MANAGING NUTRIENTS AND HERBICIDES WHEN USING COVER CROPS

COVER CROP

TRAINING MODULE

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These training modules are being made available by free use of other educators through University of Missouri and the Midwest Cover Crops Council, which participated in the WFF project supporting development of these modules and provided many of the technical reviewers.

All photos are by Rob Myers, University of Missouri, unless otherwise noted.

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Part 1. Cover crops and nutrient management

Part 2. Cover crops and herbicide management

Photo credit – Edwin Remsburg

Cover Crops and Nutrients

1. Legume contributions to fertility
2. Impacts of cover crops on tying up nutrients
3. Taking a look at nutrient management through the lens of soil health

Legume Cover Crops

Cool season legumes

- Crimson clover
- Hairy vetch
- Austrian winter peas
- Others – balansa clover, sweet yellow clover, red clover, white clover, berseem clover, faba bean, etc.

Warm season legume

- Cowpeas and mung beans
- Sunn hemp other tropical legumes

Two balansa clover varieties

Crimson clovers vary in flowering date

Clover differences – southern Illinois

Variety	Seeding rate	Winter Survival	Rooting Depth	Weed Suppression	N in biomass
	lbs/a	*%*	*inches*	*%*	*lbs/ac*
FIXatioN Balansa Clover	8	98	33	98	269
Frosty Berseem Clover	15	95	32	97	52
Kentucky Pride Crimson Clover	15	94	31	88	187
Dixie Crimson Clover	15	69	24	56	14

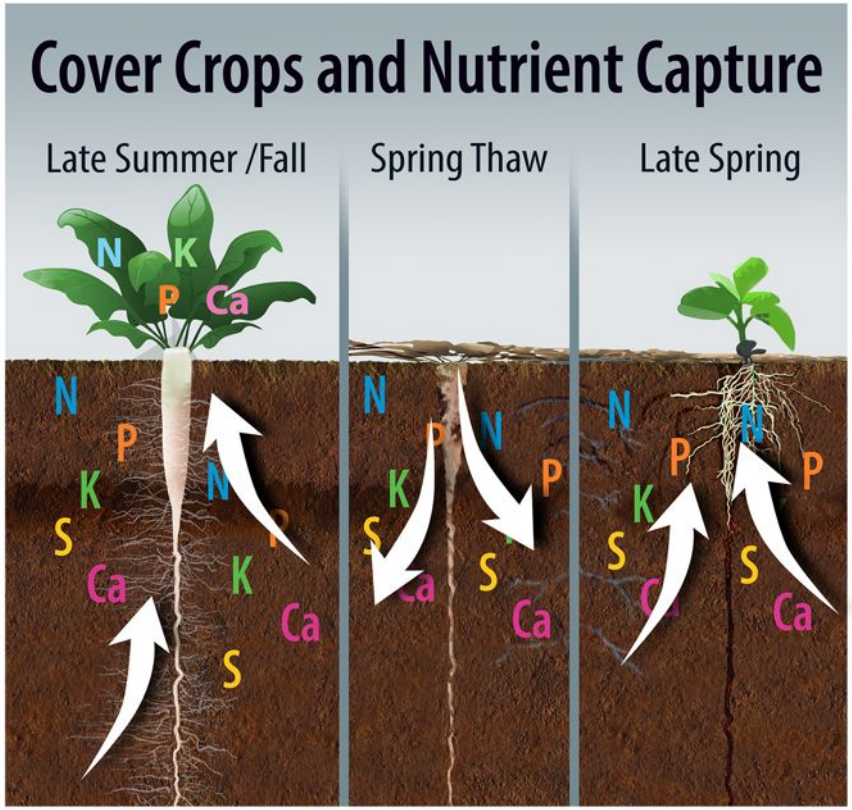
Planted 9/24/15, Nathan Johanning, U of IL Ewing Center

Non-legume impacts on nutrients

Some non-legumes appear particularly good at capturing or scavenging left over nitrogen, such as radishes

There is a risk of some cover crops tying up too much nitrogen, particularly winter cereals such as cereal rye

Scavenging nutrients



Cover crops can increase the amount of nutrients available for the next crop by taking up nutrients that remain in the soil and holding them in plant tissue until they are released the next spring, when they can be used by the following crops. *Courtesy: Cover Crop Solutions*

To minimize spring nutrient loss from radishes, consider planting with a winter annual cover

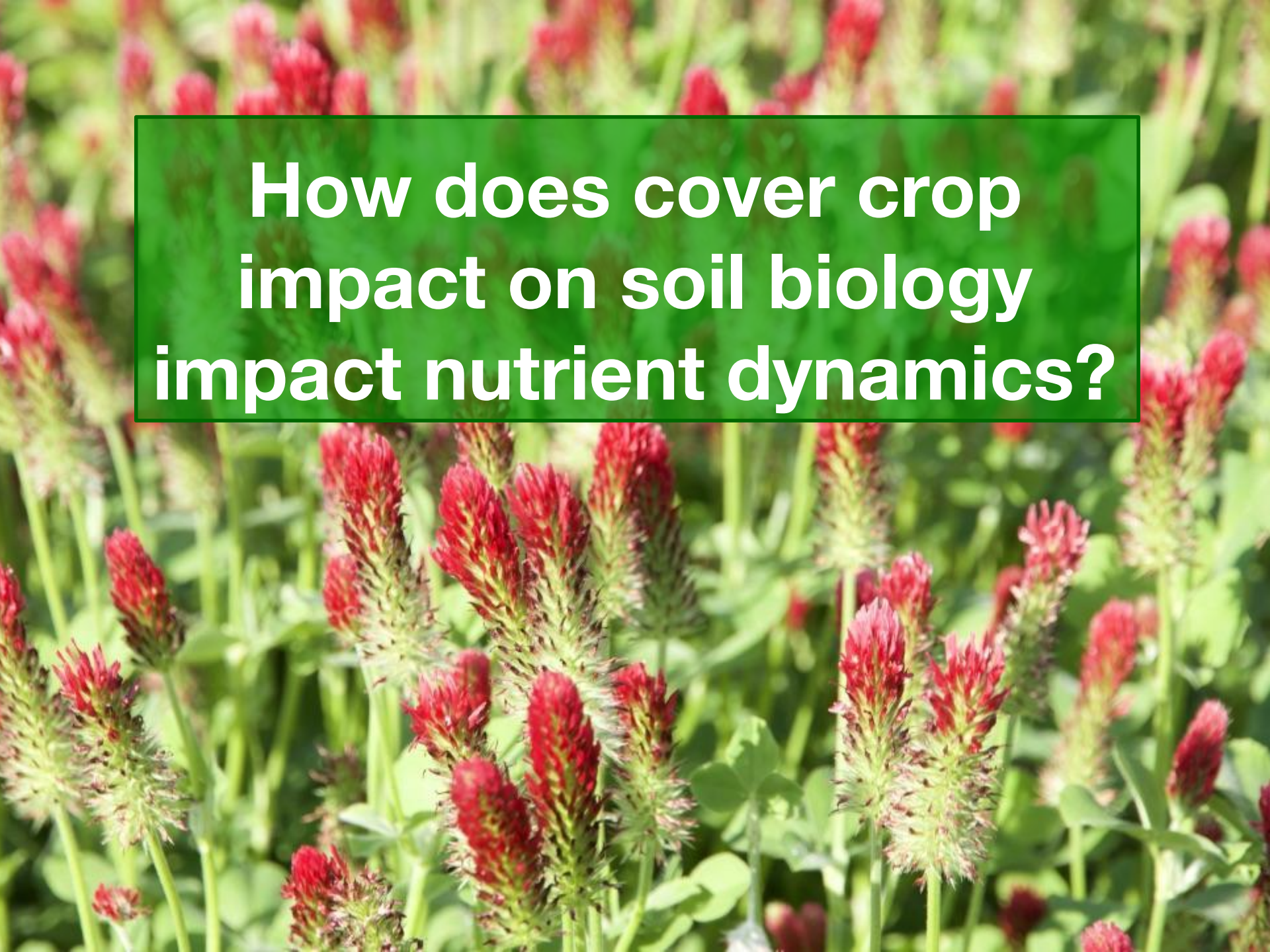
Challenge: corn planted into cereal rye

- Yield loss from planting corn into rye is a potential challenge
- **Termination timing important!**
  - Safest option is to spray terminate the rye 15-20 days ahead of corn planting when it is still small, especially in a dry spring
  - Avoid terminating 7-10 days before planting corn, especially if rye is already 2 feet or more in height *(risk of wet mat of decaying rye)*
  - Some farmers have had good success planting corn into living rye then terminating, but probably not a good idea for first timers
- **Adjust nitrogen management**
  - Split the N, half shortly before planting and half sidedress at V4-V6
  - Place extra nitrogen in proximity to seedling, such as 50 lb. N/a in 2x2 placement or banded close to rows
- Other options for future planting of cover crops before corn, can cut back on rye seeding rate or do skip rows, or do a different cover crop

Nitrogen immobilization in relation to C:N ratio

Organic Material	C:N Ratio
Rye straw	82:1
Wheat straw	80:1
Rye at flowering (anthesis)	37:1
Rye vegetative	**26:1**
Ideal ratio	24:1
Hairy vetch	11:1

NRCS


How does cover crop impact on soil biology impact nutrient dynamics?

Extension of Corn Root Surface Area through Mycorrhizal Fungi

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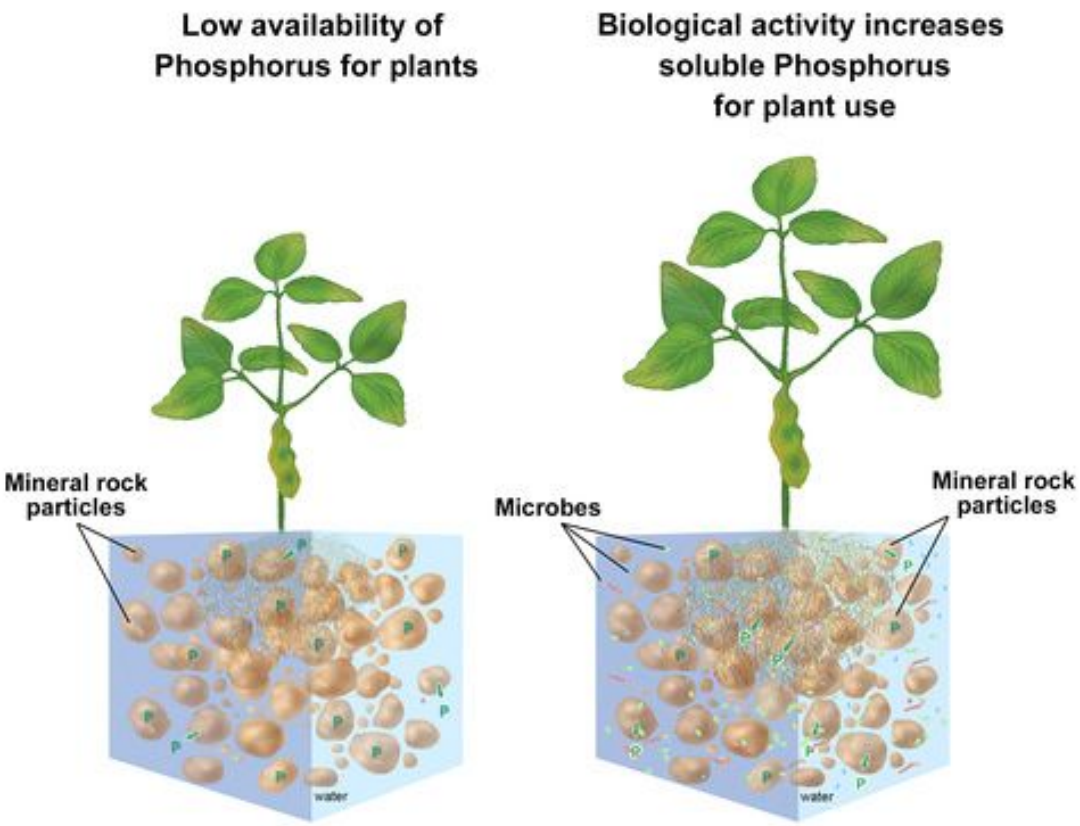
Microbe impact on phosphorous



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Higher Soil Organic Matter
= Greater Nutrient Release
Photo credit – Edwin Remsburg

Cover crop nutrient credits

From Dr. Matt Ruark, University of Wisconsin

Following winter cereal grass cover crops

- Use nitrogen in starter fertilizer to help overcome N tie-up
- Don't assume nitrogen will release fast enough to help cash crop
- If strong growth of cover crop, may need to reduce amount of nitrogen being credited from manure application

Following radishes – assume no change in nutrients

Following legumes

- If good growth of legumes are obtained, can provide 40-60 pounds per acre of nitrogen credit before corn (based on Wisconsin data), or more in some situations if legume grows for long enough

Cover crop mixes – depends on the mix

Potential adjustments for in-season N management following cover crops

Photo credit: Trimble.com

Cover Crops and Herbicide Adjustments

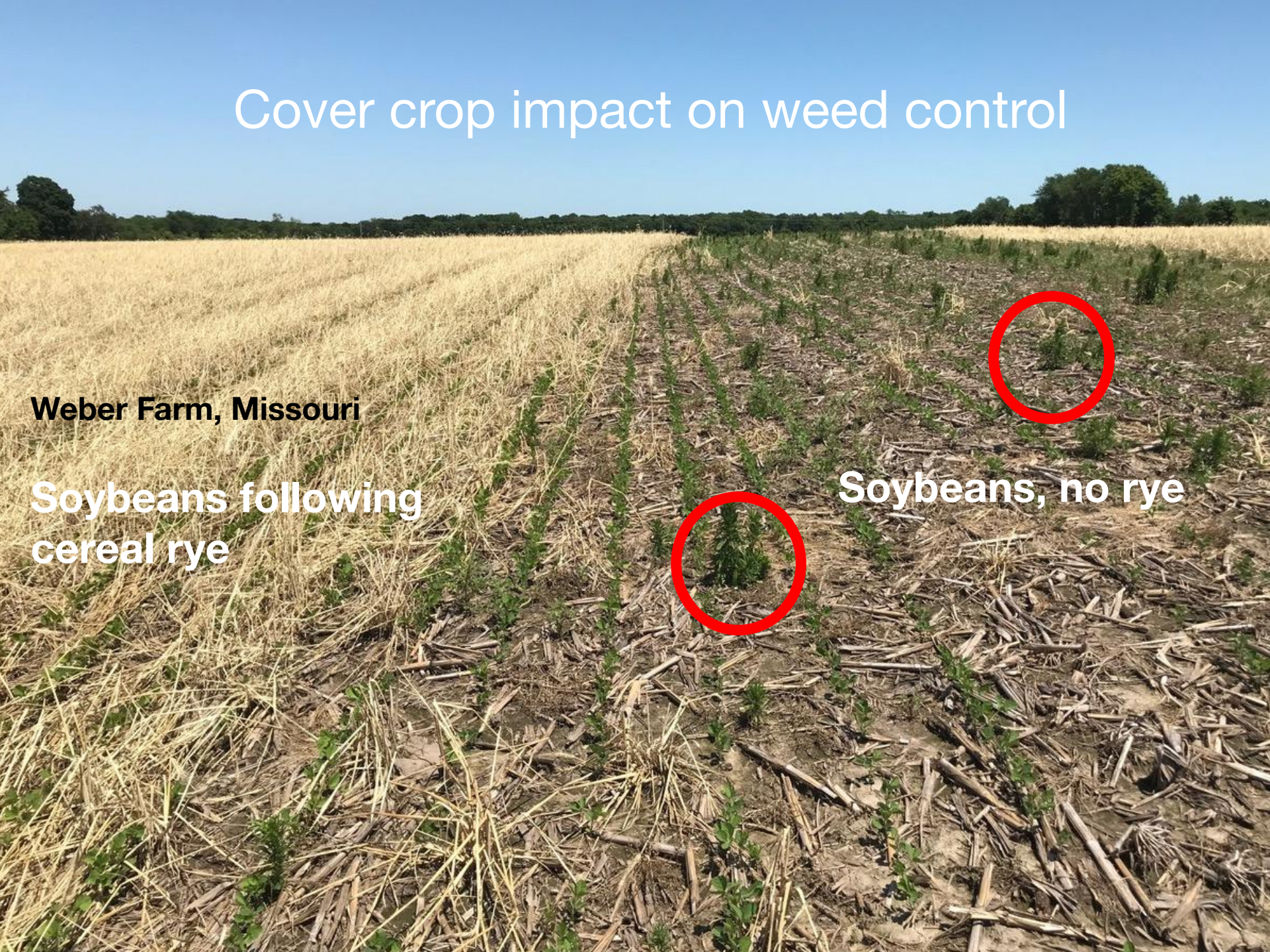
1) Does use of cover crops lead to any changes for herbicide management for commodity crops?

2) Are there any issues from residual herbicides affecting establishment of cover crops?

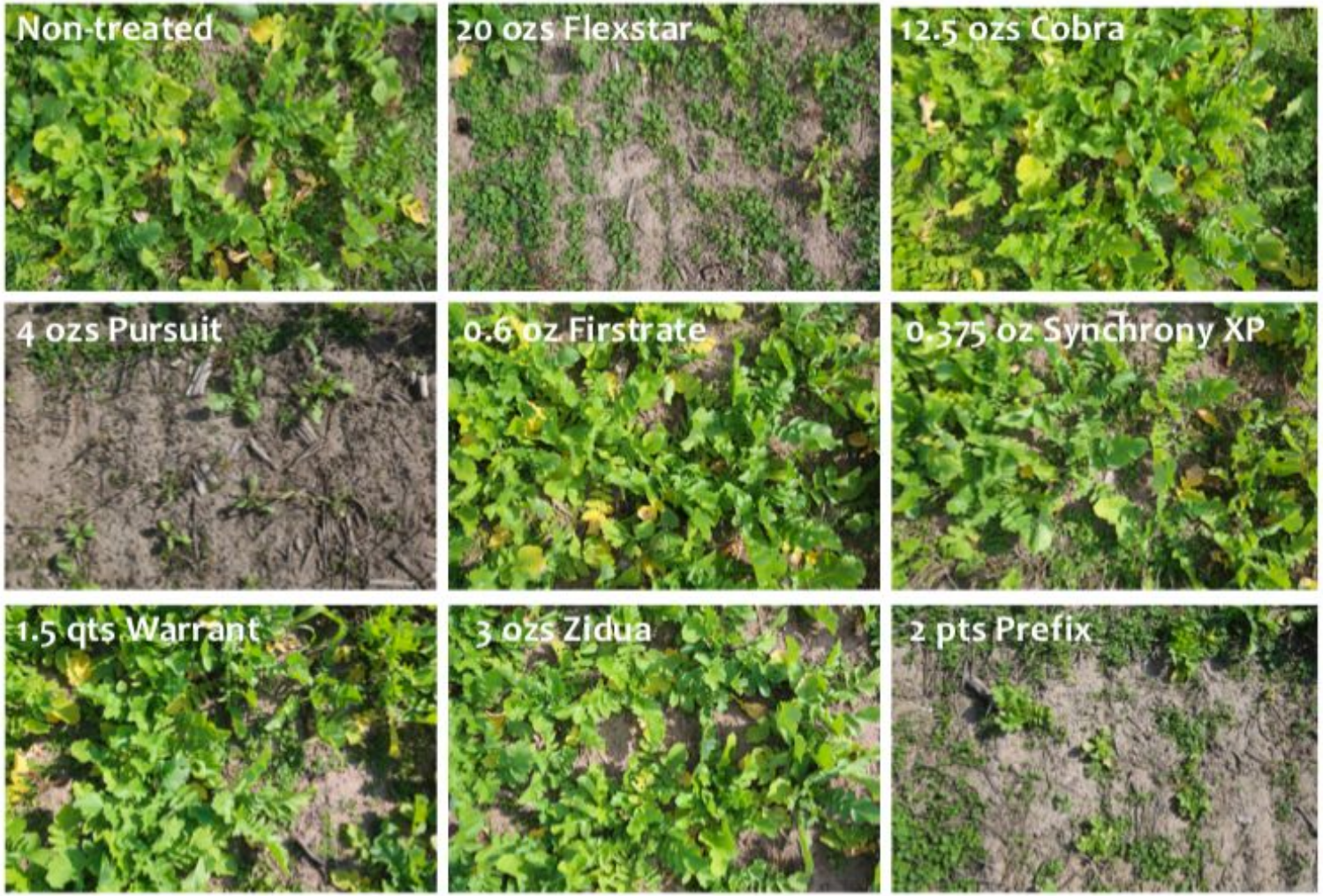
Adjusting herbicides following cover crops

- Termination herbicide – in most situations, glyphosate works well – may need to add a broadleaf herbicide like 2,4D for clovers and annual ryegrass can sometimes be a challenge
- Do we need any changes to residual herbicides?
  - If it's a residual chemistry that requires good soil contact and there is extensive cover crop residue at spray time (particularly no-till), may want to switch products or delay application of the residual
  - Good biomass of rye or other winter cereal cover crop mixed with other species like vetch may allow a lower cost residual approach
- What about post-emerge sprays?
  - Depending on amount of cover crop biomass and whether rye was used, it MIGHT be possible to get by with one post-emerge pass instead of two (assuming it's a weed profile where a second pass is otherwise needed)

Cover crop impact on weed control



Carryover Impacts of Post-Emerge Soybean Herbicides on Radish Cover Crop



Photos from Kevin Bradley, MU Weed Science

Some Residual Herbicide Observations*

- Cereal rye is pretty tolerant of residual products
- Soybean herbicides to be careful of: fomesafen (Flexstar/Prefix/etc.), pyroxasulfone (Zidua), acetochlor (Warrant)
- Flexstar a problem for radish, clover, Austrian pea
- Corn herbicides to be careful of: topramezone (Impact), mesotrione (Callisto, Halex GT, etc.) clopyralid (Stinger, SureStart), isoxaflutole (Balance Flexx), pyroxasulfone (Zidua, etc.)
- General order of sensitivity (most sensitive to least)
  - Radish > Austrian winter pea > crimson clover = annual ryegrass > winter wheat = winter oats > hairy vetch > cereal rye

    (exact order depends on the product being considered)
- Potential for cover crop injury from residual herbicides will vary depending on weather, soil type, and date of application

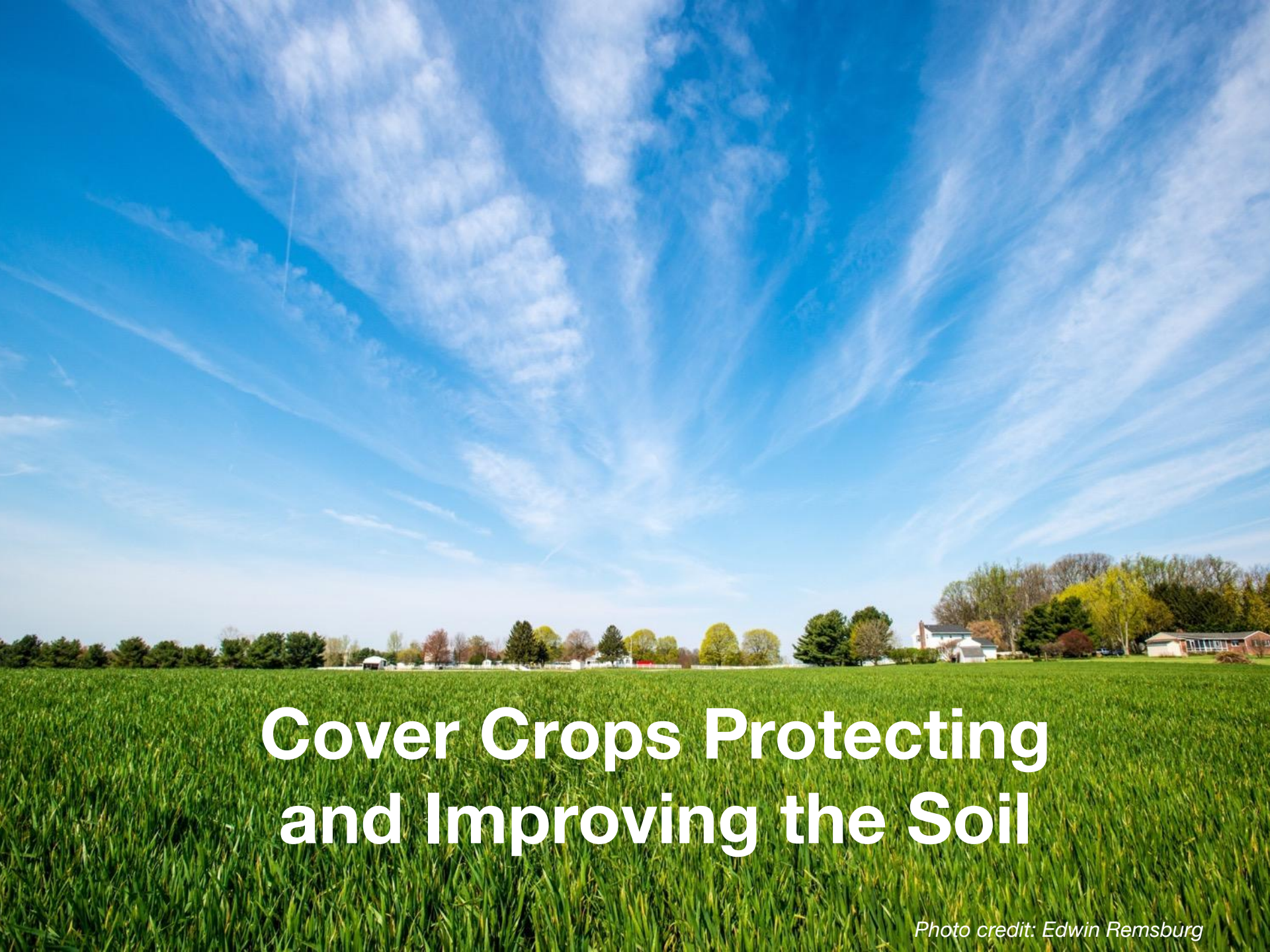
**Notes from Kevin Bradley research, University of Missouri Weed Science*

Consider timing of cover crop seeding

- Residual herbicides become less problematic for cover crops with passage of time
  - Most challenging – interseeding cover crops in knee-high corn
    - Annual ryegrass (most to least impact): Dual > Zidua > Outlook > Harness
    - Red clover: Calisto harmful, Sharpen, Resolf, atrazine okay (Penn State)
  - August interseeding also requires careful herbicide planning
  - October cover crop planting less like to be affected

- Other key factors in residual herbicide impact
  - Soil type – fine-textured soils have longer residual life
  - Weather – dry conditions may prolong residual life

- Can do a simple field bioassay – broadcast some cover crop seed in August, water it in, observe emergence



Cover Crops Protecting and Improving the Soil

Photo credit: Edwin Remsburg