



# Effect of Tillage Practice and Cover Crop Termination Timing on Soybean Production

## Trial Objective

- Determining when to terminate a cover crop while getting the most benefit out of the cover crop and maintaining the yield potential can be impacted by the tillage practice.
- The objective of this trial was to determine the interaction between cover crop termination timing and tillage practice, as well as the effect on soybean stand, weed suppression, and yield.

## Experiment/Trial Design

| Location       | Soil Type      | Previous Crop | Tillage Type           | Planting Date | Harvest Date | Potential Yield (bu/acre) | Seeding Rate (seeds/acre) |
|----------------|----------------|---------------|------------------------|---------------|--------------|---------------------------|---------------------------|
| Gothenburg, NE | Hord silt loam | Corn          | Strip-till and no-till | 6/1/2022      | 10/18/2022   | 90                        | 160,000                   |

- This trial was designed as a split-plot with cover crop termination timing as the whole plot and tillage practice (strip-till or no till) as the sub-plot.
- The cover crop species used was winter wheat which was drilled at 120 lbs of seed/acre on 11/11/2021.
- On 4/12/2022 the trial had a base fertilizer application of 29 lbs of nitrogen (N)/acre, 60 lbs of phosphorus (P)/acre, 25 lbs of sulfur (S)/acre, and 0.25 lb of zinc (Zn)/acre. The fertilizer was applied with a strip-till machine in the strip-tilled plots and banded on the soil surface of the no-till plots.
- All treatments were planted in 30-inch rows.
- Each termination timing of 1, 3, and 5 weeks before planting (WBP), was paired with no-till and strip-till (Table 1).
- Cover crops were terminated using Roundup PowerMax® herbicide at 32 fl oz/acre with a spray volume of 15 gal/acre (Table 2).

**Table 1. Treatments with cover crop termination timings and tillage practice treatment combinations.**

| Treatment                             | Cover Crop Termination Timing | Tillage Method |
|---------------------------------------|-------------------------------|----------------|
| 1                                     | 5 WBP                         | No-till        |
| 2                                     | 5 WBP                         | Strip-till     |
| 3                                     | 3 WBP                         | No-till        |
| 4                                     | 3 WBP                         | Strip-till     |
| 5                                     | 1 WBP                         | No-till        |
| 6                                     | 1 WBP                         | Strip-till     |
| WBP, week(s) before planting soybean. |                               |                |



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| Table 2. Herbicide applications made during the 2022 growing season.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                                                                              |                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------------------------------------------------------------------------------|-------------------|
| Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Timing                      | Herbicide                                                                    | Rate (fl oz/acre) |
| 04/22/2022                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 5 WBP                       | Roundup PowerMAX® herbicide                                                  | 32                |
| 05/06/2022                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3 WBP                       | Roundup PowerMAX herbicide                                                   | 32                |
| 05/22/2022                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1 WBP + Pre in entire study | Authority® MTZ herbicide                                                     | 12                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                             | Zidua® herbicide                                                             | 4                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                             | Warrant® herbicide                                                           | 48                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                             | Roundup PowerMAX herbicide                                                   | 32                |
| 06/14/2022                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Post                        | Section® Three herbicide                                                     | 6                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                             | Warrant® herbicide                                                           | 48                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                             | Roundup PowerMAX herbicide                                                   | 32                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                             | XtendiMax® herbicide with VaporGrip® Technology, a restricted use pesticide* | 22                |
| 06/30/2022                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Post                        | XtendiMax herbicide with VaporGrip Technology*                               | 22                |
| 07/12/2022                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Post                        | Clethodim 2E herbicide                                                       | 16                |
| <p>WBP, week(s) before planting.</p> <p>*XtendiMax® herbicide with VaporGrip® Technology is part of the Roundup Ready® Xtend Crop System, is a restricted use pesticide and must be used with VaporGrip® Xtra Agent (or an equivalent volatility reduction adjuvant). For approved tank-mix products (including VRAs and DRAs), nozzles and other important label information visit <a href="https://www.bayer.com/xtendimax-application-requirements">XtendiMaxApplicationRequirements.com</a>. Applicators must check XtendiMaxApplicationRequirements.com no more than 7 days before application of this product for additional labeling, including state restrictions. Where applicable, users must comply with additional requirements found on this website.</p> |                             |                                                                              |                   |

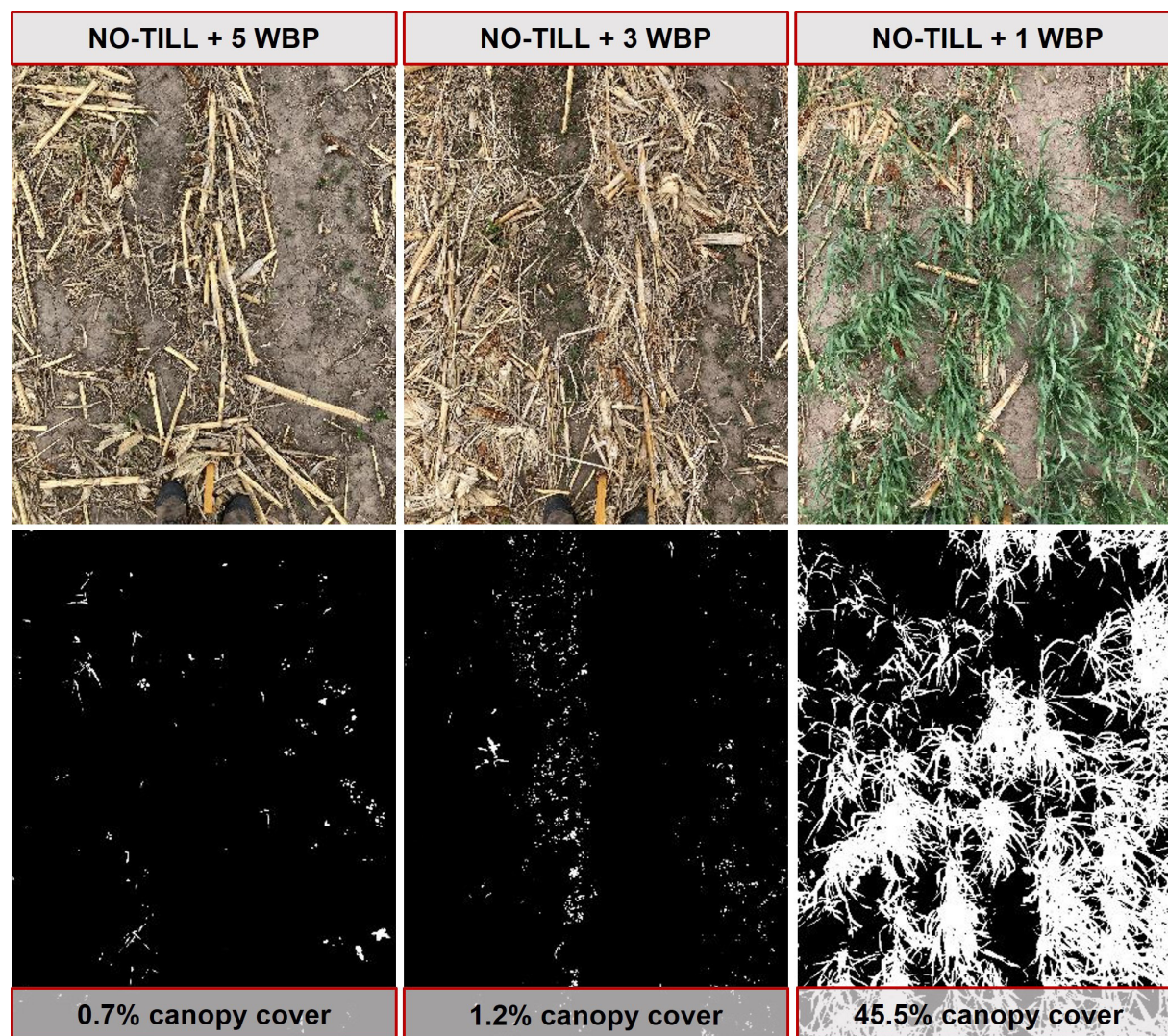
- Pre-plant, burndown, and post-emergence herbicide applications are listed in Table 2. All plots had identical weed management but differed in cover crop termination timing.
- A total of 6.48 inches of precipitation accumulated during the soybean growing season. An additional 8 inches of water was applied by sprinkler irrigation which was a limited amount, leading to lower-than-normal yields.
- Weed suppression and early soybean stand were assessed when the crop reached the V1-V2 growth stage, prior to the first post-emergence herbicide application. Late stand assessment notes were recorded close to soybean harvest time.
  - » Primary weed species evaluated in this trial were Palmer amaranth (*Amaranthus palmeri*) and volunteer corn.
- The trial was harvested with a plot combine, measuring grain moisture content, test weight, and total grain weight to determine yield.



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## Understanding the Results

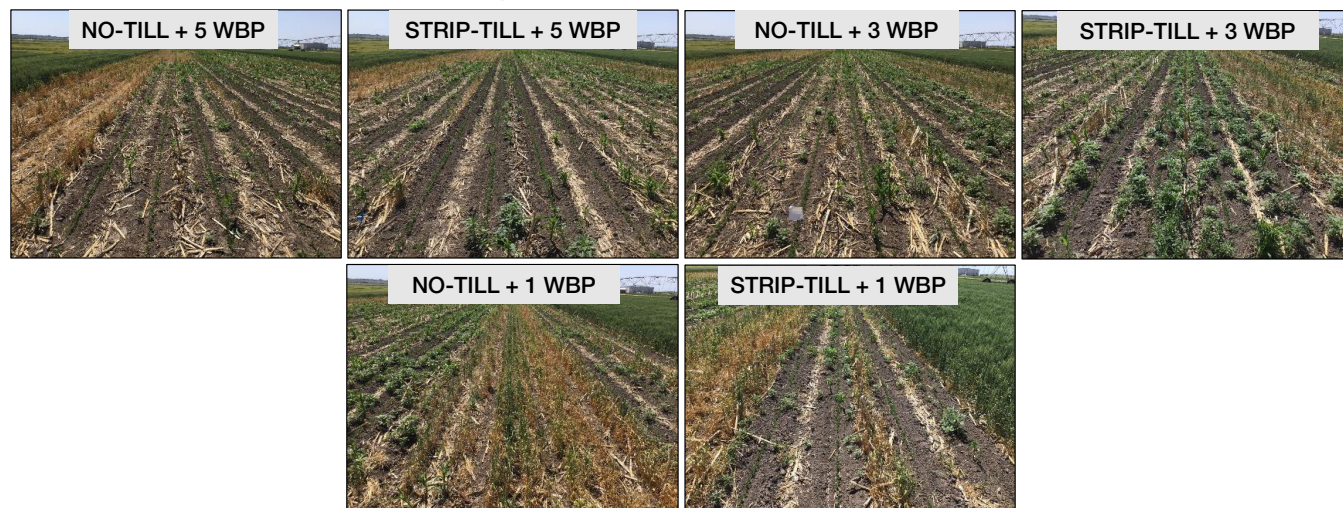
- Winter wheat biomass accumulation took off after April 25th due to dry weather in the fall of 2021 and spring of 2022. By the time 1 WBP was terminated, the cover crop canopy cover was 45.5% of the soil, compared to 1.2% and 0.5% in the 3 WBP and 5 WBP, respectively. Therefore, there was no significant cover crop growth in the 3 WBP and 5 WBP treatments (Figure 1).



**Figure 1. Cover crop biomass accumulation prior to soybean planting. Pictures were taken on 5/19/2022 at the Bayer Water Utilization Learning Center near Gothenburg, NE. WBP: week(s) before planting soybean.**

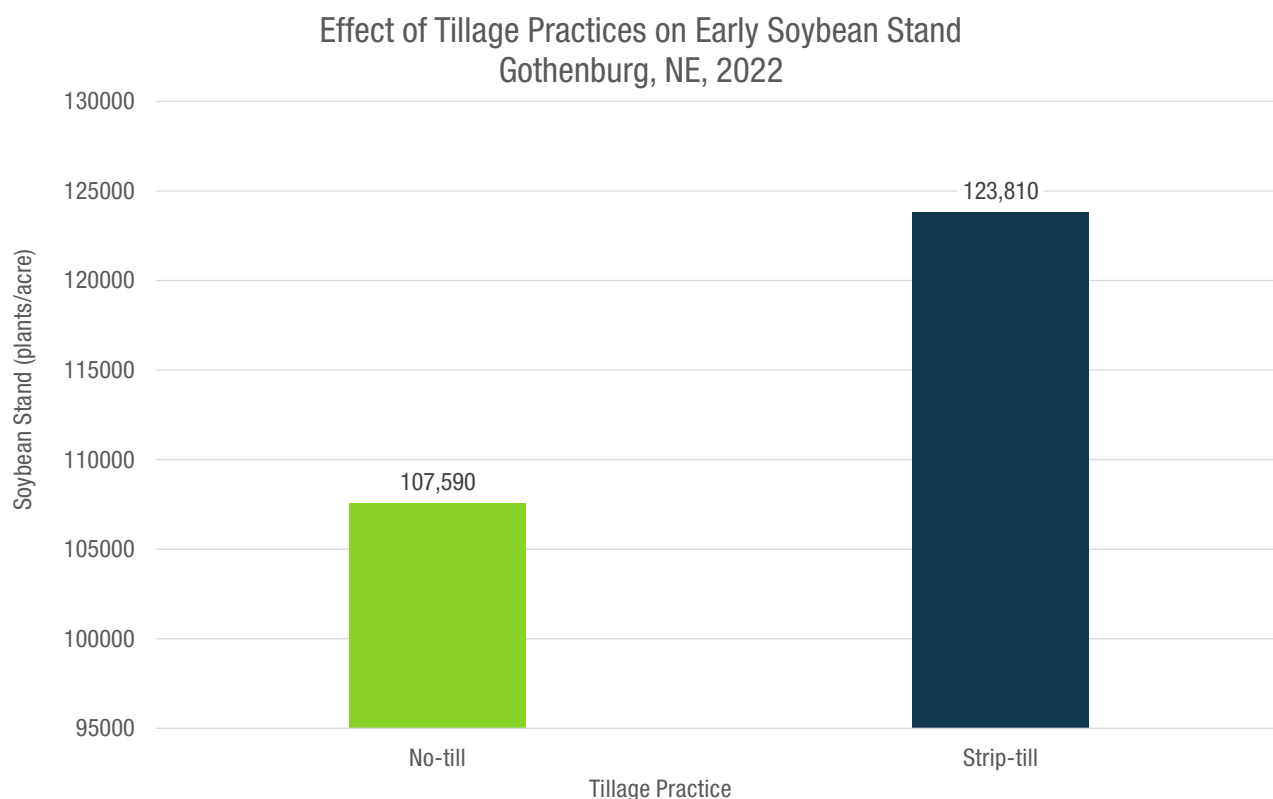
- Weed pressure in this trial was high and required four herbicide applications to achieve effective weed control. Weed suppression was greater (66%) when the cover crop was terminated 1 week before soybean planting (1 WBP) compared to 3 WBP and 5 WBP (Figure 2). The increased cover crop biomass accumulation in treatment 1 WBP helped building canopy closure to compete against weeds in the area. No difference in weed suppression was found between tillage practices.

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**Figure 2. Cover crop termination timings and tillage practice treatments in soybeans at the V1-V2 growth stage. Pictures were taken on 6/14/2022 at the Bayer Water Utilization Learning Center near Gothenburg, NE. WBP: week(s) before planting corn.**

- There was an advantage of strip-till compared to no-till for early stand of soybean which could be due to the increased seed bed quality that is provided by strip-tilling (Figure 3).

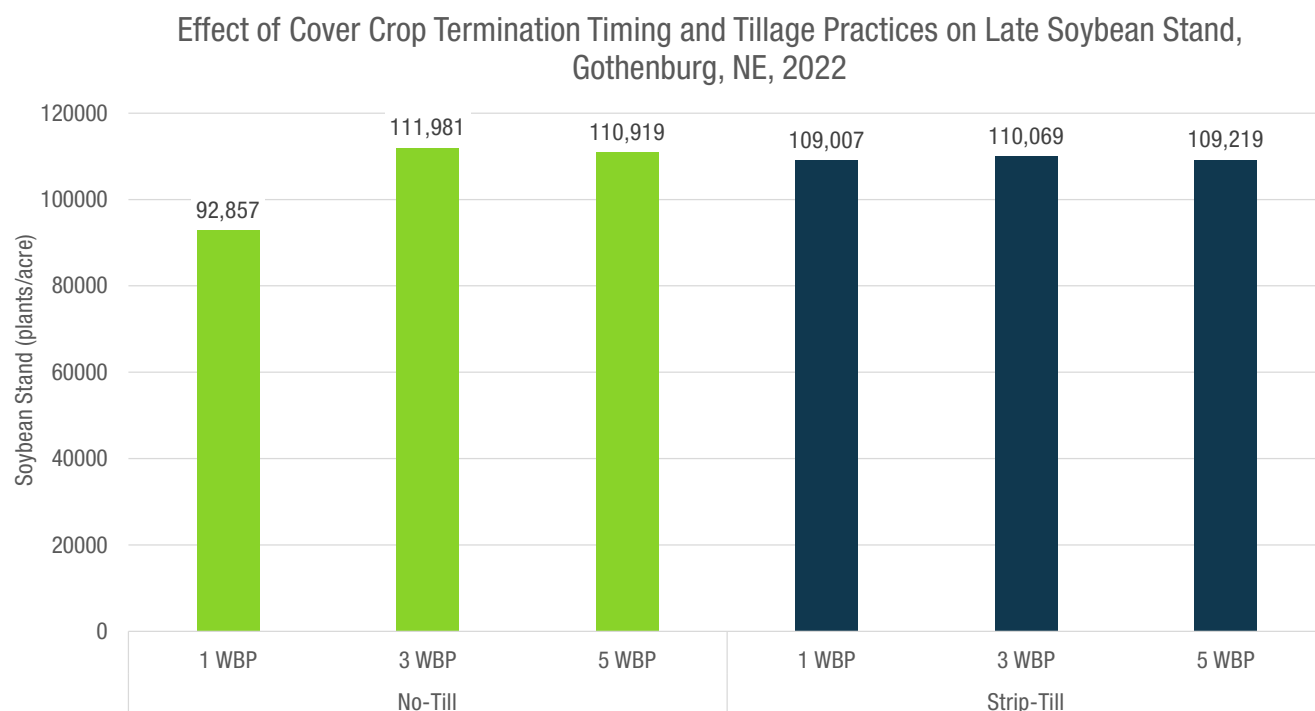


**Figure 3. Early soybean stand counts with different tillage practices, Gothenburg, NE, 2022.**



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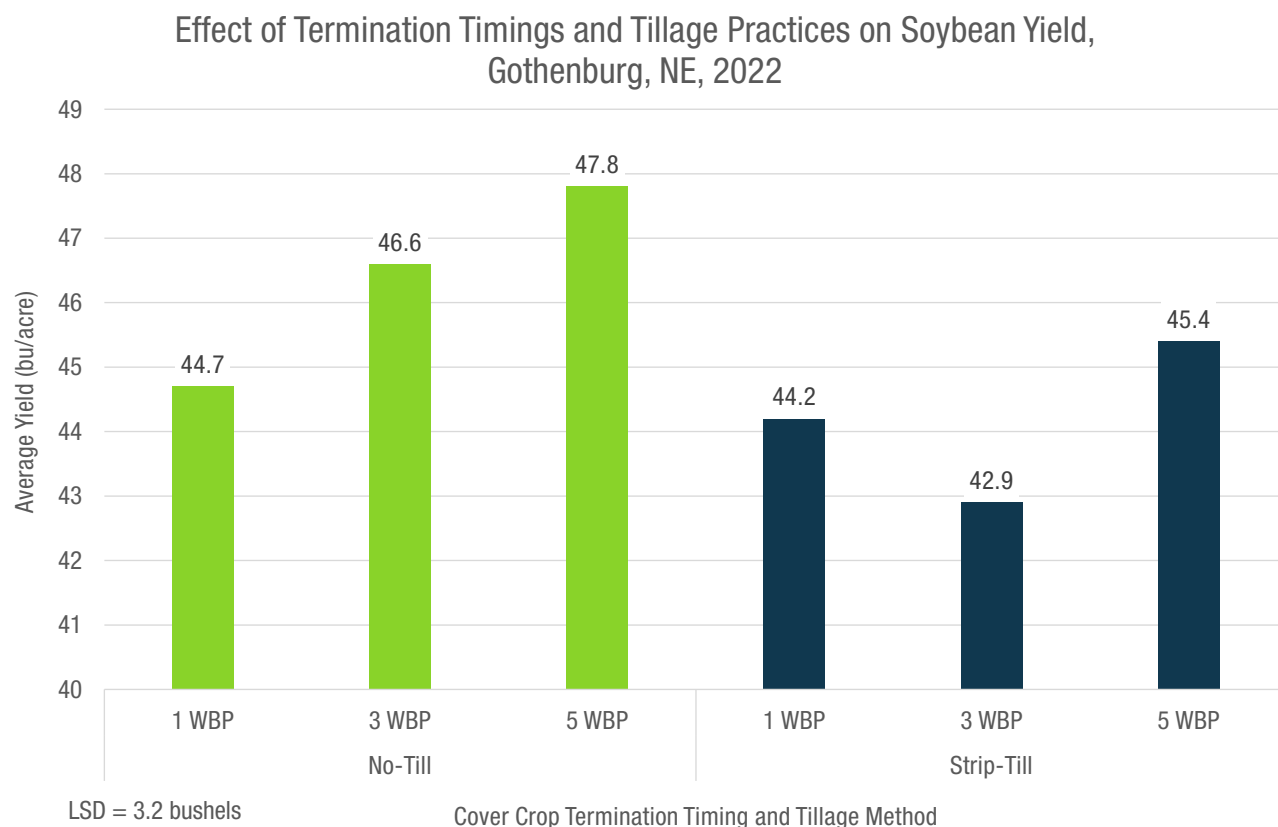
- No-till and strip-till reached similar soybean late stands, with the exception of the cover crop termination timing 1 week before soybean planting (1 WBP) in the no-till system (Figure 4). That is likely due to the increased cover crop biomass that impacted soybean emergence (Figure 1).



**Figure 4. Late soybean stands with different cover crop termination timings and tillage practices, Gothenburg, NE, 2022.**

- In general, soybean yield was better with no-till than strip-till. On average, soybean yields in no-till were 46.4 bu/a compared to 44.2 bu/a in the strip-till treatment (Figure 5).
- There were no significant soybean yield responses due to cover crop termination timing (Figure 5).
- Although the soybean stand in the strip-till treatment was better than the no-till, the no-till plots had higher yields. This emphasizes the ability of soybean to adapt to population reductions.

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**Figure 5. Average soybean yield with three cover crop termination timings, and no-till versus strip-till, Gothenburg, NE, 2022.**

## Key Learnings

- Winter wheat cover crop helped to increase weed suppression (mostly Palmer amaranth) when terminated 1 week before planting (WBP) soybean. Cover crop canopy is key to providing soil coverage and could be used as a weed management tool.
- The strip-till treatments had higher early emergence and final stand than no-till, but soybean plants have the ability to adapt to adverse growing conditions and can produce similar yields with a reduced stand when the growing conditions are favorable.
- In a dry year like 2022, soil moisture preservation is key to achieving better yields. In this scenario, no-till treatments yielded better likely due to more soil moisture present. The strip-till plots possibly lost moisture by having the soil exposed to the environment due to the strip-till machine removing residue cover from the row. In addition, cover crops can use moisture and must be terminated timely. In this study we saw a trend of lower yields (not significant) when cover crops were terminated at 1 WBP.
- The soybean yields were similar across the cover crop termination timings likely due to irrigation application.



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