

Roller Crimping Cereal Rye Cover Crop Ahead of No-Till Soybean Planting. A Systems Approach.

A Quick Guide for Organic or Non-Organic Systems.

Definition: Roller crimping is a technique used to terminate cover crops ahead of no-till planting a cash crop. It is a practice that has existed for decades in South American cropping systems and popularized in the US by the Rodale Institute for organic no-till soybean production. It is a high management system that requires an adaptive management approach. Roller crimping is most commonly adapted to terminating cereal rye cover crop ahead of no-till soybean production in US cropping systems. This guide explores considerations with roller crimping cereal rye cover crop ahead of no-till planting soybeans in organic and non-organic systems, with a focus on lessons learned from Indiana on-farm experience.



Roller crimping may be right if you . . .

- are an experienced no-tiller;
- growing later planted soybeans;
- are willing to plant green or into high residue;
- are comfortable with cereal rye cover crop potentially setting viable seed (for those raising small grain crops, this is a major risk to be managed or completely avoided);
- are a farmer looking to reduce tillage and/or herbicide use.

Cereal Rye Cover Crop Species Selection.

- Variety matters.
 - Variety Not Stated (VNS) potentially has multiple varieties or a range of maturity dates. Consistent phenological development of the cover crop is crucial to high termination rates with roller crimping.
 - Early flowering and high biomass production are keys to preserve soybean planting date and suitable weed control.
- To achieve earliest planting date of soybeans, plan to use Aroostook or Elbon cereal rye varieties. Other varieties are being evaluated--consider evaluating varieties on your farm in strip trials or plots. VNS sources generally result in 2 weeks later and uneven flowering relative to the stated/named varieties above.
- Farmers and researchers are also evaluating the potential of hybrid rye varieties and triticale varieties in comparison to OP rye cover crop varieties.

Cereal Rye Cover Crop Seeding.

- While seeding rate is important, the goal is establishing a good stand of cover crop to achieve consistent cover with adequate biomass production for maximum weed suppression during the growing season.
- Seeding before October 10 in Northern and Central Indiana should be your target, or earlier. Earlier seeding provides for more fall tillering, resulting in suppression of winter annual weeds

and more biomass production for the next year's soybean crop. More biomass provides for better termination with roller crimping and greater weed control.

- Be on time to make the system work. Explore shorter day corn or alternative crop rotations to create this early seeding window. Treat the cover crop as you would a cash crop!

- Seeding can be accomplished with drill, broadcast and incorporate, or precision planting, but each method has pros and cons and must match your goals, equipment, and logistics. Aerial seeding into standing crops is not recommended for this system of management due to limited coverage and reliability of stand establishment
 - Drill and planting provides the most consistent stands and even emergence, especially when planting later and in drier conditions, but are slower operations relative to broadcast and incorporation. Drilling and planting also create inter row space without cover creating niches for some weeds to possibly get established. For more coverage, consider double drilling/planting at an offset angle.
 - Crimp at an angle offset to the direction of cereal rye planting to maximize soil cover in the spring
 - Broadcast with incorporation is fast and is a good way to utilize manure and take out a flush of weeds in an organic system. It also provides full coverage with no inter-row space. Broadcast allows for crimping in any direction if soil coverage is primary goal.
- Seeding 2-3 bushels of cereal rye with little Nitrogen if seeding late or in an organic system, consider higher seeding rate, up to 3 bushel and top dressing with N in spring.
- One could also top dress with 30 lb/a in March to help compensate for later planting, but nothing truly compensates for timely fall seeding of the cover crop
- If crimping in combination with herbicide application in a non-organic system, a little herbicide goes a long way. Also, consider whether you need to knock down the cover crop with a roller crimper when using herbicide; some non-organic farmers just plant into rye and burndown the cover crop without rolling. A rolled cover crop may provide more weed suppression and late season moisture retention, but also makes for a “cleaner” looking field as the soybean crop emerges and gets established.

- Evaluate cereal rye cover crop stands in March/April.
 - Thin stands of cereal rye will not terminate well and will only provide weed control for a short time frame.
 - 5,000-8,000 pounds/ac of biomass is a minimum for season long weed control in organic systems at anthesis.
 - Are weeds already present, gaps in cereal rye stand, how will these be managed?
 - If managing in an organic system, you must assess weed pressure and uniformity of the stand of cereal rye. If weed pressure is high and/or the rye stand is weak or inconsistent, consider going to plan B: incorporate the rye as a green manure and manage the soybean crop with cultivation.

The Roller Crimper.



- The tool may be the least important aspect of this system. It is the full system of management that will provide consistent results.
- Goal is to crimp not cut the cover crop.
- Several roller crimper designs exist and have pros and cons. Know your situation and challenges. Key considerations with roller crimping:
 - A minimum of 200 pounds per linear foot of tool width is required for good mechanical termination. Filling the roller crimper drum with water is the most common way to attain this weight, but be creative if that is not an option with your tool.
 - The chevron pattern of the Rodale-style roller crimper will not generate excessive vibration or bouncing at high speeds compared to a roller with parallel blades.
 - The tool must be set on “float setting” on tractor to ride with the ground topography.
- If you’re using herbicide in a non-organic system, rolling may be all you need, since the crimping action won’t be needed to terminate the cover crop.
- Crimping pinches the stem between the tool and the soil, terminating cereal rye by disrupting the flow of water and nutrients in the plant.
- Front or rear mounting the tool works, but front mount is generally preferred to minimize need to crimp rye that is rolled down in tractor wheel tracks.
- If you have rolling ground, consider using a narrower tool, or narrow tool sections if a folding tool, to provide for better ground contact

When to Crimp?

- Species must be at right growth stage (anthesis) to terminate. This is not determined by planting date. Know the growth stages and be willing to wait.
 - Full flower or anthesis. [A link for growth stages.](#)
 - Link =<http://alturl.com/n6jyo>
 - Waiting two days can make a big difference to attain full flower, which should result in a 95% termination rate.
- Cereal rye must be at full flower (anthesis) to reach 95%+ termination rate by crimping. Flowering begins in the middle of the flowering head and then moves up and down. Wait for the pollen anthers to be at the top of the head. If anthers have blown off in the wind, you may have to look on ground.
- Pollen may clog your tractor radiator screen and intake filter when roller crimping cereal rye in full flower.
- In dry springs or sandy soils, cereal rye will reduce root zone moisture for soybeans. Irrigation is a nice backup if you have fields with irrigation systems. Later in summer, the mat of cereal rye biomass has an opposite effect, holding soil moisture and releasing some nitrogen for soybean filling.



Soybean Planting

- Most farmers find it easier to plant first, then roller crimp. But every situation and season is different:



- Roll when time to roll. If cereal rye is tall and a storm threatens to lodge the cereal rye, then plant before crimping if you have time, or crimp before the storm hits. If you crimp before planting, and a rainfall pattern sets in, the thick mat will hold moisture and make it hard to get back in the field if soil moisture is high. Once the cereal rye is terminated, it will stop evapotranspiration.
- Increase soybean seeding rate by 10-15%.
 - Thicker cereal rye mulch presents a challenge to soybean germination and emergence.
 - Higher soybean seeding rates can be viewed as low-cost insurance and good weed suppression.
 - Many organic farmers working with this system are seeding at 200,000+ seeds/acre.
- If you crimp first, you will need to plant in the same direction of crimping.
 - Planting into lodged cereal rye is not easy, do not over fertilize the cereal rye to limit this potential, and plant ahead of big wind storms if necessary. If you plant at a direction opposite of the crimping direction (or lodged), the planter will be challenged to cut through the biomass and could result in hairpinning.
- Planting at boot stage of cereal rye provides for earlier planting dates.
 - Boot stage occurs when the head (and awns of the flowering head) are about to emerge from the stem.
 - [A link for growth stages.](#)
 - Soybeans emerged in uncrimped cereal rye can be crimped at 1st to 3rd trifoliolate stage (V1-V3) with no significant loss to soybean stand, if cereal rye mat is thick enough.
 - Avoid crimping when soybeans are at crook stage during emergence (VE).
 - Planting at boot can result in reduced percent termination of rye, increasing viable rye seed production. Recent on-farm results and research trials suggest that some rye varieties may be more “stressed” during early planting, resulting in more tillers and/or inconsistent phenological development, reducing percent kill with roller crimping once the beans reach V1-V3.
- Think about your drill/ planter setup
 - Drilling at 7.5 inch may achieve greater weed control from earlier canopy but leave no “rescue” cultivation options.
 - Planting at 15 inch may result in more even emergence, but there is limited data on this reality.
 - High residue row cultivators can be used in crimped cereal rye when planting at 30” row spacing. A weed zapper could also be navigated through 30” row beans with limited tractor tire damage of the soybeans compared to narrow row beans. Increasing seeding rates at 30” can help with in-row weed suppression with earlier stem elongation and in-row shading.
 - Extra weight is sometimes needed to penetrate through cereal rye mulch, particularly when planting after crimping.
- A sharp lead coulter can be helpful if cereal rye is thick.
- Ensure sharp double disc openers and good down pressure.
- Make sure seed trench is closed.



- Spiked closing wheels and/or cast iron, but not long or curved spikes.
- No drag chains.
- Residue movers not needed (or recommended). Want to maximize cover in the row, not remove it.
- Emergence is slower compared to conventional till or bare no-till planting conditions. But, the soybean plants generally catch up as season progresses. In some cases, plant height may lag all season, but yields can still be competitive or higher with more pod set on tighter nodes and more seed fill. Remember, soybeans are adaptive.
- **Consider walking away for three weeks after planting, don't judge the stand by plant height in July or August. Look at number of pods and size in September.**
- Scout for armyworm and slugs. Practice Integrated Pest Management. Recent research suggests that neonicotinoid seed treatment can exacerbate slug feeding by killing the slugs' main predators, like ground beetles.

What is coming next with roller crimping systems?

- Work is being done to have a successful crimp ahead of corn, but many challenges have yet to be worked out. A mix of grass and legume cover crops with low C:N ratio tends to be the approach to success with corn, along with a willingness to plant corn late to allow the cover crop to reach anthesis/full flower. The cover crop must reach this state for adequate termination from roller crimping, and to provide maximum N fixation.
- Predicting full flowering date of cereal rye in April would help with adaptive management decision making . . . a team of researchers, agronomists, and farmers are currently improving data collection to inform development of predictive models.
 - possible ranges based on data from Central to Northern Illinois and Indiana during 2014-2017 growing seasons.
 - You can see that the end of April to early May soybean planting can be accomplished before crimping occurs. If dry spring or no rain after planting this could result in very dry soil and poor emergence.

Year	Boot Stage Range of Cereal Rye (possible to plant soybeans now)	Full Flowering Range (crimp kill now)
2014	May 9-May 23	June 6-June 16th
2015	May 5-May 16	June 5-June 12
2016	April 26-May 11	June 2- June 9
2017	April 20- May 6	May 30 - June 6

Resources.

- Join the following two listserves for real time feedback when researching and implementing this system
 - To subscribe to the OGRAIN list send an email to: join-ograin@lists.wisc.edu
 - Join IDEA list serve at <https://groups.google.com/forum/#!forum/ideafarmnetwork>
 - Midwest Cover Crop Council. <http://mccc.msu.edu/>
- [OGRAIN Fact Sheet on No-till Soybeans 2018](#). Wisconsin
- [Practical Farmer's of Iowa Report](#).

- [NO-Till Farmer Article on Roller Crimping](#), Mark Parker.

Revision - April 2019

The authors envision this guide as a living document that will be updated annually as we learn more about this practice in organic and non-organic cropping systems. Feedback is encouraged. Contact the authors at:

Michael O'Donnell
Extension Educator, Organic and Diversified Agriculture
Certified Crop Adviser
Purdue Extension
modonnel@purdue.edu

Dan Perkins
Certified Crop Adviser
Perkins' Good Earth Farm
perkinsgoodearthfarm@gmail.com