Science Societies

Soil health education in Nebraska: Practitioner insights and needs

By Ingrids Mata, Andrea Basche, and S. Carolina Córdova

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Photo courtesy of USDA-NRCS.

Despite widespread interest in soil health across Nebraska, many practitioners struggle to translate concepts into practical, locally relevant management decisions. This article explores survey insights revealing key challenges, preferred tools, and a growing demand for simpler, more actionable, and regionally tailored soil health education.

Soil health is a common topic at agricultural events, in conservation and policy discussions, and in everyday conversations among producers, advisers, and educators across Nebraska. Despite the topic's popularity, one question keeps surfacing: How can we make soil health truly relevant and valuable to Nebraskans, rather than just another trendy phrase?

To tackle this question, it is important to consider Nebraska's unique agricultural landscape and background. The state is primarily known for being home to a large-scale row-crop and livestock production system with corn, soybeans, and cattle dominant (Figure 1). While conservation practices such as cover crops, reduced tillage, and diversified rotations are often discussed, their adoption varies significantly across regions and farming operations. Considering this agricultural context in Nebraska, current practices can represent a high potential for degradation, but also a high potential for positive impact through the implementation of conservation and diversification practices such as increasing organic farming areas, implementing cover

crops, and extending crop rotations (Figure 1).

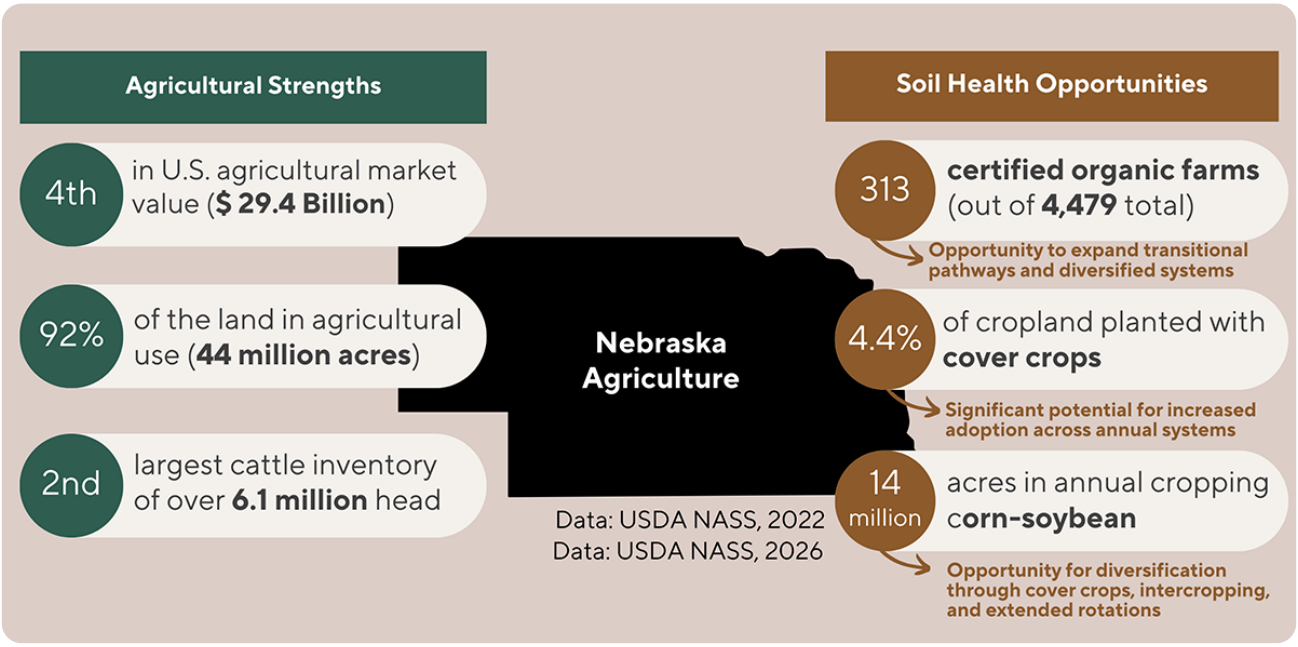


Figure 1. *Nebraska agriculture: key production statistics highlighting both the scale of production and opportunities to enhance soil health outcomes.*

To better understand how soil health education is currently implemented in Nebraska and to identify potential gaps, we conducted a statewide anonymous online survey in April 2025 using the University of Nebraska–Lincoln's Qualtrics platform. The survey was shared with a diverse group of agricultural professionals (agronomists, technical service providers, conservation specialists, and producers) as well as a list of extension educators who are involved in or familiar with soil health to some extent (Figure 2A). We also offered a QR code with the survey at a soil health extension event attended by approximately 30 people. We estimate that approximately 60 to 70 individuals received an email to take the survey and/or had access to it via the QR code. The individuals targeted for the survey play a crucial role in shaping how soil health concepts are understood, taught, and applied at the local level.

Rather than evaluating specific practices, the survey aimed to capture participants' experiences with soil health assessment and training. It sought to identify the tools and approaches they currently use, the challenges they face, and the types of resources that could better support their work.

Of the individuals receiving or responding to part of the survey, 41 respondents completed all of the survey questions, offering a valuable snapshot of soil health education and related needs across the state. The results revealed consistent themes: while soil health is widely valued and prioritized, many practitioners often struggle to translate its core principles into practical, site-specific recommendations that fit local conditions and production systems. By focusing on the perspectives of those working directly with producers and land managers, these findings offer a realistic view of the daily decisions influencing soil health management across Nebraska's agricultural landscapes.

Since soil health has gained popularity over the past two decades, many frameworks have emerged to quantify, analyze, and/or assess it. They vary in their approach, depth, and practicality for users and can be categorized as lab-based, field-based, or hybrid/digital systems (Table 1). Some frameworks emphasize quantitative indicators derived from lab analyses (i.e., the Haney Test) while others take a more qualitative approach, encouraging simpler in-field structured observations (i.e., NRCS's In-Field Assessment). With the context of many pre-existing frameworks and tools already available, we sought to explore the experiences of practitioners in the state with these assessments and other training experiences.

Table 1. Overview of selected soil health assessment frameworks and tools: Strengths and limitations for adoption in Nebraska.

Category	Soil health framework or tool	Core soil properties	Strengths	Limitations
Lab-based diagnostics	Cornell Framework - CASH (Moebius et al., 2016)	Soil wet aggregate stability, soil respiration, total or active carbon, nutrients, pH, soil hardness, and WHC.	Detailed insights, regional scoring, and management suggestions.	Higher cost, requires laboratory analysis, may need Nebraska-specific calibration.
	Haney Test (Ward Laboratories, 2019)	Solvita CO□ burst, water-extractable C: N, inorganic nutrients.	Integrates chemical and biological indicators; trend tracking.	Inter-lab variability requires interpretation.
	Soil Health Institute (SHI) Recommended Indicators (Soil Health Institute, 2022)	SOC, soil respiration 24 h, and soil wet aggregate stability.	Streamlined; research-backed; cost-effective.	Designed for monitoring, more so than field-level decisions.

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Soil Management Assessment Framework–SMAF (Andrews et al., 2001)	SOC, soil respiration, water infiltration, pH, EC, and soil bulk density.	Customizable scoring based on management goals.	Requires training; may not be widely accessible.	
Regen Ag Lab–Soil Health Panel (Regen Ag Lab, LLC, 2025)	Provides tests such as the Haney test, PLFA, POXC, enzymes, WHC, and aggregate stability.	Offers customizable test packages that integrate chemical, biological, and physical indicators regionally based in Nebraska. Quick turnaround.	No one unifying interpretive framework; results may require additional guidance for decision-making.	

Category	Soil health framework or tool	Core soil properties	Strengths	Limitations
Field-based qualitative	NRCS In-Field Guide (450-06) (USDA-NRCS, 2020)	Qualitative metrics: percentage of residue, compaction, infiltration, color, porosity.	Free, easy to use, and good for training.	Subjective scoring without numeric benchmarks.
	Penn State Worksheet (Duiker, 2017)	Qualitative metrics: soil structure, soil water infiltration, and SOM.	Inexpensive; encourages routine checks.	Qualitative only; requires consistency in evaluations.
Hybrid (field + lab)	Soil Quality Test Kit (USDA-NRCS, 2001)	Soil water infiltration, pH, EC, nitrate, soil respiration, and compaction.	Portable, low-cost, practical trend tracking.	Limited indicators, interpretation needed.

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Conservation Evaluation and Monitoring Activities–CEMA 204 (USDA-NRCS, 2024)	Standardized field protocols with lab options.	Structured evaluation of management practices; integrates field and lab data; designed for adaptive management.	Requires trained personnel (qualified Individual); multi-year commitment; data interpretation may require technical support.	
Digital/hybrid	LandPKS Mobile App (LandPKS, 2025)	Soil texture, infiltration, visual soil and vegetation scoring, GPS tracking, and lab data storage	Supports time-series monitoring; NRCS-aligned modules; offline capability	Requires smartphone and user training; limited benchmarking tools

Indicators: SOC = soil organic carbon; POXC = permanganate oxidizable carbon; EC = electrical conductivity; SMC = soil moisture content; MBC = microbial biomass carbon; PLFA = phospholipid fatty acid analysis; AWC = available water-holding capacity

What we gathered with the survey

1. Soil health is a priority, but it is not always straightforward

The message was clear: practitioners across Nebraska are involved in soil health work, whether they are just starting out or have years of experience. Many respondents

reported significant agricultural experience and prior soil health training (Figure 2A–B), indicating that soil health is already part of various professional roles throughout the state. However, experience alone does not solve all challenges. Practitioners pointed out an ongoing gap between their engagement with soil health and the tools or conditions needed for implementation (Figure 2C). The most common barriers they mentioned were the cost of testing (n = 19), limited time (n = 18), and a lack of clear action steps (n = 17). Concerns about reliable benchmarks were also raised (n = 14). These results suggest that although many are familiar with soil health concepts, even those with decades of agricultural experience may struggle to translate them into practical, site-specific management decisions.

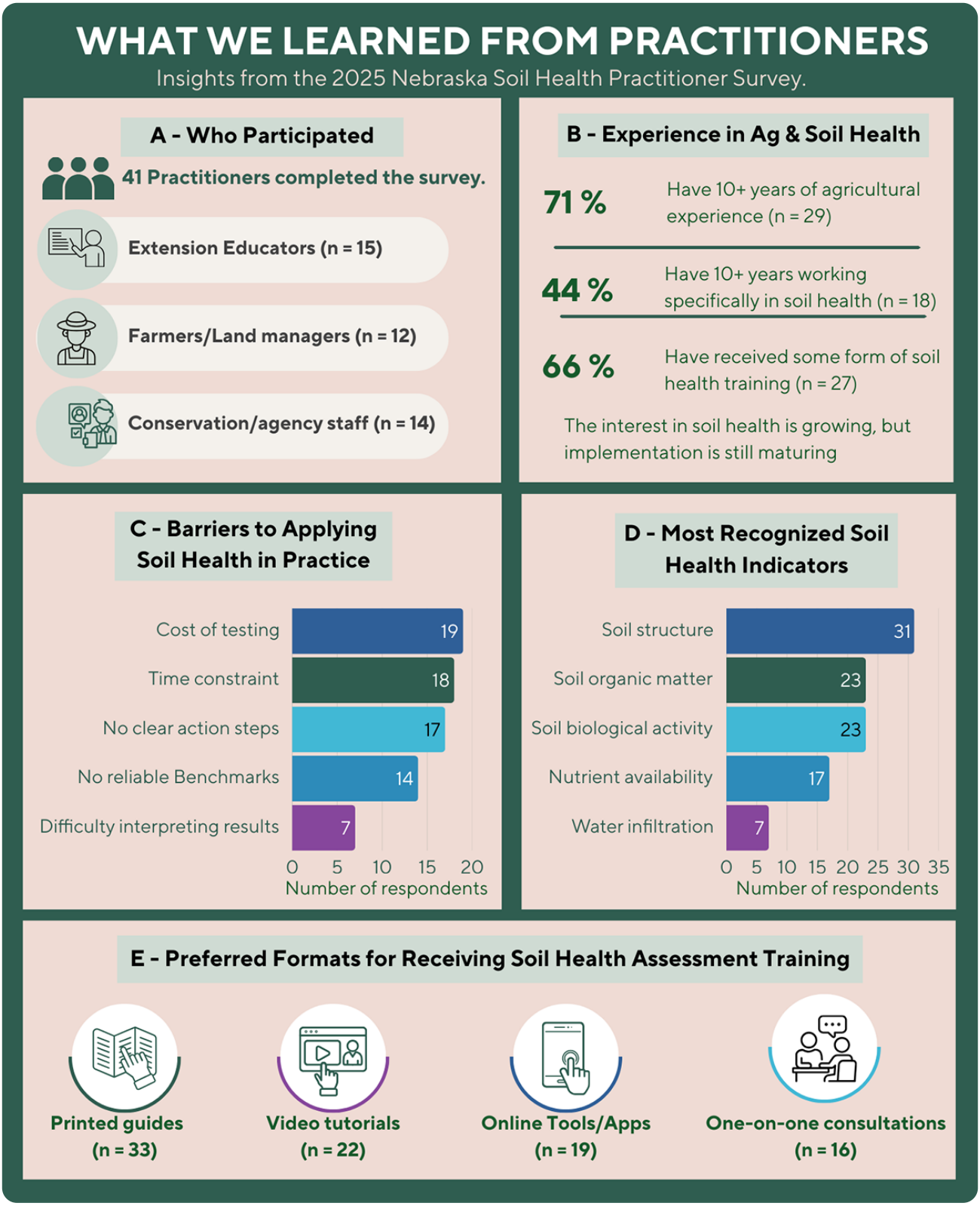


Figure 2. *Survey responses from Nebraska soil health practitioners (n = 41). Panel A: Professional roles. Panel B: Experience and soil health training. Panel C: Reported barriers to soil health implementation. Panel D: Recognized soil health indicators. Panel E: Preferred training formats.*

2. A reliance on familiar and interpretable indicators

When asked which soil health indicators they most commonly recognize or rely on, respondents mentioned a familiar set of soil health indicators (Figure 2D). Soil structure was identified most often (n = 31), followed by soil organic matter (n = 23) and biological activity (n = 23). Nutrient availability was also frequently selected (n = 17), whereas water infiltration was less commonly mentioned (n = 7). Commonly, indicators like soil structure and organic matter are included in standard soil testing and extension programs, making them accessible points of reference in management conversations. Although more comprehensive biological or integrated assessments exist and were mentioned as having been at least tried for some participants, their use may be influenced by practical factors, including the need for additional guidance, context, or resources. Overall, these responses suggest that widely recognized and easy-to-interpret indicators may play a greater role in routine soil health discussions.

3. Existing soil health tools are helpful but not always a good fit

Many respondents indicated that they use established soil health assessment tools and educational resources, including several of the frameworks summarized in Table 1. These tools are generally viewed as scientifically credible and based on research. However, survey responses suggest that not all tools align seamlessly with Nebraska's production systems or the needs of different audiences. This is consistent with the previously reported barriers, including tool complexity, cost, time constraints, and difficulty translating assessment results into clear management recommendations (Figure 2C). It suggests that when tools require additional interpretation, adaptation, or resources, implementation may become more challenging for practitioners to adopt. As a result, some resources may be used selectively or adjusted to better fit local

cropping systems, livestock operations, and operational realities.

4. A clear demand for practical, visual, and adaptable educational resources



Video tutorials were the second most preferred training format in the survey. Photo by Jaclyn Fiola.

Survey responses indicate a clear preference for practical training formats (Figure 2E). Printed guides were the most frequently selected option (n = 33), followed by video tutorials (n = 22) and online tools (n = 19). One-on-one consultations were also valued (n = 16). Considering that respondents also identified cost, time constraints, and a lack of clear action steps as key challenges (Figure 2C), it is not surprising that practitioners gravitate toward straightforward, easy-to-apply resources. When time and budgets are limited, materials that are concise, affordable, and clearly linked to management decisions become especially important. In Nebraska's diverse agricultural systems, site-specific and adaptable resources may help bridge the gap between soil health concepts and everyday decision-making for those working the land on a daily basis.

Overall implications for soil health education in Nebraska

These findings highlight the growing interest in soil health in Nebraska while also pointing out the challenges that still need to be addressed to make educational efforts more effective. Practitioners are enthusiastic and engaged, but they often find themselves navigating complex materials with limited time and resources. If outreach information is too technical, lacks local context, or is hard to translate into practical

management decisions, it risks missing the mark. It is essential that soil health education is rooted in the realities of local agriculture and responsive to the needs of practitioners. This approach should foster meaningful discussions in the field. By actively listening to practitioners and learning from their experiences, soil health programs can bridge the gap between scientific knowledge and practical applications.

Insights from this work are already shaping the development of soil health resources in Nebraska, including new educational materials that are both accessible and regionally relevant. For example, Dr. Córdova and the University of Nebraska–Lincoln Soil Health Program team are developing short videos and a new soil health workbook for agriculturally managed fields, supported by USDA-SARE. Similarly, Ingrids Mata at City Sprouts in Omaha, with the Conservation and Soil Health Program, is bringing soil health into community-based education initiatives. These efforts include practical workshops, soil health outreach events, and locally tailored materials that help urban growers, small-scale producers, and community gardeners apply soil health principles in more complex and diverse production settings. As interest in soil health continues to grow, prioritizing practitioners' perspectives will be crucial to ensure that soil health education is not only informative, but also actionable and impactful.

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