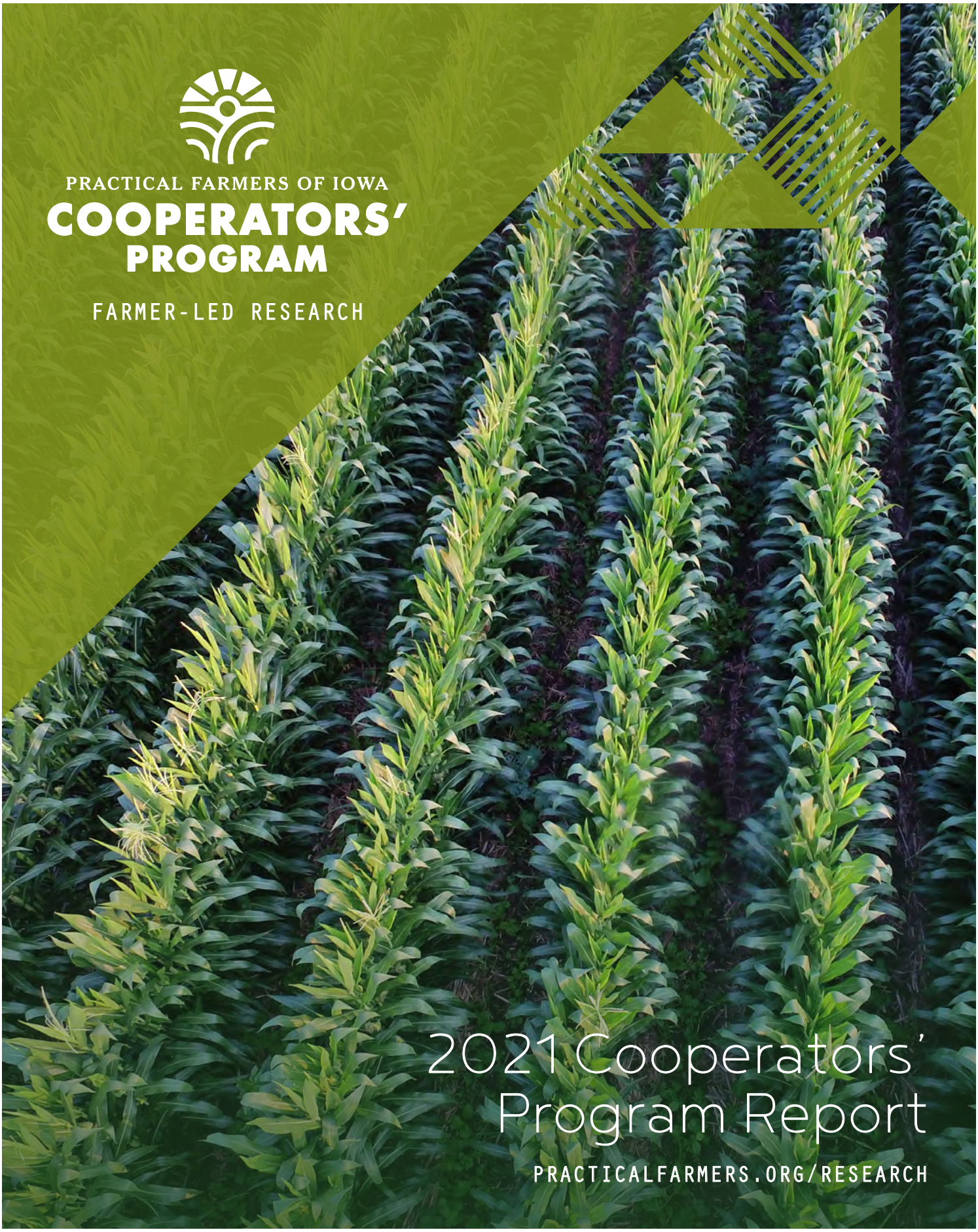
PRACTICAL FARMERS OF IOWA
COOPERATORS' PROGRAM
FARMER-LED RESEARCH
2021 Cooperators' Program Report
PRACTICALFARMERS.ORG/RESEARCH

"I find working with PFI, other farmers and doing on-farm research so valuable. Conducting trials always spark new ideas!"

- Jon Yagla

OPENING LETTER

Since 1987, our Cooperators' Program has encouraged and guided research aimed at environmentally sound, lower-cost, profitable farming techniques. The program is one of several ways that Practical Farmers of Iowa carries out its mission to equip farmers to build resilient farms and communities.

Curiosity and creativity drive the Cooperators' Program, and are attributes that unite all who participate. Since the very first trials, participating farmers have employed scientific inquiry to shed light on a host of questions. While those questions have evolved and changed over the years, the underlying approach – rooted in the methods and spirit of rigorous science – has not.

In the past few years, farmers have sought to answer questions such as: Which crop or vegetable varieties are most appropriate for my farm? How can I reap economic benefits from cover crops, like reduced weed pressure, or lower winter feed costs from grazing cover crops? Do I really need to use preventive neonic seed treatments? How do I use diversified crop rotations for replacing purchased fertilizer? What are ways I can successfully extend the season for growing vegetables?

From reflections cooperators share with us at the end of their trials, it's obvious to me that the very process of designing and carrying out a trial on one's own farm hones observational skills and breeds even more creativity. Cooperators tell me and fellow PFI staff that conducting trials not only directly helps answer questions like those above, it also opens their eyes and minds to other possibilities. Questions and ideas beget more questions and ideas.

To cooperators, on-farm research is a tool that can be used to help evaluate just about anything. And when this tool is intentionally trained on a specific subject, it can help farmers make informed decisions about whether to make a change on the farm. In fact, 70% of those who conducted a trial last year told us they were likely to make a change thanks to the results of their trial and the experience of conducting it. And most of those who aren't making a change are doing so confidently because the new practice they tested didn't perform as well as their existing practice.

But as LeVar Burton used to say on "Reading Rainbow," "You don't have to take my word for it." In the pages that follow, you'll find summaries of a few of the research projects from 2021 as well as some takeaways from the participating farmers.

You'll read about how Emily Fagan and Hannah Breckbill learned the importance of re-covering arugula between harvests to prevent flea beetle damage. You'll also read about Arlyn Kauffman realizing the value of red clover as a cover crop. "I had heard of it," he says, "but had never seen for myself how medium red clover can produce nitrogen for a corn crop." To dive deeper and learn about more projects, I encourage you to explore the full research reports on our website at **practicalfarmers.org/research.**

To the farmer-scientists who committed their time, effort and ideas – thank you for trying something new and applying your curiosity to benefit yourselves and your farming colleagues in the spirit of learning, knowledge-sharing and improvement.

Let me know if something you read here or observe on your farm sparks some curiosity. We're always looking for new cooperators who wish to hone their own skills and join our community of farmers who take a scientific approach to improving their farm. We can help with that! Write me at **stefan@practicalfarmers.org,** or give me a call at **(515) 232-5661.**

Yours in research,

Stefan Gailans

PRACTICAL FARMERS OF IOWA
COOPERATORS' PROGRAM

MISSION

To empower farmers to generate and share knowledge through timely and relevant farmer-led research.

VISION

A community of curious and creative farmers taking a scientific approach to improving their farms. These farmers are leaders among their farming peers whose work contributes to the field of agricultural research, resulting in more profitable, diverse and environmentally sound farms.

GUIDING PRINCIPLES

Practical Farmers and the Cooperators' Program are always seeking to grow our network and our members' impact. We proactively and passionately seek out creative ideas and flexible funding to support farmer-led research. These guiding principles define common characteristics of the Cooperators' Program and, in an effort to make the most of finite resources, serve as a filter for our work.

THE COOPERATORS' PROGRAM IS

- **Farmer-Led.** We believe that farmers should lead both the creation and exchange of knowledge. Farmers set our research goals and priorities. We also help farmers inform academic agricultural research that affects their farms by connecting researchers and farmers in meaningful dialogue and promoting the exchange of ideas.
- **On-Farm.** We believe that real-world, applied research on farms is critical for building a better agriculture in Iowa and beyond. We prioritize research conducted on-farm by farmers, but recognize the limitations and understand not all topics can sufficiently be addressed with this approach.
- **Collaborative.** We believe in working together. Research that is collaborative facilitates the sharing of knowledge and, ultimately, builds community. We prioritize multi-farm projects as well as single-farm trials that have broad support within the cooperator community or could yield important insights for other farmers. We occasionally collaborate with university researchers and other partners who have gained the trust and confidence of farmers through their work, research and extension activities.
- **Relevant.** We believe that research should answer questions individual farmers have about their farms. This often involves supporting proof-of-concept investigation, ground-truthing new ideas and products and helping farmers design research that can satisfy their curiosity about their farms. Our farmer-researchers and partners are on the cutting edge of innovation in agriculture, and the Cooperators' Program supports their efforts.
- **Accessible.** We believe the knowledge, experience and findings generated by the Cooperators' Program should be available to the public. Farmers are our primary audience; we present results using farmer voices while also adhering to standards of scientific reporting. The products of the Cooperators' Program are used by farmers to make more informed decisions.
- **Empowering.** We believe that farmers are capable of conducting experiments on their own farms and carrying out the process from beginning to end. As the experts on their farming systems, we believe the role of PFI staff is to support farmers' inherent curiosity. Being at the helm of the on-farm research process builds on this curiosity by boosting farmers' scientific skills and confidence while generating powerful questions and advancing farmer-ownership of research conclusions and created knowledge.
- **Science-Based.** We believe the scientific method and good experimental design are necessary tools for farmers. The work of PFI farmers who conduct on-farm research is highly valued and trusted by both the broader PFI membership and non-members, including farmers, academic researchers and the general public.
- **Committed.** We believe in following through. Cooperators and PFI staff are eager to participate, engage and complete on-farm projects. We reward cooperator efforts and commitments to on-farm research by providing modest honoraria and showcasing their contributions.

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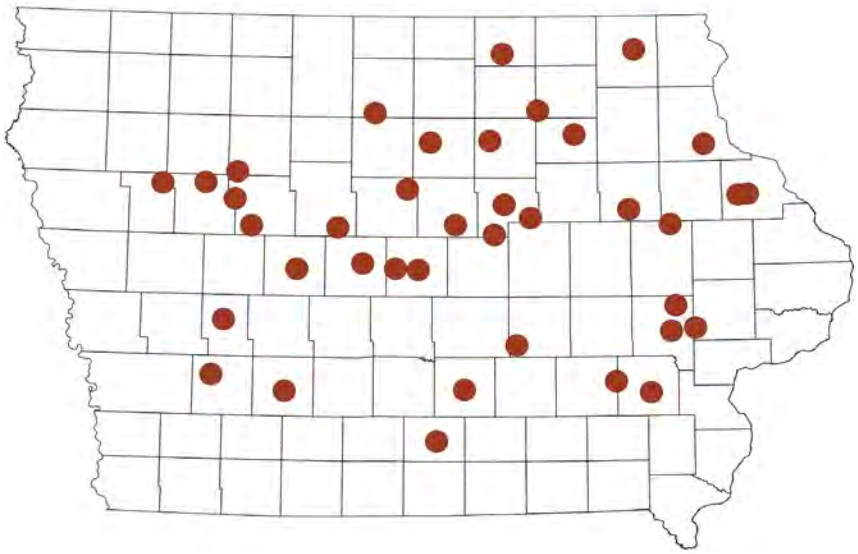
LIVESTOCK

STAFF

STEFAN GAILANS	SENIOR RESEARCH MANAGER
HAYLEY NELSON	RESEARCH COORDINATOR
MEGHAN FILBERT	LIVESTOCK FARM VIABILITY MANAGER*
LYDIA ENGLISH	FIELD CROPS VIABILITY MANAGER
EMMA LIDDLE	MEMBERSHIP AND EVENTS COORDINATOR**
MEGAN SWEENEY	AMERICORPS MEMBER*

*NO LONGER WITH PRACTICAL FARMERS OF IOWA
**FORMERLY AMERICORPS MEMBER

2021 FARMER-LED
RESEARCH TRIAL LOCATIONS



IN 2021,

42 COOPERATORS

PARTICIPATED IN

55 RESEARCH TRIALS

FREQUENTLY ASKED QUESTIONS
ABOUT THE COOPERATORS' PROGRAM

Since 1987, PFI's Cooperators' Program has empowered curious farmers to conduct on-farm experiments that answer their questions and guide their decision-making. Our program is unique in that farmers have always been at the helm – they are the ones brainstorming projects, setting on-farm research priorities and gathering the data on their farms.

While PFI staff guide farmers through the process of setting up an on-farm trial (and no prior research experience is necessary), farmers are very much partners and leaders in the process. Most on-farm research trials take place on the farms of participating farmers, and the Cooperators' Program research agenda is developed and carried out by farmers.

What's a "cooperator?"

We refer to our farmer-researchers as cooperators because the first experiments in the program were done in cooperation with agricultural researchers. Nowadays, on-farm research trials are collaborative efforts between farmers and PFI staff scientists who guide the design of experiments based on questions posed by the participating farmers. On-farm research projects are also often collaborative endeavors among several farmers. So "cooperator" applies on many levels!

Do I have to be a "scientist" to participate?

Not at all! You do not need a research or science-based background to participate. All you need is an idea you want to test on your farm and PFI's staff scientists help with the rest. That said, just like scientists, you are making observations about your farm – and decisions based on available data – on a regular basis. So you're arguably a scientist already! What we do in the Cooperators' Program is empower you to answer your pressing farm questions using the simple yet rigorous tools of scientific research.

How exactly does it work?

Each year, farmers who have conducted on-farm research – and those who've told us they aspire to – are invited to our annual Cooperators' Meeting. Held in December, this gathering is about connecting as a community of on-farm researchers, and focuses on sharing results and observations from the past year's farmer-led research trials.

During the meeting, cooperators are encouraged to describe what they did, why they did it and what they found. Cooperators also generate ideas and make plans for future projects based on previous results and new questions. Before the onset of spring, cooperators and PFI staff mutually agree on project plans and commitments.

When the time comes to conduct the trials, farmers are ultimately responsible for planting seeds, tending to animals and taking measurements throughout a trial.

What will I gain from participating?

- Useful, reliable research that helps you understand what works and what doesn't on your farm
- Connection with a community of curious farmers with whom you can exchange ideas and experiences, and who can help you expand your knowledge of what's possible with on-farm research
- The chance to become a leader who inspires improvements to our agricultural landscape

Okay, you've got me hooked. I have something I'd like to investigate on my farm. What should I do now?

We'd love to hear about it! Contact Stefan Gailans, senior research manager, to learn more and get started.

I can't be a farmer-researcher but would like to see the results. How can I do that?

The results of our Cooperators' Program research provide relevant, unbiased and science-based information that farmers can trust about new practices. You'll see summaries of our 2021 research in the following pages. For more in-depth results (as well as reports from previous years' trials), visit us online at **practicalfarmers.org/research**.

TO LEARN MORE ABOUT THE COOPERATORS' PROGRAM, VISIT

practicalfarmers.org/research

HAVE QUESTIONS OR WANT TO GET INVOLVED?

CONTACT US AT **(515) 232-5661** OR **stefan@practicalfarmers.org.**

FIELD CROPS

2021 FIELD CROP TRIALS

ALLOWING ESTABLISHED CLOVER TO GROW WITH CORN

Jack Boyer, Dick Sloan

ARE SOYBEAN SEED TREATMENTS JUSTIFIED?

Alec Amundson, Sam Bennett, Steve Saltzman

CEREAL RYE VARIETY TRIAL

ISU Northeast Research Farm, ISU Northern Research Farm, ISU Ag Engineering & Agronomy Farm, ISU Southwest Research Farm

CORN FOLLOWING CLOVER AND RYE COVER CROPS

Arlyn Kauffman

EFFECT OF PLANTING CORN INTO GREEN CEREAL RYE COVER CROP ON SEEDLING DISEASE, STALK ROT AND YIELD – YEAR 2

In Partnership with Alison Robertson Lab, ISU Plant Pathology
Jack Boyer, Eric Fynaardt, Kevin Holl, Rob Stout

NITROGEN RATES IN FOOD-GRADE OATS

Kellie & A.J. Blair

OAT SELECTOR TOOL VARIETY TRIAL

Ortrude Dial, Eric Madsen, Matt Miller, Landon Plagge, Justin Petersen

OAT VARIETY TRIAL

ISU Northeast Research Farm, ISU Northern Research Farm, ISU Ag Engineering & Agronomy Farm, ISU Southwest Research Farm

PLANTING CORN IN 60-IN. ROW-WIDTHS FOR INTERSEEDING COVER CROP

Landon Brown, Tim Sieren

REDUCING NITROGEN IN CORN AFTER REPEATED USE OF COVER CROPS

Jack Boyer

TERMINATING COVER CROPS AFTER PLANTING SOYBEANS

Dick Sloan

ALLOWING ESTABLISHED CLOVER TO GROW WITH CORN TRIAL AT DICK SLOAN'S FARM IN ROWLEY, IOWA.

Nitrogen Rates in Food-Grade Oats

COOPERATORS	**Kellie and A.J. Blair,** *DAYTON*

Food-grade oats are making a comeback in corn-soybean rotations, and it's a win-win for farmers and the environment. Diversifying with oats spreads the risk for growers across additional enterprises. It also improves corn and soybean yields and reduces nitrogen and herbicide inputs without sacrificing weed suppression.

Kellie and A.J. Blair additionally enjoy how committing some of their acreage to oats makes their schedules easier to manage over the course of a year. Getting fertility right can be tricky with food-grade oats, though. Too much or too little nitrogen affects yield and test weight (a quality indicator); but research on this is sparse, and the Blairs have heard conflicting recommendations from other growers. For this reason, they conducted strip trials to compare oat yield among strips receiving 25 , 50 and 75 pounds of nitrogen per acre.

Left to right: Kellie and A.J. Blair

Germinated oat seedlings at Blair Farm in April 2021.

FINDINGS

Statistical analysis showed that applying 25 lb N/ac resulted in the same oat yields as applying 50 and 75 lb N/ac. Additionally, it saved the Blairs $15/ac and $30/ac, respectively, in fertilizer costs. These results add to previous research in which the Blairs found that applying 50 lb N/ac resulted in greater yield and better financial returns than applying no nitrogen to oat fields. After two years of on-farm research, the Blairs have found that applying 25 lb N/acre is their sweet spot for maximizing oat yield and profit.

Oat yields, treatment costs, revenues and returns on investment (ROI).

Treatment	Oat yield (bu/ac)	Treatment cost ($/ac)[a]	Revenue at $3.75/bu ($/ac) [b]	Return on investment ($/ac)
25 lb N/ac	102	$15.57	$390.00	$374.43
50 lb N/ac	104	$30.34	$390.00	$359.66
75 lb N/ac	107	$45.51	$390.00	$344.49

[a] Cost includes fertilizer.

[b] The combined average yield of all three treatments (104 bu/ac) was used to calculate revenue and ROI because yields were statistically similar.

Are Soybean Seed Treatments Justified?

COOPERATORS | **Alec Amundson** , *OSAGE;* **Sam Bennett,** *GALVA;* **Steve Saltzman,** *LENOX*

Research has shown that neonicotinoid insecticide seed treatments do not improve plant population or yield. Due to their low cost, however, seed treatments are commonly marketed to farmers for preventive use and without scouting first for target insect pests to confirm the need for these seed treatments. Previous PFI cooperators have done a range of on-farm trials exploring the benefits of using treated seed and found no yield gain.

Continuing this research interest, Alec Amundson, Sam Bennett and Steve Saltzman conducted strip trials to find out if neonicotinoid and fungicide seed treatments offer any value to early-planted soybean seed. They compared yield and profitability of soybeans grown from fungicide-treated seed with soybeans grown from seed treated with their typical seed treatment combination (fungicide + neonicotinoid; or fungicide + neonicotinoid + insecticide + nematicide). Steve Saltzman additionally compared untreated soybean seed.

Clockwise from top: the Bennett family (Sam is third from left), Steve Saltzman and Rachel and Alec Amundson.

FINDINGS

The combined results of Alec's, Sam's and Steve's data provide evidence that neonicotinoid seed treatments may not be necessary in early-planted soybeans. Soybean yields and populations between treatments at each site were statistically similar. By eliminating nematicide and insecticide from their seed treatments, Sam saved $10/ac and Steve saved $3/ac.

The growers originally hypothesized that fungicides, but not insecticides, would be necessary in early-planted soybeans. But Steve's results show that even fungicides were not needed. Alec was unable to complete the trial due to a late frost that killed his beans, but was able to observe no difference in soybean plant population prior to the frost on his farm and make some anecdotal conclusions. After seeing final results from the other two farms, he commented, "I think we can adjust our seed treatment plans on all crops going forward."

"I WANT TO TAKE OWNERSHIP OF WHAT I'M APPLYING TO MY FARM INSTEAD OF JUST USING PESTICIDES BECAUSE IT'S WHAT IS STANDARD. I HOPE TO WORK TOWARD ELIMINATING INSECTICIDES THAT COULD BE HARMFUL TO POLLINATORS WITHOUT SACRIFICING YIELD OR PROFITABILITY."

- SAM BENNETT

Soybean yields, treatment costs, revenues and returns on investment (ROI).

Trial site[a]	Treatment	Soybean yield (bu/ac)[b]	Treatment cost ($/ac)[c]	Revenue at $11.75/bu ($/ac)	Return on investment ($/ac)
Bennett	Insecticide + Fungicide + Nematicide	76.9	$19.00	$902.99	$883.99
	Fungicide-only	76.8	$9.00	$902.99	$893.99
Saltzman	Insecticide + Fungicide	71.8	$2.98	$846.00	$843.02
	Fungicide-only	72.6	$2.13	$846.00	$843.87
	Untreated	71.7	$0.00	$846.00	$846.00

[a] Amundson was unable to take the trial to harvest due to frost in late May. Analysis of soybean populations prior to the killing frost showed no statistical differences between seed treatments.

[b] Statistical analysis determined no significant differences in soybean yield between treatments at either site. To calculate ROI, we used the overall yield average of each site.

[c] Cost included seed treatments only.

Terminating Cover Crops After Seeding Soybeans

COOPERATOR	**Dick Sloan,** *ROWLEY*

PFI farmers have been conducting on-farm research since 2015 to determine how late they can delay terminating cover crops relative to planting soybeans. At that time, farmers were being advised to terminate covers three weeks before planting and told that terminating five days after planting was pushing the envelope. Through different iterations of the trial, some farmers settled on five days after planting as ideal for terminating cover crops; others found it was possible to delay termination as many as 27 days after planting but concluded that moisture management is essential for doing so.

Delayed termination is standard practice for Dick Sloan, but he wanted to validate its benefits to his operation with on-farm research. Dick compared weed pressure, yield and profitability between two cover crop termination dates relative to soybean planting: 6 days before planting (DBP), and 26 days after planting (DAP).

Beans reached the trifoliate stage 26 days after planting – the same date on which Dick Sloan terminated the cover crop in his delayed treatment near Rowley, Iowa.

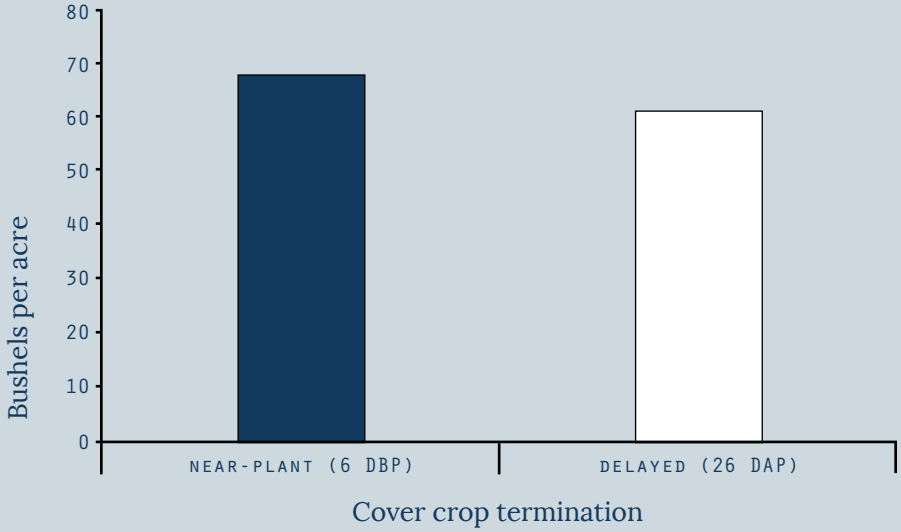
At five weeks after Dick Sloan planted soybeans on his farm near Rowley, Iowa, rye that was terminated 26 days after planting soybean (left) is dead but not yet decomposed while rye that was terminated six days before planting soybeans (right) has decomposed.

FINDINGS

Delaying cover crop termination until 26 days after planting lowered Dick's soybean yield and resulted in a loss in revenue of $39/ac compared to terminating six days before planting soybeans. He commented, "While soybeans can tolerate some early season competition with cover crops for light and moisture, and there is a benefit of improved weed control by letting covers grow longer, soybean yield can be reduced if covers grow too long."

"WE HAD A DRIER START TO THE CROP YEAR, SO EARLIER TERMINATION OF COVERS PROBABLY HELPED SOYBEANS MORE THAN IN A WETTER YEAR." - DICK SLOAN

SOYBEAN YIELD



Statistical analysis determined that delaying cover crop termination until 26 days after planting soybeans reduced yield at Dick Sloan's farm near Rowley, Iowa.

Corn Following Clover and Rye Cover Crops

COOPERATOR	**Arlyn Kauffman,** *WELDON*

Arlyn Kauffman initially wanted to compare biomass and grazing value among three green manure cover crops established between the rye and corn phases of his crop rotation. He frost-seeded strips of red and balansa clovers into his rye crop in March 2020, but sparse summer rainfall forced him to abandon seeding his third treatment: a cover crop mix seeded after rye seed harvest in July 2020.

Furthermore, the balansa clover did not establish, and Arlyn was instead left with a cover crop of volunteer rye in those strips. With what remained of his plantings, Arlyn was able to shift his focus and compare the effects of red clover and cereal rye cover crops on corn planted the following year in 2021. In his rye treatment strips, Arlyn drilled additional rye into the volunteer rye.

Corn following red clover (center) was darker green than corn following cereal rye (sides). "They were so green," Arlyn said. "It was astonishing from the road to see the difference in corn color. From the air, even more."

FINDINGS

Drought reduced Arlyn's corn yields substantially in both treatments – by 132 bu/ac in his red clover strips and 91 bu/ac in his rye strips. But the benefits of the red clover cover crop were clear. Compared to using a cereal rye cover crop, frost-seeding red clover saved Arlyn $220/ac, cut his nitrogen inputs and generated a 45% increase in yield.

Arlyn said of his experience, "[This trial] built my confidence that using clover to drastically reduce commercial N is a real thing. In an extended rotation that includes a small-grain followed by corn, this has to be about the lowest-hanging-fruit practice a person could imagine, based on what we learned."

Corn yields, treatment costs, revenues and returns on investment (ROI).

Cover crop	Corn yield (bu/ac)	Treatment cost ($/ac)[a]	Revenue at $5.20/bu ($/ac)[b]	Return on investment ($/ac)
Red Clover	132	$23.30	$686.40	$663.10
Rye	91	$32.62	$473.20	$440.58

[a] Cost includes seed and seeding.

[b] Because statistical analysis confirmed treatment yields were statistically different, we calculated revenues using each treatment's unique corn yield instead of a single average of both treatments' yields.

"NEEDLESS TO SAY, WE ARE ORDERING MEDIUM RED CLOVER TO UNDERSEED TO OUR SMALL-GRAIN [IN 2022] GOING TO CORN IN 2023."

– ARLYN KAUFFMAN

Allowing Established Clover to Grow With Corn

COOPERATORS | **Jack Boyer** , *REINBECK;* **Dick Sloan,** *ROWLEY*

Cover crops are typically grown during the periods between two cash crops, then killed around the date the second crop is planted. Jack Boyer and Dick Sloan, however, wanted to prolong growth of a clover cover crop beyond corn planting to maximize the clover's benefits. They hypothesized that suppressing, but not killing, the clover cover crop at the time of planting corn followed by fully killing it at a later date (delayed termination) would not harm corn yields compared with fully terminating a clover (Dick) or rye (Jack) cover crop at the time of planting corn (referred to as at-plant termination). Weed pressure at both sites necessitated earlier clover termination in both Dick's and Jack's delayed termination treatments than both hoped – 38 days after planting at Jack's and 24 days after planting at Dick's.

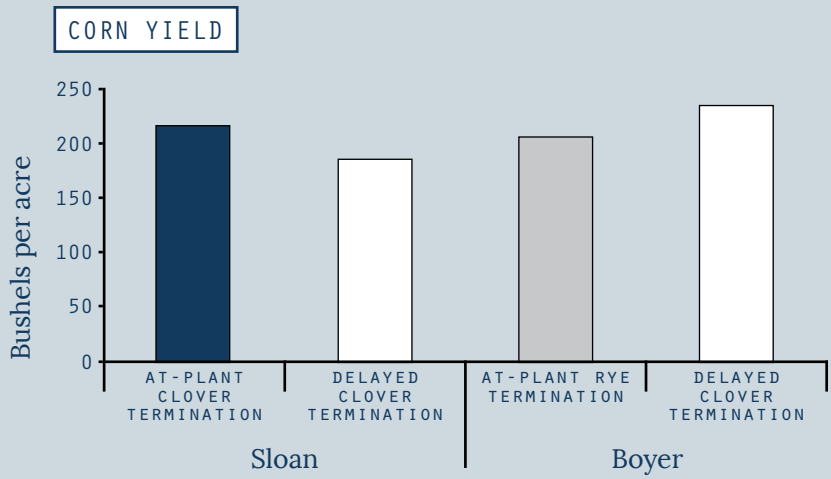
Corn in Dick's delayed termination treatment (right) was visibly behind developmentally compared to corn in his at-plant termination treatment (left).

FINDINGS

Dick's corn yielded better where he terminated the clover at the time of planting corn compared to where he delayed clover termination until 24 days after planting. At Jack's, delaying clover termination until 38 days after planting corn actually resulted in greater corn yield compared with at-plant termination of a rye cover crop. Both farmers expressed hesitancy about adopting the practice of suppressing or delaying termination of a clover cover crop in corn, though.

Jack does see some promise to the practice but is ultimately skeptical it would be consistently feasible. Dick intends to continue using clover cover crops but will terminate them before planting corn. Watch for results of Dick's 2022 trial in which he compares yields among corn planted into fall-terminated clover, spring-terminated clover and delayed termination clover.

"I SAW SOME OPPORTUNITY FOR CLOVER TO PRODUCE NITROGEN. HOWEVER, WEED CONTROL BECAME AN ISSUE. THE CONCEPT WAS GOOD, BUT IN PRACTICE IT WAS MORE DIFFICULT TO IMPLEMENT SUCCESSFULLY." - JACK BOYER



Statistical analysis revealed that delaying clover termination reduced corn yields at Dick's farm near Rowley, Iowa, while the opposite was true at Jack's farm near Reinbeck, Iowa: delaying clover termination improved yields compared with terminating a rye cover crop at the time of corn planting.

HORTICULTURE

2021 HORTICULTURE TRIALS

ANNUAL FLOWER POLLINATOR RESOURCE FOR CUCURBITS
Rob Faux, Mark Quee

BASIL VARIETY TRIAL
Carmen Black, Mark Quee, Jon Yagla

FALL RED CABBAGE VARIETY TRIAL
Emily Fagan & Hannah Breckbill, Alice McGary

REPLACING ROW COVER FOR FLEA BEETLE MANAGEMENT IN ORGANIC ARUGULA
Emily Fagan & Hannah Breckbill, Jon Yagla

SNAPDRAGON VARIETY TRIAL
Jill Beebout, Anna Hankins & Shae Pesek

SPINACH VARIETY AND SEEDING METHOD TRIAL
Kate Edwards, Emily Fagan & Hannah Breckbill

SUMMER CABBAGE VARIETY TRIAL
Kate Edwards, Emily Fagan & Hannah Breckbill

Row cover for organic arugula trial at Jon Yagla's farm in Iowa City, Iowa.

Basil Variety Trial

COOPERATORS	**Carmen & Maja Black, Helaina Thompson,** *SUNDOG FARM, SOLON;* **Mark Quee,** *SCATTERGOOD FARM, WEST BRANCH;* **Jon Yagla,** *THE MILLET SEED FARM, IOWA CITY*

Downy mildew is a basil disease that shortens the harvest window and reduces cumulative yield. The farmers at Sundog Farm, Scattergood Farm and The Millet Seed Farm wanted to compare yields between Genovese basil – a tried-and-true variety – and two varieties (Rutgers Devotion DMR and Prospera DMR) that are more expensive but bred for downy mildew resistance (DMR).

Carmen Black, of Sundog Farm, is satisfied with her basil production but believes her CSA members would appreciate a more consistent supply of basil for a longer duration, as well as greater quantities. Jon Yagla, of The Millet Seed Farm, on the other hand, said, "Basil has been an unsuccessful crop for me. If these downy mildew-resistant varieties actually work on my farm, I will be able to grow basil again." Mark Quee, of Scattergood Farm, hoped to determine "whether to go with a mix of several varieties (some not downy mildew-resistant, but cheap) or all in on downy mildew-resistant varieties."

THE UNDERSIDE OF A GENOVESE BASIL LEAF AT JON YAGLA'S FARM IN IOWA CITY, IOWA, ON JULY 16, 2021, REVEALS SIGNS OF DOWNY MILDEW.

A HEALTHY AND PRODUCTIVE PROSPERA DMR BASIL PLANT AT SCATTERGOOD FARM ON AUG. 9, 2021.

FINDINGS

Prospera DMR was the clear winner at all three sites with greater yield and less downy mildew pressure than Genovese and Rutgers Devotion DMR. Jon said, "It is great to have a basil variety (Prospera DMR) that will actually survive on the farm here in Iowa City!" Mark and Carmen were likewise sold on Prospera DMR and planned to use it for the bulk of their basil production going forward. Carmen remarked, "We learned that disease-resistant plant breeding can be successful."

"FOR ME, THE MOST VALUABLE ASPECT OF CONDUCTING THIS TRIAL WAS LEARNING ABOUT THE DOWNY MILDEW STRAINS AND PLANT BREEDING, AND LEARNING HOW TO USE THAT KNOWLEDGE TO MAKE BETTER DECISIONS IN THE FUTURE – NOT JUST FOR BASIL."

– HELAINA THOMPSON, SUNDOG FARM

Replacing Row Covers for Flea Beetle Management in Organic Arugula

COOPERATORS	**Hannah Breckbill & Emily Fagan,** *HUMBLE HANDS HARVEST, DECORAH;* **Jon Yagla,** *THE MILLET SEED FARM, IOWA CITY*

Arugula greens are highly desirable to humans and, unfortunately, flea beetles too. Flea beetles pierce the tender arugula leaves to feed and leave small holes that can render leaves unmarketable. Row covers protect arugula until they are removed for the first harvest, but time and labor constraints can keep growers from re-covering arugula between the first and second harvest.

Emily Fagan, Hannah Breckbill and Jon Yagla wanted to find out if the time used to re-cover plants and secure row cover edges is well spent or wasted. To do this, they compared the effects of three row-cover strategies on arugula quality. Emily and Hannah hypothesized that re-covering arugula and securing row covers with either sandbags, or more meticulously with soil, would reduce arugula damage compared to leaving plants uncovered. Jon hypothesized arugula damage would be similar among treatments.

JON YAGLA REMOVES ROW COVERS TO HARVEST ARUGULA AT THE MILLET SEED FARM IN MAY 2021.

EMILY FAGAN (LEFT) AND HANNAH BRECKBILL (RIGHT), OF HUMBLE HANDS HARVEST.

DIFFERENCES IN FLEA BEETLE FEEDING DAMAGE BETWEEN RE-COVERED (LEFT) AND UNCOVERED (RIGHT) ARUGULA AT JON YAGLA'S FARM IN IOWA CITY, IOWA.

FINDINGS

At both farms, re-covering arugula between harvests resulted in significantly fewer holes from flea beetle feeding. Hannah and Emily, who compared both row cover replacement strategies, found that meticulously burying the row cover edges with soil provided better protection from flea beetle feeding than securing the edges with sandbags. All growers agreed that making the effort to re-cover arugula between harvests, regardless of the strategy used to secure row cover, is prudent under heavy flea beetle pressure but may be less important if flea beetle pressure is minimal, such as at Jon's.

"NOW I HAVE A CONCRETE REASON TO SPEND EXTRA ENERGY RE-BURYING ROW COVER EDGES. I MIGHT STILL GET LAZY ABOUT IT, BUT I'LL AT LEAST TRY HARDER TO FOLLOW THROUGH ON RE-COVERING [ARUGULA] AFTER HARVEST."

- EMILY FAGAN

Statistical analysis showed that re-covering arugula between harvests resulted in significantly fewer flea beetle holes per leaf than leaving arugula uncovered.

	Uncovered	Covered	Re-Covered – Buried
Breckbill & Fagan	90.1	29.2	0.8
Yagla	4.5	0.4	n/a

Spinach Variety and Seeding Method

COOPERATORS	**Hannah Breckbill & Emily Fagan,** *HUMBLE HANDS HARVEST, DECORAH;* **Kate Edwards,** *WILD WOODS FARM, SOLON*

Climbing summer temperatures eventually cause spring-planted spinach to bolt, reducing yields with each successive harvest. Hannah Breckbill, Emily Fagan and Kate Edwards, all of whom wish to provide their customers with spinach later into the summer, sought to determine which of three seeding methods – seeding by hand at double the rate, or with a seeder at a double and single rate – would result in greater yields. Kate commented, "Calibrating mechanical seeders in horticulture is very imprecise. Unpredictable seeding rates results in under- or over-seeded spinach and inconsistent yields." Kate additionally compared yield between two spinach varieties: Kolibri and Kookaburra.

At Kate's farm, the yield of Kolibri spinach planted by a seeder at the double rate (left) was visibly greater than the yield when seeded by hand at a double rate (center) or by a seeder at the single rate (right).

FINDINGS

At Kate's farm, planting with a seeder at the double rate resulted in a statistically significant yield increase compared to seeding by hand at a double rate or with a seeder at a single rate. She saw no effect of spinach variety on yield. Statistical analysis of Hannah and Emily's data showed seeding method had no impact on yield in either of two succession plantings; however, their data were highly variable.

Emily commented, "I do feel that seeding rate impacts how well our spinach yields, even though the data were not statistically conclusive. Using the seeder is a job I don't like to do very much, so I'm not likely to choose to do it that way unless the data really tell me I should."

Kate Edwards and her newborn, Ada Marie, count spinach seeds at Wild Woods Farm near Solon, Iowa.

"CALIBRATING MECHANICAL SEEDERS IN HORTICULTURE IS VERY IMPRECISE. UNPREDICTABLE SEEDING RATES RESULTS IN UNDER- OR OVER-SEEDED SPINACH AND INCONSISTENT YIELDS."

– KATE EDWARDS

Fall Red Cabbage Variety Trial

COOPERATORS

Hannah Breckbill & Emily Fagan, *HUMBLE HANDS HARVEST, DECORAH;*
Alice McGary, *MUSTARD SEED COMMUNITY FARM, AMES*

In a 2020 summer cabbage variety trial, cooperators that year tested red and green cabbage varieties and found the red varieties yielded significantly less and were of lower quality. Emily Fagan, Hannah Breckbill and Alice McGary have also found it challenging to produce quality red cabbages and have heard the same from other growers. Curious to look more specifically at red cabbage production, they conducted this trial in 2021 to compare yield and quality of four red cabbage varieties: Buscaro, Ruby Perfection, Mammoth Red Rock and Integro.

A full view of Alice McGary's fall red cabbage trial at Mustard Seed Community Farm in August 2021.

Close-up views of the three red cabbage varieties trialed at Mustard Seed Community Farm in Ames, Iowa. From left to right: Ruby Perfection, Mammoth Red Rock and Integro. Not pictured is Buscaro, a fourth variety trialed only at Hannah and Emily's farm in Decorah, Iowa.

FINDINGS

Buscaro, which was grown only at Emily and Hannah's farm, was the top-performing red cabbage variety. It yielded a statistically greater weight of cabbage compared to Integro and Mammoth Red Rock. Buscaro and Ruby Perfection yielded similarly, but Buscaro experienced the least amount of black rot of all varieties.

At both farms, Ruby Perfection, Integro and Mammoth Red Rock yielded similarly. Although Buscaro performed best out of the four varieties, Emily commented, "I don't love any of the varieties we grew. I am still underwhelmed by how red cabbage grows on our farm compared to green cabbage. But I learned a lot and feel closer to red cabbage success."

"I AM STILL UNDERWHELMED BY HOW RED CABBAGE GROWS ON OUR FARM COMPARED TO GREEN CABBAGE. BUT I LEARNED A LOT AND FEEL CLOSER TO RED CABBAGE SUCCESS."
- EMILY FAGAN

Snapdragon Variety Trial

COOPERATORS	**Jill Beebout,** *BLUE GATE FARM, CHARITON;* **Anna Hankins & Shae Pesek,** *OVER THE MOON FARM & FLOWERS, COGGON*

Jill Beebout, Anna Hankins and Shae Pesek grow cut flowers to provide their CSA customers with weekly flower arrangements. The three wished to gain experience growing different snapdragon varieties with different bloom times and types. They counted the number of marketable stems produced by each of the varieties they grew to find out which was most prolific. Jill said, "Growing cut flowers is still a fairly new enterprise for us and we've just defaulted to the same standby variety. This trial gives us a push to expand our familiarity with other varieties and increase our cutting beds."

Snapdragons harvested at Jill Beebout's farm near Chariton, Iowa, on July 2, 2021.

Shae Pesek pinches back snapdragon plants on May 23, 2021 (about one month after transplanting) at her farm near Coggon, Iowa. Pinching helps to encourage branching and more blooms.

The farm crew at Jill Beebout's farm near Chariton, Iowa, collects observations on the final harvest date: July 16, 2021.

FINDINGS

Jill, who grew Costa Mix, Rocket Mix and Tall Deluxe Mix varieties, found that no variety outperformed another and was happy to gain experience with new varieties. She will use any of these varieties in the future. Anna and Shae grew Rocket Mix, Chantilly Purple and Madame Butterfly varieties – each with different bloom types and flowering periods.

They found that Rocket Mix yielded the greatest number of stems. Anna and Shae harvested throughout June, which is a peak flowering period for Rocket Mix and Madame Butterfly, but not for Chantilly Purple. Anna commented, "This trial really showed us that we need to spend more time and energy thinking about the varieties we're growing, where we are sourcing seeds and the conditions of our seedlings in order to produce the highest-quality flowers."

"THE MOST VALUABLE ASPECT OF THIS TRIAL WAS GETTING OUR FEET WET WITH THE COOPERATORS' PROGRAM. IT SPARKED OUR OWN INTEREST IN FUTURE TRIALS RELATED TO FLOWERS, BUT IT ALSO GOT SHAE'S FAMILY EXCITED ABOUT BEING POTENTIAL COOPERATORS INTERESTED IN HORTICULTURE AND ROW CROP TRIALS."

– ANNA HANKINS

LIVESTOCK

2021 LIVESTOCK TRIALS

ECONOMIC AND SOIL HEALTH IMPACTS OF CONTRACT GRAZING COVER CROPS

Nick Smith, Tim Daly

ECONOMIC AND SOIL HEALTH IMPACTS OF GRAZING COVER CROPS IN COW-CALF OPERATIONS

Perry Corey, Wesley Degner, Bill Frederick, Zak Kennedy, Mark Schleisman, Seth Smith

ECONOMIC AND SOIL HEALTH IMPACTS OF GRAZING COVER CROPS IN A FEEDLOT SYSTEM

Ben Albright

ECONOMIC AND SOIL HEALTH IMPACTS OF GRAZING DIFFERENT COVER CROP MIXES

Mark Glawe

FEEDING WHEY TO PASTURED BROILER CHICKENS

Carmen & Maja Black, Helaina Thompson, Carlos Williams

Carlos Williams, of Sundog Farm near Solon, Iowa, holds a processed, pastured chicken fed whey as part of an on-farm trial.

Economic and Soil Health Impact of Grazing Different Cover Crops Mixes

COOPERATOR | **Mark Glawe,** *GRABER*

The practice of letting livestock graze cover crops provides economic returns, and farmers wonder if benefits to soil health follow suit. Economic returns are realized within a year's time, while soil health impacts are slower to manifest. Mark Glawe, an integrated cattle-crop farmer, grazed cover crops in the fall, winter and spring from 2019-2021. To determine the economic and soil health impact of grazing cover crops, Mark kept cover crop and grazing records and had his soil sampled in the fall and spring of each year.

MARK HAS TRIED SEVERAL DIFFERENT COVER CROP MIXES FOR GRAZING HIS CATTLE NEAR GRABER, IOWA. CEREAL RYE AND OATS PROVE TO BE CONSISTENTLY PROFITABLE.

FINDINGS

Mark profited from grazing cover crops within the year of planting. In year 1, he profited $62.07/ac. In year 2, he profited $302.01/ac. Year 2 profits were higher due to a dry spring that provided more grazing days (21 in year 2 versus four days in year 1). Soil samples from May 2019 through May 2021 show few detectable trends in soil health indicators.

However, a nine-species diverse cover crop mix seeded after a small-grain crop and grazed in the fall improved microbial respiration compared with rye+radish+rapeseed cover crops seeded after soybeans. Grazing cover crops continues to be a way to achieve short-term economic benefits in integrated crop and livestock systems, and helps subsidize the cost of cover crops in non-grazed fields.

"GRAZING COVER CROPS IS A NO-BRAINER."

- MARK GLAWE

Cash crop and cover crop planted in each field, for both years of Mark Glawe's study.

Field	Year	Cash crop	Cover crop	Graze
A	2019	Oats + peas	mung beans, crimson clover, winter peas, pearl millet, cereal rye, sorghum-sudan grass, turnip, rapeseed and sunflowers	Yes
	2020	Corn	cereal rye, oats	Yes
B	2019	Soybeans	cereal rye, radish, rapeseed	Yes
	2020	Corn	cereal rye	Yes
C	2019	Soybeans	cereal rye, radish, rapeseed	No
	2020	Corn	no cover crop	No

Economic and Soil Health Impacts of Grazing Cover Crops in a Feedlot System

COOPERATOR

Ben Albright, *LYTTON*

Ben Albright and his family operate a diversified crop and beef feedlot farm. In this trial, feedlot cattle were allowed access to a cereal rye cover crop field adjacent to the lot in fall, winter and early spring, which provided supplemental forage to the herd. To determine the economic and soil health impact of grazing cover crops, he kept cover crop and grazing records and had his soil sampled in 2019, 2020 and 2021.

Cattle graze a cereal rye and oat cover crop field in early November at the Albright farm near Lytton, Iowa.

Ben Albright stands in the cover crop field adjacent to his feedlot on his family's farm near Lytton, Iowa. Photo courtesy of Landus Cooperative.

FINDINGS

Ben profited from grazing cereal rye cover crops each year. His profits averaged $45.56/acre or $16.08/head. Soil samples from May 2019 through April 2021, though, showed very few detectable trends in soil health. Grazing cover crops is becoming standard practice for cow-calf producers, but less so for feedlot producers. Ben proved how a cover crop field adjacent to his feedlot could provide supplemental forage through simply allowing finishing cattle to graze them, which saved him thousands of dollars in feed costs each year.

"I will definitely continue to plant cover crops on all the fields we graze."

- Ben Albright

Economic impact of grazing cover crops at Ben Albright's from 2018-2021.

	2018-2019	2019-2020	2020-2021
Total cover crop acres grazed	79	79	79
Number of head (steers)	240	248	193
Average gain per steer (lb)	296	344	387
Value of feed replaced by cover crops/lb gain	$0.05	$0.05	$0.05
Value of feed replaced by cover crops/head	$14.80	$17.20	$19.35
Total value of gain/yr	$3,552.00	$4,265.60	$3,734.55

WHAT'S NEXT?

In 2022, PFI cooperators are testing their hypotheses on a variety of topics. As of this writing, 80 trials are in the works. Twenty corn farmers will test whether healthy soils need less nitrogen fertilizer – many have remarked that such a statewide coordinated project couldn't have come at a better time, given how high fertilizer prices are right now.

Squash and pepper growers are evaluating cover crops like hairy vetch and cereal rye for improving soil fertility and controlling weeds in the walkways between beds. Vegetable farmers are looking at ways to diversify their operations and evaluating feed rations for pastured poultry.

Managing inputs like herbicide or labor are ever on farmers' minds. Can a roller-crimper convert a robust cereal rye cover crop into a thick mulch that suppresses weeds and eliminates the need for herbicide in soybeans? Should heirloom tomatoes grown in a high tunnel be pruned and trellised or left bushy and caged? Clearly, PFI cooperators are not short on ideas or practices they wish to test for themselves and share with others. They may not have all the answers, but through on-farm research PFI cooperators are on the case!

If anything in this report has piqued your interest or spurred any questions, please get in touch with me – I'd love to hear from you. Maybe you want to learn more about the Cooperators' Program or hear more about a trial directly from a cooperator.

Or maybe you have some ideas of your own – perhaps you've been mulling over a practice you've been wondering about for a while. Is it time to give it a try and put it to the test? To paraphrase a common sentiment shared by all PFI cooperators, "You don't know until you try!"

We hope to help you know. I look forward to hearing from you,

Stefan Gailans

SENIOR RESEARCH MANAGER

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