



Beyond Yield app results

February 2026

Our project team developed an app to support producers' soil health experimentation efforts on their own farms. We launched a closed beta of the app in December 2024, and onboarded 8 producers by February 2025. App usage results from the 2025 season showed that on-farm realities prevented 50% of users from implementing their experiments. Only 25% of users used the app during the growing season; time constraints were cited as the largest barrier.

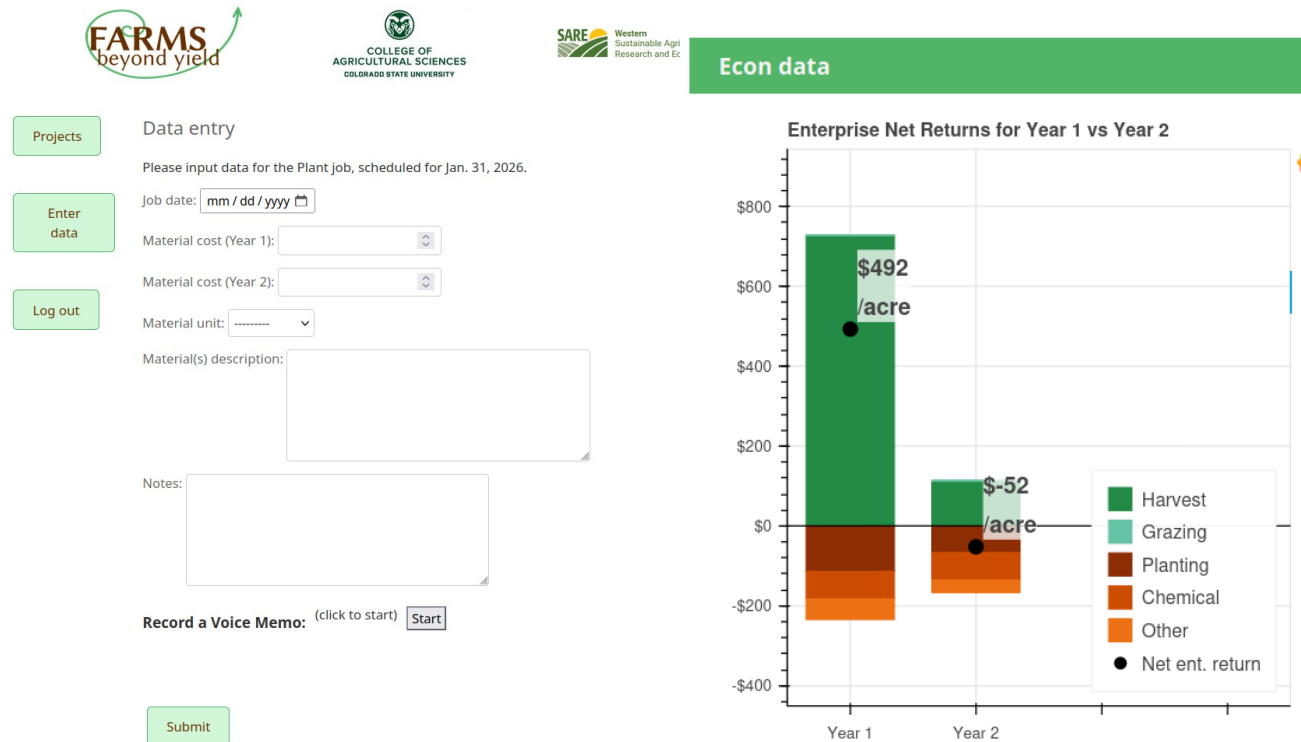
Motivation and key features: Producers are continually experimenting with soil health practices, and our app helped them document those experiments in higher fidelity, with less hassle. Key features include nudging producers toward more structured and rigorous experimental design (e.g., replication, controls, measuring variability), establishing timelines and metrics for data collection, and defining experimental goals and success criteria. Our app keeps track of what data is due to be entered (or overdue), and producers are texted reminders to input that data. If they ignore the text, they will be reminded again later (they selected the frequency; most chose 3 days). At the end of the season, the data they entered enabled producers and project staff to write post-experiment case studies collaboratively. The case studies included information about experiment setup and variables, photographs of the experiment in-progress, qualitative data from free text and voice memos, a partial budget analysis, and changes in soil health markers over time.

User interface: The main page of the app shows the data you've entered so far: photos, written observations, and econ data. Clicking "Enter Data" brings you to your task list and data entry schedule.



This work supported by Western SARE project #SW23-952

There are data entry pages for each job type: Planting, Harvesting, Grazing, Watering, Chemical, Other. They prompt for the user to enter job-specific economic and descriptive data, and gathers the costs of control and experiment plots side-by-side. The producer just has to input the cost of materials, and the app uses UNL economic data to add equipment, labor, and overhead costs to each job. Those costs flow directly into the partial budget analysis on the producers' front page.



In this case, the treatment was 'Year 1' and the control was 'Year 2.'

The data collected by the app gets compiled into a detailed write-up, allowing it to be easily shared in high fidelity with other producers or interested professionals.

FACT SHEET

Getting Diversity into Kernza using Pasture Cropping
Advice from FARMS producers

FARMS
Farmers Advancing Regenerative Management Systems
Supported by the U.S. Department of Agriculture under agreement number NR203A75001302006
Prepared Jan 2023



What is Kernza?

Kernza® perennial grain is harvested from domesticated forms of intermediate wheatgrass and is undergoing ongoing breeding and development by The Land Institute (Salina, KS).

What is Pasture Cropping?

Planting an annual crop or cover crop into an established perennial field, during the perennial's dormant season.

Region & Context

This Kernza field is in Rush County, central KS (24" precipitation). We are in the first D4 drought since 2012 and are at 50% normal precip for the last 15 months.

Why pasture crop into Kernza?

I'm becoming convinced that in our brittle environments, **perennials are possibly the only way to keep year-long living roots and covered soil**. None of my other perennial experiments are monocultures, so I decided to try **pasture cropping into the established Kernza**, in order to get diverse and high-quality forage for cattle to graze while they're trampling the Kernza straw (this also gets light on the crowns of the Kernza). I also want to get away from synthetic fertility, instead

U.S. Drought Monitor
Rush County, KS

This work supported by Western SARE project #SW23-952

Limited live demo of the app: [Click here](#). Contact me (lauren.hafford@colostate.edu) if you want a login to try the app out.

Usage during the 2025 growing season: Unfortunately, overall app usage was low. For 4 of the users, on-farm realities prevented them from implementing their experiments as planned (hail, land tenure issues, or ran out of time). For the four who did their experiments, only two of them used the app during the growing season as we had hoped: the reminders caught them at the right time and they added data while it was fresh in their minds. For the remaining two, one backfilled all the data using his existing, well-kept records, and the other did not use the app due to discomfort with the technology, but he texted photos and text to project staff.

Feedback from users: Post-experiment interviews suggested that all producers were hungry for the output of the app: the experimental reports from other producers' experiments. All were eager to share their collected data except for one (see below). However, low usage during the growing season suggests that this app (or perhaps most apps?) is not enough by itself to encourage producers to spend more time implementing or documenting their experiments. ***The bottleneck here is producers' time during the busy season*** – future solutions should focus on addressing this constraint.

All of the users liked the persistent reminders (text messages), even if they weren't necessarily effective in prompting data entry. One producer said, "Unless you're there, you're not going to take the picture, you know, at the time that you get the reminder." None of the users thought that the reminders were annoying. Several felt nudged by the text messages, saying they "felt guilty" or "felt pressured" to do the reporting, but they didn't say this in a negative way. I think that because this was an experiment that they had designed, to answer their own questions, and so the pressures were intrinsic in nature. Several mentioned wanting to make the reminders more persistent, and less easily snoozed. Many of them marveled at their own inability to make time for it during the season: "it only takes all of three minutes to get it done!" or "seems to me that whatever your experiment is, a monthly pic with a quick note would be a negligible time commitment compared to the actual [experiment]. Although I get the mindset, I do it all the time, I get so busy I don't think so much about what I should be busy doing."

One producer had serious concerns about the privacy of his data. This producer is historically underserved and lacks much of the landed privilege that some of his counterparts within this project enjoy. He has more than once had to fight for equity from his neighbors. He sees himself as a small player building a new market, and as such, if he were to share his learnings, his larger neighbors might think he's on to something interesting and completely flood the market, putting him out of business. Objectively, he's right. We need to tread carefully and have extremely clear, non-identifying, opt-in procedures in the app, to ensure that no producer is accidentally sharing information that they do not intend to share. The landed participants in this project enjoy generational wealth and highly capitalized operations, and did not have the same concerns. None of those participants were building new markets, and all were eager to share what they learned about building soil health on their land.

The beta version of the app was fairly rudimentary, and all users experienced issues with some of the more barebones aspects. These could be improved if this app were further developed. Producer feedback included:

- Streamline password recovery. Better yet, don't require a login after initial setup; this was a web app and wasn't able to keep producers logged in for very long. A standalone app would fix this.
- Improve the user interface (UI): many producers has issues with uploading the written data or photos. It would be nice to take the photo from within the app (instead of with your camera then uploading it with an awkward interface)
- More visuals – a map of the field, popups showing what you had planned for each plot, and what labels you chose for each treatment strip. This would help jog memories when you go to implement an experiment months after you set it up.
- The next version would need to include the ability for producers to set up their own experiments. It would be good to still involve project staff, so we can nudge towards increased experimental rigor.
- Have the app send the reminder when you're nearby the field, instead of arbitrarily. Allow producers to opt-in to location sharing to enable this feature.
- Automatically convert units of measure. If you measure in animal units, or head, or pairs, display other producers' experiments in those same units, so that you don't have to manually do the conversion when reading other peoples' writeups.
- Allow producers to upload soil test data so others can evaluate if an experiment is relevant to themselves: climate, soil type, pH, etc.
- Add new calendar reminders / nags. The schedule for these are set up at the beginning of the season (plant on this date, prompt for periodic observations twice weekly, etc). One user wanted to add new reminders for when to irrigate next, based on what he was observing.
- A more complex "Share" feature. We had envisioned the app being a data dump, later written up into a report by the producer and project staff during the off-season. One producer wanted to streamline this and cut out the delay inherent in relying on project staff, posting directly to Facebook. Another producer wanted to be able to search through the catalog of experiments to find things other producers did, and get in contact with them.

We would likely need to do more training on how to use the app. We set up the experiments in the off-season (Jan and Feb), and producers didn't start entering data until months later. This made password recovery, remembering what experiment they wanted to run, and having to re-learn the user interface much harder. One quick example experiment run-through right before the experiment started might have helped.

We were able to incorporate some of the feedback and make updates to the app, mainly related to how data is displayed once it is entered. Of the three producers who entered data, two of them wanted the data to be displayed in chronological order (latest entry at the end) instead of reverse chronological order. We had initially set the app up to hide the detailed economic data on the public version of the document for privacy reasons, but producers agreed that if they were taking the time to add that data, they wanted it to be publicly shared, indicating that they wouldn't post it on this app otherwise.

Potential for future work: While the app was released in a barebones state and there is ample room for improvement, it is likely that there is no amount of streamlining that could be done to overcome the fact that producers' time in the busy season is incredibly limited. It is a reality that these sorts of soil health experiments do not take priority over the sheer number of in-season field activities that need to occur.

More investment is needed on improving evaluation and documentation of the wealth of on-farm experimentation that is happening across private farms every year. This app didn't have much impact because it was competing for producers' time; a twice-weekly notification nag wasn't enough to bring their experiment to the top of the priority pile. ***Instead, one producer suggested that we could add more time for a farmer by adding more personnel: creating a new professional role that is part-agronomist, part-research assistant to the farmer.*** This person would add value through their agronomy consulting, and also be available on-farm to help implement and document the trials that producers are dreaming up and funding. In that scenario, this app would be a helpful tool for that research assistant to gather and organize data.

Beyond Yield app documentation

The repository for the app is available at <https://gitlab.com/f2190/beyondyield>

Before deploying the app, a cloud provider (such as DigitalOcean) should be chosen and a virtual machine created with the following properties:

1. Memory: at least 1GB
2. Storage: at least 25GB – This should be monitored, and a separate volume may be necessary if there are going to be a large number of photo uploads.
3. A firewall in the cloud provider that exposes only the following ports:
 - 80/TCP
 - 443/TCP
 - nnnn/TCP – For the SSH port, which should be changed from the default value of 22
4. OS: Debian 12 or newer

After creating the virtual machine the following steps should be performed:

1. Install a firewall, such as ufw, directly on the virtual machine and open the same ports as the firewall on the cloud provider. This is a redundancy should the cloud provider firewall ever fail or get accidentally removed.
2. Install the following packages:
 - nginx
 - certbot
 - python3-certbot-nginx
 - git
 - postgresql postgresql-contrib
 - rsyslog
 - redis
3. Create a new unprivileged user and checkout the repository in this user's home directory.
4. Configure postgres by creating a beyondyield role and database
5. Configure nginx
 1. Use certbot to get an ssl certificate for your hostname
 2. Set the root directory to the 'www' directory in the beyondyield project you checked out earlier. You may have to update the permissions of this directory to allow access for nginx.

Deploying – This should be done using the unprivileged user created earlier. More details can be found in the project README.md

1. Create a virtual environment and install python dependencies
2. Initialize/Update the database and static files
3. Create initial superuser
4. Install and enable the systemd services
5. Update your DNS record to point to the IP address of the virtual server