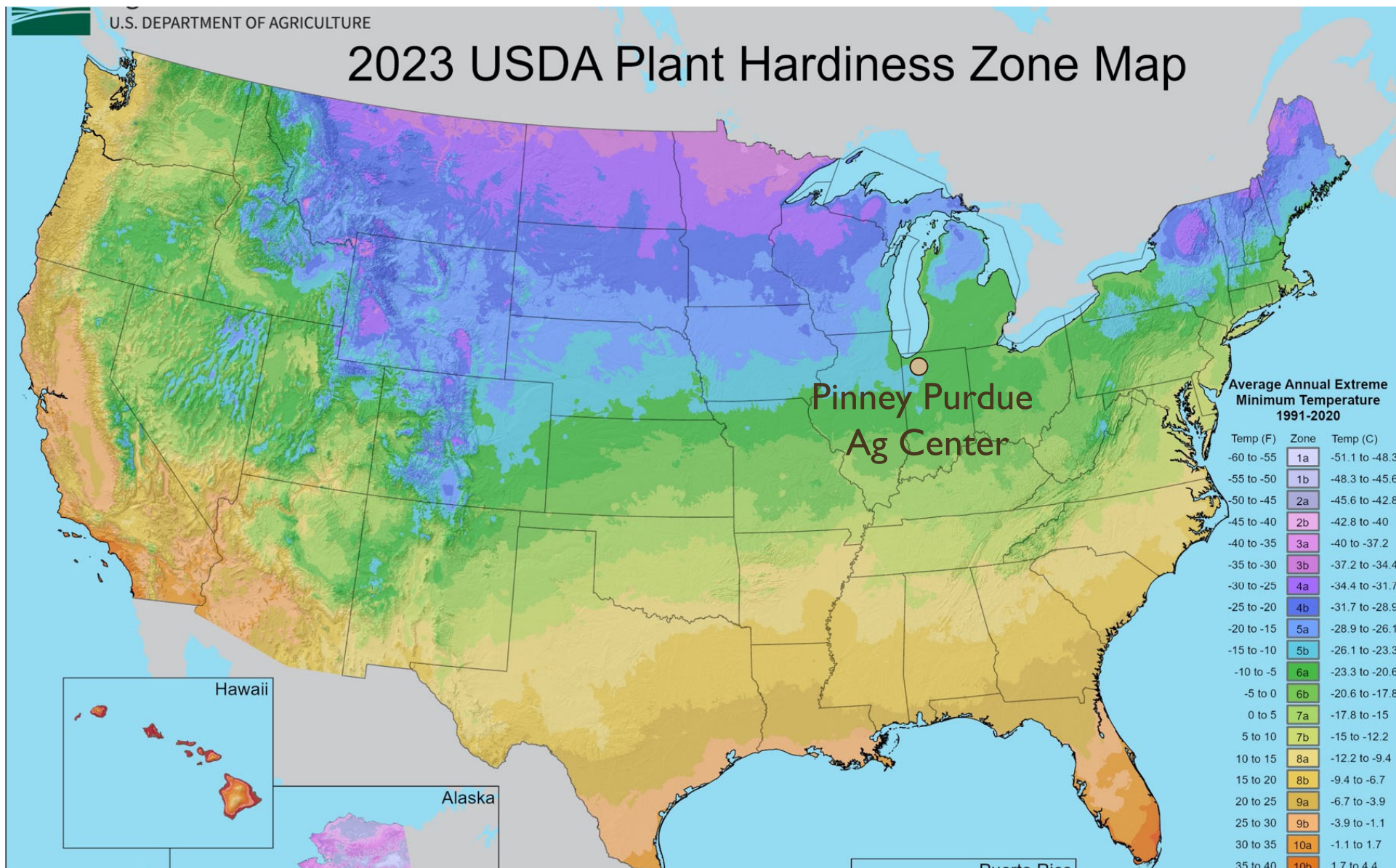Dept. of Horticulture and Landscape Architecture
Purdue University

1

Farmers want to protect their soils. **Rye is one of the most common species for cover crop in grain fields in the Midwest.**

- Soil Erosion
- Nitrate Leaching
- Resistant Weed Populations
- Water Retention
- Soil Organic Matter

2

Slide courtesy Dan Quinn

2023 USDA Plant Hardiness Zone Map

Pinney Purdue
Ag Center

Hawaii

Alaska

Puerto Rico

Average Annual Extreme Minimum Temperature 1991-2020

Temp (F)	Zone	Temp (C)
-60 to -55	1a	-51.1 to -48.3
-55 to -50	1b	-48.3 to -45.6
-50 to -45	2a	-45.6 to -42.8
-45 to -40	2b	-42.8 to -40
-40 to -35	3a	-40 to -37.2
-35 to -30	3b	-37.2 to -34.4
-30 to -25	4a	-34.4 to -31.7
-25 to -20	4b	-31.7 to -28.9
-20 to -15	5a	-28.9 to -26.1
-15 to -10	5b	-26.1 to -23.3
-10 to -5	6a	-23.3 to -20.6
-5 to 0	6b	-20.6 to -17.8
0 to 5	7a	-17.8 to -15
5 to 10	7b	-15 to -12.2
10 to 15	8a	-12.2 to -9.4
15 to 20	8b	-9.4 to -6.7
20 to 25	9a	-6.7 to -3.9
25 to 30	9b	-3.9 to -1.1
30 to 35	10a	-1.1 to 1.7
35 to 40	10b	1.7 to 4.4

Winter Rye Cover Crop Seeded Sept. 25, 2020

- About 100 lbs./A.
- Variety Hazlett
- JD 8300 Drill after soybean harvest

Nov. 9, 2020

May 10, 2021

April 22, 2021

Brown flags mark HERB plots (rye to be killed with glyphosate)

White flags mark corners of sweet corn plots

Yellow flags mark BARE plots

Orange flags mark corners of pumpkin plots

- chickweed
- crucifers
- marestail

Tilled Apr. 16

- BARE

    Fall-planted rye terminated in April with tillage and/or glyphosate

    Soil prepared with conventional tillage

- HERB

    Fall-planted rye terminated with glyphosate in May

    No-till planting

- ROLL (RPOST)

    No-till planting into standing rye

    Rye terminated by roller-crimping after planting

- RPRE

    Rye terminated by roller-crimping before planting

    No-till planting

- STRIP

    Remlinger strip-till bar March 30

    No-till planting into standing rye

    Rye terminated by roller-crimping after planting

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- Standard Rubber

STD

- Cruiser Extreme

CE

- Furrow Cruiser

FC

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Varieties and Planting Periods

Varieties

- Catalyst
  Illinois Foundation Seeds
  66 day bicolor
  sh2
  Xtra-sweet™

Source: IFSI.com

- Flagler
  HM Clause
  77 day bicolor
  sh2
  Quality Elite™

Planting Periods

- May 30 – June 11
- June 22
- July 1 – July 7

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Tillage, Closing Wheels, Planting Dates, Varieties

	2020	2021	2022	2023
Tillage				
BARE	√	√	√	√
HERB	√	√	√	√
ROLL	√	√	√	√
RPRE	√	√		
STRIP				√
Closing Wheel				
STD	√	√	√	√
CE			√	√
FC			√	√
Planting Date				
5/30-6/11	√	√	√	√
6/22			(√)	
7/1-7			(√)	√
Cultivar				
Flagler	√	√	√	√
Catalyst	√	√		

(√):Yield data not collected.

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Rye, Fertilizer, and Planting Dates

	2020	2021	2022	2023
	Rye			
Seeding date	10/2/19	9/25/20	10/23/21	10/6/22
Seeding rate (lb/A)	100	100	100	100
Cultivar	VNS	Hazlett	Hazlett	Elbon
Seeding method	overseed	drill	drill	drill
Termination date (BARE)	4/27/20	4/16/21	4/29/22	4/15; 5/5/23
Termination date (HERB)	5/21/20	5/12/21	5/5; 6/3/22	5/10/23
	Fertilizer			
Broadcast (N-P2O5-K2O lb/A)	51.5-0-0	50-0-0	25-0-0	10-26-45
Broadcast date	5/11/20	4/9/21	4/26/22	4/14/23
Starter N lb/A	0	0	20	30
Sidedress N lb/A	60	60	90	90
Total N	111.5	110	135	130
	Planting Dates			
PD 1	6/9/20	6/11/21	6/10/22	5/30/23
PD 2			6/22/22	7/5/23
PD 3			7/1, 7/7/22	

11

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Before seeding, after rolling RPRE treatments

BARE

HERB

RPOST

RPRE

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13

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May 30
After seeding, before rolling ROLL and STRIP treatments

BARE

HERB

ROLL

STRIP

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Emergence Issues in Rolled Rye

June 18, 9 DAS

- Unburied seed
- Shallow furrow
- Uneven emergence

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June 11, 2021 (0 DAS)
Seeding and planting depth check in sweet corn.

Sweet Corn, PPAC 2021

BARE

HERB

RPOST and RPRE

June 10
At seeding

BARE
STD

HERB
FC

RPOST
CE

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June 16
6 DAS

Sweet Corn, PPAC 2022

BARE
STD

BARE
FC

BARE
CE

June 16
6 DAS

Sweet Corn, PPAC 2022

HERB
STD

HERB
CE

HERB
FC

June 16-17
6-7 DAS

ROLL STD
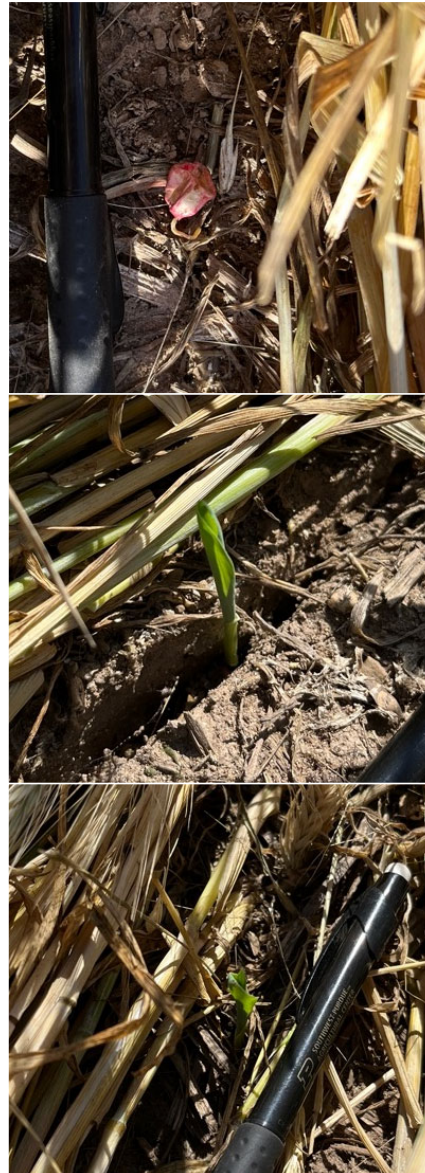
Sweet Corn, PPAC 2022

ROLL FC

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ROLL
CE

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Emergence 2023

Sweet corn emergence in three tillage treatments with three closing wheels.

Planting dates: 5/30 and 7/5/2023. Wanatah, IN, USA.

TRT
- B-STD
- B-CE
- B-FC
- H-STD
- H-CE
- H-FC
- R-STD
- R-CE
- R-FC
- S-STD
- S-CE
- S-FC

27

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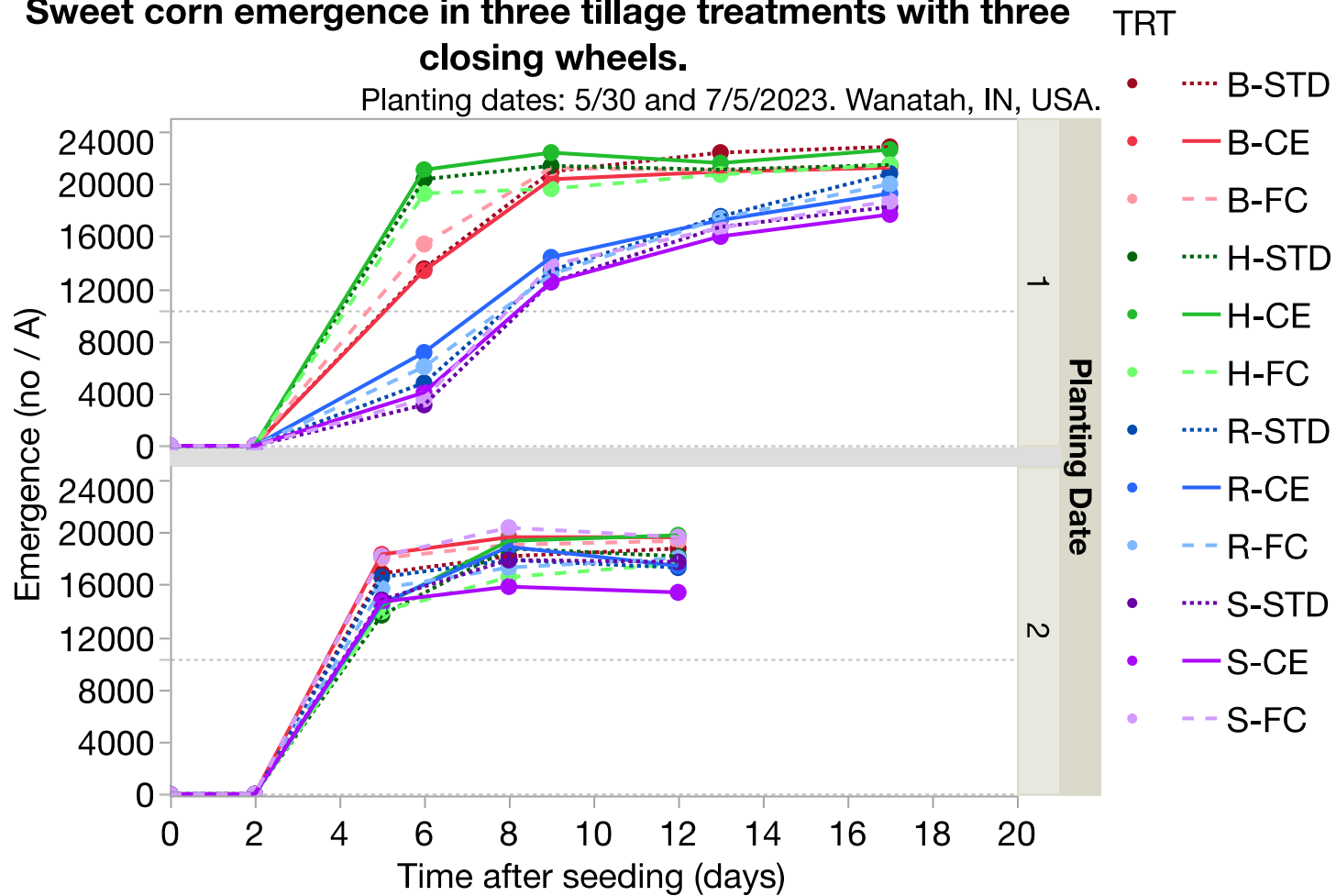
Treatment	Emergence (%)			
	2020	2021	2022	2023
BARE	93.0 A	81.7 A	72.1 AB	99.5 A
HERB	90.9 A	72.2 A	77.0 A	97.8 AB
RPOST	70.6 B	73.2 A	69.1 B	91.2 BC
RPRE	67.9 B	73.6 A	-	-
STRIP	-	-	-	88.7 C

2020 and 2021: Average across two varieties.
2022 and 2023: Average across all closing wheels.
2023: Average of May 30 and July 5 planting dates.

*Means within a column followed by the same letter do not differ at 10% (2020, 2021) or 5% (2022, 2023) level of significance.

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Emergence – Days to 50% or Early Emergence

Treatment	Emergence % 9 DAS	Emergence % 7 DAS	Days to 50% Emergence	Emergence % 5 to 7 DAS
	2020	2021	2022	2023
BARE	87.5 A	80.3 A	4.8 A	77.2 A
HERB	86.1 A	63.0 A	4.6 A	83.0 A
RPOST	31.1 B	0.0	5.1 B	52.3 B
RPRE	20.1 B	0.0	-	-
STRIP	-	-	-	47.2 B

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2023: Average of May 30 and July 5 planting dates.

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Total Emergence Affected by Closing Wheel

Treatment	Emergence (%)	
	2022	2023
STD	70.0 B	94.1 A
CE	77.0 A	94.2 A
FC	71.2 B	94.6 A

Means across all tillage treatments and planting periods.

Means within a column followed by the same letter do not differ at 5% level of significance.

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Soil Temperature vs. Tillage — 6/10/2022

Legend: BARE, HERB, ROLL, Range

Y3 (Soil Temp °F) vs. Tillage (BARE, HERB, ROLL)

Soil Moisture vs. Tillage — 6/10/2022

Legend: BARE, HERB, ROLL, Range

BARE soil was much wetter than plots with standing rye (ROLL)

Y1 (Soil Moisture v/v) vs. Tillage (BARE, HERB, ROLL)
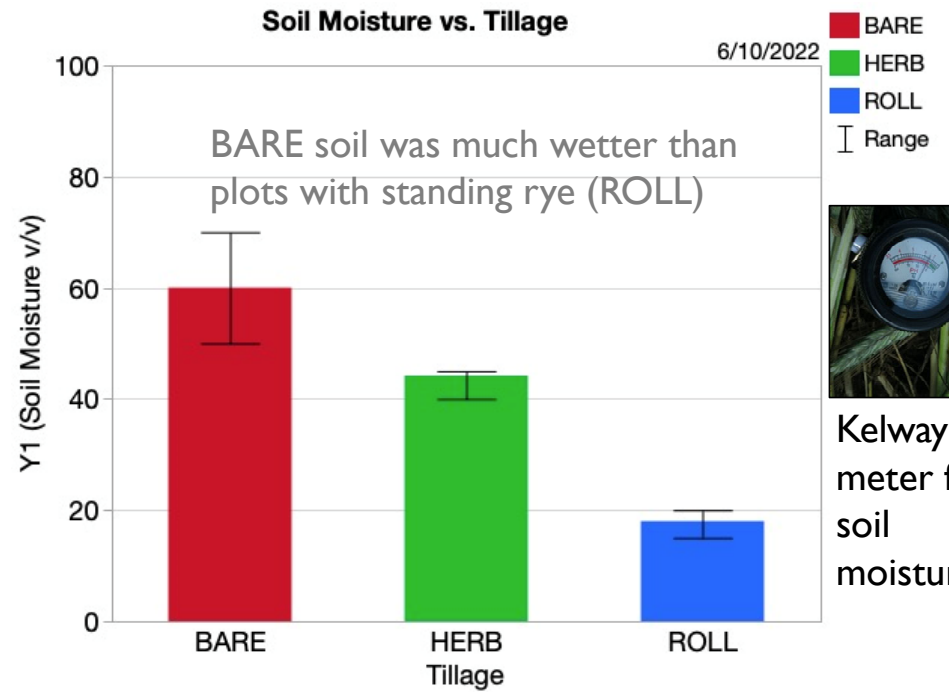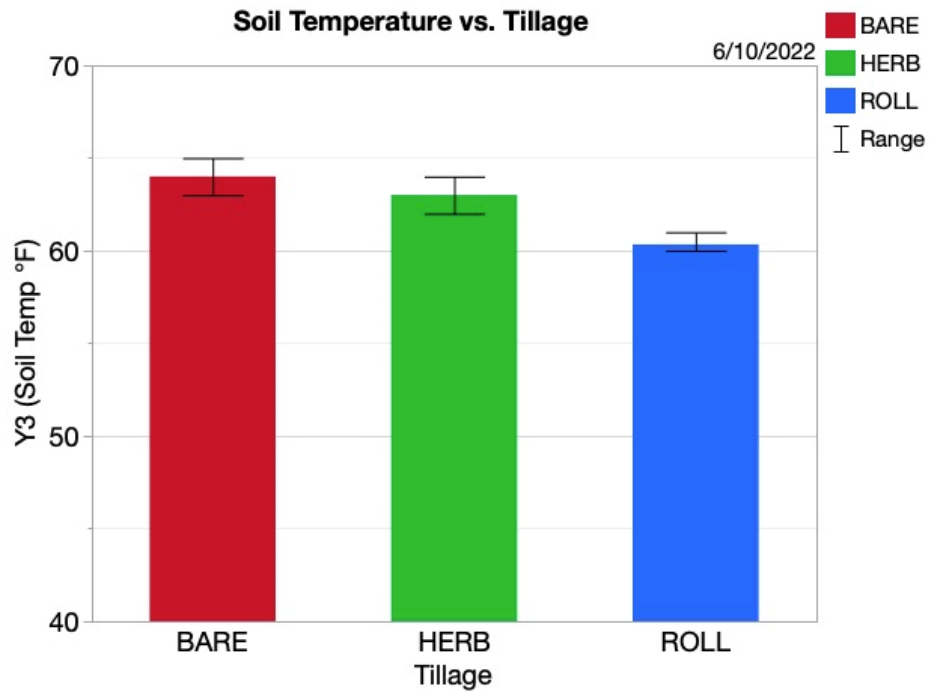
Kelway meter for soil moisture

BARE

HERB

ROLL

31

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BARE

HERB

RPOST

RPRE

Sweet Corn, PPAC 2021

BARE

HERB

RPOST

RPRE

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BARE

HERB

RPOST

RPRE

Field notes

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BARE

HERB

RPOST

RPRE

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Sweet corn six days after rain and wind
Pinney Purdue Ag Center, Wanatah, IN

No-till into herbicide-killed rye

Conventional tillage

No-till into roller-crimped rye

Aug. 17, 2021

P. Woolery

drone photo
by P. Woolery

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BARE

HERB

RPOST

8/10

7/31

37

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Days to Harvest

Treatment	Days to Harvest				
	2020	2021	2022	2023 PD1 (May 30)	2023 PD2 (July 5)
BARE	68.5 B*	68.0 ± 1.2†	72.7 ± 0.2	79.8 ± 0.3	77.5 ± 0.2
HERB	69.0 B	72.5 ± 1.4	70.2 ± 0.5	78.3 ± 0.6	77.0 ± 0.0
RPOST	76.0 A	78.5 ± 0.9	75.0 ± 0.0	85.8 ± 0.4	77.0 ± 0.4
RPRE	75.3 A	79.5 ± 1.4	-	-	-
STRIP	-	-	-	83.3 ± 0.9	77.5 ± 0.2

2022 and 2023 averaged across all closing wheels.

*Means followed by same letter do not differ at 10% level of significance.

†Mean ± standard error of mean.

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Yield and Ear Quality

All top ears harvested and then categorized as marketable or not

Number of ears

- Marketable

  'Fancy'

  Not 'Fancy'

- Unmarketable

  Underdeveloped or young

  Smut

  Other

- Data presented is for top ears only, not 2nd ears

For marketable ears only:

- Weight per plot
- Weight per ear
- Ear length (2020-21)
- Ear diameter (2020-21)
- Husk cover rating (2020-21)
- Tip fill rating (2020-21)

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Harvest – PD1 72-73 DAS

Sweet Corn, PPAC 2022

BARE STD

BARE CE

BARE FC

**BARE
STD**

**BARE
FC**

**BARE
CE**

unmarketable

undeveloped

marketable but not 'fancy'

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Harvest – PD1 69-71 DAS

Sweet Corn, PPAC 2022

HERB
STD

HERB
CE

HERB
FC

ET Maynard

HERB STD

HERB CE

HERB FC

unmarketable

undeveloped

marketable but not 'fancy'

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Harvest – PD1 75 DAS

Sweet Corn, PPAC 2022

**ROLL
STD**

**ROLL
CE**

**ROLL
FC**

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ROLL STD

ROLL FC

ROLL CE

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45

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ROLL
STD

ROLL
CE

ROLL
FC

46

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Yield – Marketable Ear Number

Treatment	Mkt. Doz/Acre			
	2020	2021	2022	2023
BARE	1227 A*	1379 A	992 A	1563 A
HERB	1009 AB	1048 B	1174 A	1410 AB
RPOST	889 B	1012 B	234 B	1224 BC
RPRE	944 B	883 C	-	-
STRIP	-	-	-	1091 C

2020 and 2021: Average across two varieties.
2022 and 2023: Average across all closing wheels.
2023: Average of May 30 and July 5 planting dates.

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Yield – Marketable Ear Weight

Sweet Corn, PPAC 2020-2023

Treatment	Mkt. Tons per Acre			
	2020	2021	2022	2023
BARE	5.9 A*	8.5 A	4.9 A	7.1 A
HERB	4.9 AB	7.3 AB	5.6 A	6.6 AB
RPOST	4.4 B	7.1 B	1.3 B	5.8 BC
RPRE	4.9 AB	7.2 B	-	-
STRIP	-	-	-	5.2 C

2020 and 2021: Average across two varieties.
2022 and 2023: Average across all closing wheels.
2023: Average of May 30 and July 5 planting dates.

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Yield – Marketable Ear Number and Weight

Closing Wheel	Mkt. Doz/Acre		Mkt. Tons/Acre	
	2022	2023	2022	2023
Standard	816 A*	1311 A	3.9 A	6.1 A
Cruiser Extreme	791 A	1343 A	3.8 A	6.3 A
Furrow Cruiser	794 A	1311 A	3.9 A	6.2 A

2023: Average of May 30 and July 5 planting dates.

*Means within a column followed by the same letter do not differ at 5% level of significance.

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Yield Components – Plant Stand at Harvest

Treatment	Plants per Acre (1000s)			
	2020	2021	2022	2023
BARE	19.3 A*	17.0 A	13.2 A	20.3 A
HERB	16.7 B	15.2 A	15.1 A	19.9 A
RPOST	15.2 B	15.1 A	13.2 A	19.2 AB
RPRE	14.9 B	15.6 A	–	–
STRIP	–	–	–	17.6 B

2020 and 2021: Average across two varieties.

2022 and 2023: Average across all closing wheels.

2023: Average of May 30 and July 5 planting dates.

*Means within a column followed by the same letter do not differ at 10% (2020, 2021) or 5% (2022) level of significance.

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Yield Components – Marketable Ear Number per 10 Plants

Treatment	Marketable Ears per 10 Plants			
	2020	2021	2022	2023
BARE	7.7 A*	9.8 A	9.0 A	9.2 A
HERB	7.3 A	8.3 B	9.3 A	8.5 AB
RPOST	7.1 A	8.0 C	2.1 B	7.7 BC
RPRE	7.6 A	6.9 D	–	–
STRIP	–	–	–	7.4 C

2020 and 2021: Average across two varieties.

2022 and 2023: Average across all closing wheels.

2023: Average of May 30 and July 5 planting dates.

*Means within a column followed by the same letter do not differ at 10% (2020, 2021) or 5% (2022) level of significance.

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53

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Yield Components – Weight per Marketable Ear

Treatment	Wt per Marketable Ear (lb)			
	2020	2021	2022	2023
BARE	0.81 A*	1.03 C	0.82 A	0.76 A
HERB	0.81 A	1.17 B	0.81 A	0.78 A
RPOST	0.84 A	1.18 B	0.74 B	0.78 A
RPRE	0.86 A	1.34 A	–	–
STRIP	–	–	–	0.80 A

2020 and 2021: Average across two varieties.
2022 and 2023: Average across all closing wheels.
2023: Average of May 30 and July 5 planting dates.

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Possible reasons for fewer marketable ears per plant

- Emergence over a long period of time; later emerging plants can't compete
- Poor establishment and growth due to shallow planting
- Injury leading to stunting or death of main stalk, possibly due to

  Caterpillar feeding - Herbicide - Stinkbug feeding
- Inadequate weed control

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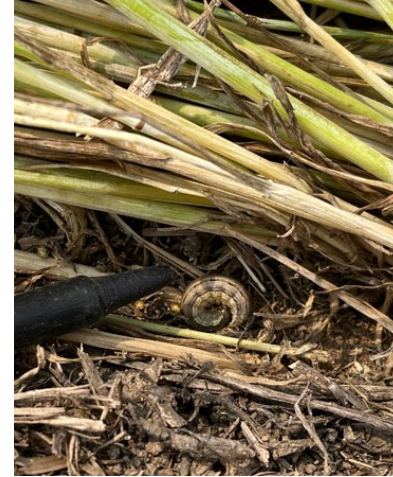
Summary

- Yield was sig. lower in no-till HERB plots 1 / 4 years.
- Yield was sig. lower in roller-crimped plots 4 / 4 years.
- Lower yield could be attributed to fewer plants and fewer marketable ears per plant—usually a bigger factor
- Improving stand establishment led to comparable yield in herbicide-killed rye in2022. Rye was planted later in fall, terminated earlier, and good moisture at planting.
- No-till with herbicide-killed rye less risky (yield) than with roller-crimped rye.
- No-till with rolled rye delayed harvest up to 1 to 1.5 week compared to conventional tillage in early planting.
- Closing wheels did not consistently influence emergence or yield.

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Aim for Success with No-till Sweet Corn

Focus on Stand Establishment

- Seed furrow depth
- Furrow closure
- Soil moisture at/after planting (target conditions, not date)
- Residue management
- Starter fertilizer use
- Row cleaners, down pressure, Etc.

Keep a Close Eye on the Crop

- Insects, Weeds, Disease, Wildlife
- Plant nutrition
- Get out and Look

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8/8/2022

THANK YOU

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