

A Strategy to Improve Soil Health in a Midwest Corn-Soybean Cropping System
(Where Herbicide Resistant Weeds Are Present)



Farmers who are in relentless pursuit of high soil health through integration of a system of cropping practices, consistently show that the benefits of the whole system exceed the sum of the parts. With slight adaption, these systems can complement many strategies to manage invasive and herbicide resistant weeds. Never underestimate the resilience or damage of these weeds.

Most weeds are opportunists and most of the resistant broadleaf weeds are gluttons for sunlight, space, water, and nutrients. Maintaining a continuous crop canopy and mulch cover throughout the year can be an effective tool in a comprehensive weed management program.

Managing for Soil Health is recognized as a systematic approach for farmers to mitigate the effects of extreme weather conditions and achieve much higher yield capacity on any soil in any year.

The following is an approach for a corn-soybean farmer interested in a soil health cropping system that is lower risk and will jump start nearly any soil type toward a functional soil health system:

Step 1: Scout corn fields in the late season or just after harvest for problem weeds that have emerged and/or escaped the past season’s weed management. Now is the time to look for perennial, biennial and winter annual weeds that have recently emerged and will gain in vigor as the crop canopy is removed during harvest.



Marestail seedlings

One of the toughest weeds to control is **marestail (*Conyza Canadensis*)** since it can germinate in the late summer through fall, survive the winter, and have subsequent germination flushes throughout the following spring and summer. Identifying and treating emerged plants in the fall helps control the toughest members of this weed that will otherwise have a substantial root system by spring.

These can be treated prior to seeding cover crops with a non-residual herbicide tank mix (e.g., -glyphosate plus 2,4-D, according to the *Ohio and Indiana Weed Control Guide WS16*) or once the Cereal Rye is up (see Step 2), there may be a warm enough window, before a hard freeze, to apply selective broadleaf herbicides. The same strategy holds true for many tough perennials like **thistles** and **dandelion**. Always follow herbicide label instructions and planting restrictions.



Early spring growth Cereal Rye drilled November 5th

Step 2: No-Till at least 60 lbs./ac. Cereal Rye Cover Crop into corn stalks—It’s easy to establish and easy to kill. Cereal Rye is one of the most versatile cover crops in that it is very cold tolerant, one of the most tolerant species to residual corn herbicides, and provides enhanced weed control. Cereal Rye can also be aerial seeded, incorporated with a vertical tillage tool, or drilled with a high rate of success. It can be mixed with

other species such as daikon oilseed radish or rape-seed depending on the seeding date and resource concerns. This is your first no-till operation.

Step 3: Use a burndown herbicide tank mix with at least 2 modes of action when the cereal rye reaches late boot growth stage. Allowing cereal rye to reach this growth stage will further stress any emerging weeds or ones that escaped the fall treatments. See several Purdue Extension publications with burndown recommendations for resistant weeds at: <https://ag.purdue.edu/btny/weedscience/Pages/default.aspx>

Step 4: No-till a relatively early group soybean with tolerance to multiple herbicide modes of action, in narrow or drilled rows into the cereal rye, and try to plant these beans early in the planting season. Early group soybeans are more determinant and benefit from early planting. This also gives a wider window to seed a cover crop mix next fall. This becomes your second no-till operation.

Consider a slightly higher seeding rate and/or a bush-type soybean to achieve an early crop canopy. Many resistant weeds are sunlight hogs so an early canopy is an additional line of defense.

Seldom is there a yield penalty for planting soybeans into even tall living cereal rye. Soybeans are not adversely affected by immobilized Nitrogen (N). In fact, they respond favorably to a rye cover crop which has tremendous benefits for weed control and late-season water conservation.

During most Midwest summers an extra half inch to one inch of water in August will have a major benefits on soybean yield. Caution should be used in a dry spring. Close monitoring of soil moisture, cover crop growth and weather forecast are critical to assure the cover crop termination is timely for moisture conservation.

Step 5: Apply a pre-emergence residual herbicide tank mix with good activity on the target weed species. Continue scouting through the summer and apply post-emergence herbicides if needed. See Purdue Extension’s publications with residual and post herbicide recommendations for resistant weeds at <https://ag.purdue.edu/btny/weedscience/Pages/default.aspx>

BE AWARE that some residual herbicides are more likely to cause carryover injury to sensitive cover crop species—this has more to do to with the half-life and mode of degradation than rotational restriction information alone. See Purdue Extension’s publications *Corn and Soybean Herbicides and Fall Cover Crop Establishment or Herbicides Persistence and Rotation to Cover Crops* at <http://extension.psu.edu/plants/crops/soil-management/cover-crops/herbicide-persistence> and USDANRCS WIN-PST (Charts for half-life and mode of degradation) <http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/quality/?cid=stelprdb1044769>.

Step 6: Spread soybean residue evenly across the harvest pass.

Step 7: Scout for any emerged perennial or resistant weeds and if needed, treat with non-residual burndown herbicide tank mix with at least 2 modes of action (see Step 1).



Soybeans planted into cereal rye



Soybeans flourishing in cereal rye residue with no marestail during extreme drought of 2012



Oat and daikon radish mix seeded September 20th near Indianapolis



Spring Austrian Winter Pea w/ nitrogen nodules

Soil health is the continued capacity of soil as a vital, living system; whereby carbon, nutrients and water are cycled efficiently, assuring primary production and environmental quality are optimized.

Step 8: Plant a low Carbon: Nitrogen (C:N) Cover Crop mix after soybeans. Pre-corn cover crops should trap or produce N in the fall and early spring, but release N at the optimum time in the spring/summer. Corn into a mix, such as an oat and daikon oilseed radish mix that winter kills, or annual ryegrass and Crimson Clover mix will capture or produce organic N and release the N at time of greatest need of the subsequent corn crop. This becomes your third no-till operation. Cereal grain cover crops ahead of corn may have a high N immobilization, which can limit plant available nitrogen for the corn crop. If cereal grain cover crops are the only available option due to other resource concerns (such as erosion control), plan to terminate them in the vegetative stage, utilize them in a mix with lower C:N cover crops like Austrian Winter Pea, and/or compensate with extra N in starter fertilizer.

Step 9: Use a burndown herbicide tank mix with at least two modes of action when the cover crop is still in the vegetative growth stage. If annual ryegrass is used see this publication: *Annual Ryegrass Management Guide*- <http://ryegrasscovercrop.com/resources/publications/>

Step 10: No-till corn into the low C:N mix the following spring. The no-till corn makes this the fourth no-till operation. By now, the soil will have many of the desired soil health qualities and advantages of a more mature system. Also, soil biological populations and processes are well on their way. Soil aggregates are stabilizing and pores are opening. By planting a cover crop mix with a low C:N ratio, N is released more timely and the corn crop also benefits from the timed release of the organic nitrogen.

Step 11: Apply a pre-emergence residual herbicide tank mix with good activity on the targeted weed species. Continue scouting through the summer and apply post-emergence herbicides as needed (see Step 5). **Always follow herbicide label instructions!**

The Result: Great production potential and weed control!

Indiana NRCS Soil Health website:

http://www.in.nrcs.usda.gov/technical/Soil%20Health/soil_health.html

Indiana Conservation Cropping Systems Initiative website:

<http://www.in.gov/isda/ccsi/>

National NRCS Soil Health website:

<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/soils/health/>



Palmer Amaranth



Corn planted into a mix of Austrian winter pea, daikon radish, crimson clover and cereal rye

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Palmer Amaranth photo: Purdue Extension

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