PEER GROUPS

SUMMARY REPORT

SOIL HEALTH NETWORK

SUMMARY BRIEF

Project Overview:

The Soil Health Network, led by Assiniboine College, funded by the Weston Family Foundation and supported by an alliance of western Canadian network partners, is building a new kind of soil health collaborative framework—one that acknowledges the unique circumstances of each farm. The Network doesn't hand out prescriptions or report cards. It listens. It enables peer-to-peer learning, supports incremental change, and connects service providers to what farmers are really asking for. This summary highlights key conversations and takeaways from over 25 peer-groups across the prairie provinces representing more than 300,000 acres.

APPLIED SOIL HEALTH PRACTICES

Current on-farm practices that are being applied with soil health in-mind

PHYSICAL LAND MANAGEMENT

- Reduced / precision tillage applications:
  - Weed suppression
    - Organic producers continuously required some tillage for weed suppression
  - Straw/ trash management
  - Seed bed preparation
  - Deep ripping compacted clay soils
  - Zero Tillage
    - Improved soil structure, microbial health, water infiltration
    - Most are zero tilling wherever possible and only till when it is necessary based on soil conditions and weather
  - Strip Tillage
  - Subsoiling to resolve major compaction and/or hardpan issues
- Residue & straw management applications:
  - Producers mentioned management being particularly critical at harvest (spreading of straw)
  - Dropping straw behind the combine and using as a source of feed for livestock
  - Swath grazing with livestock as an overwinter feed source
  - Maintenance of plant residue on the soil surface during and after livestock grazing is necessary to limit the overgrazing of forage stands and is also an important strategy to moderate soil moisture and temperature
  - Always leaving some stubble or thatch when removing straw
    - Provides inherent benefits of ground cover and moisture moisture management
    - Retain and recycle nutrients
    - Retain & build on existing organic matter
    - Reduce soil exposure to physical and moisture erosion
    - Many stopped burning straw residue altogether because of improved straw handling practices at harvest
    - Leaving too much residue can be a problem with heavy clay soils
- Reduced compaction methods:
  - Reduce passes on field wherever possible
  - Deep ripping in target troubled areas
  - Trying different tires on a variety of machinery
  - Cover crops/ green cover to reduce rain compaction
  - Straight cutting crops can reduce field operations

"In Europe many have taken back to the plow with a twist. The new plows only work the top few inches to incorporate the top-soil without too much depth. We feel the soil needs to be worked after too many years no-till. We think the nutrients are all at the surface and the plants are not taking advantage of the nutrients."

APPLIED SOIL HEALTH PRACTICES

Current on-farm practices that are being applied with soil health in-mind

WATER MANAGEMENT

- Tile Drainage
  - A high level of interest in the strategic use of tile drainage to manage soil moisture and salinity issues
    - A very popular discussion topic among groups across MB, SK, AB
    - Some noted the tiles did not work as expected
    - Many brought up the technology in particular as a potential solution to saline soils
  - In certain cases - tile drainage was used with the construction of a holdback structure for water retention to prevent downstream flooding. There is also potential to irrigate fields with the water that is retained by the holdback structure
- Water retention and drainage
  - Producers using cover crops and perennials believe they use up excess moisture and also protect the soil surface from evaporation
  - Retaining roots in the soil provides pathways for water infiltration
- Removing or consolidating standing water wherever possible
  - Identifying problem areas and managing based off where water is expected to be
- Mole plow considered for improved drainage within fields
- Using more irrigation to allow for better management of the land especially in drought prone regions
- Exploring artificial drainage options
  - Areas where flooding poses a constant financial threat to cash crop revenue
  - To reduce salt ring effect of low depressions
  - Options mentioned include the construction of ditches within a field and subsequent infrastructure (e.g. flow control structures, culverts) to limit downstream impacts.

PEST & DISEASE MANAGEMENT

- Using “See and Spray” technology for weed suppression while reducing chemical costs
- Cultural Controls
  - Disrupting weed life cycles without using chemicals through crop rotation and competition
    - Introducing competitive and desired plants
- Reducing chemical application of herbicides, pesticides, and fungicides wherever possible
  - Using diverse crop rotations as a solution
- Using more biologicals where possible
  - Biological fungus on peas and canola was mentioned
- Managing salt tolerant species
  - Fall herbicide applications with residual activity and other modes of action to target kochia and foxtail barley
- Livestock grazing as a weed management tool

APPLIED SOIL HEALTH PRACTICES

Current on-farm practices that are being applied with soil health in-mind

NUTRIENTS & FERTILITY

- Soil Sampling:
  - Using annual soil sampling to monitor changes in soil chemistry and properly apply additives
    - Sampling the same spots each year is very important (~ 7 samples per quarter)
  - Soil testing can take years to see an improvement
    - Highly dependent on what parameters are being measured
    - Some producers give-up on the practice after not seeing short term results
    - Many know soil testing is a good practice, but they don't know the best way to act on their findings because of the interference of confounding variables
- Tissue/ SAP analysis on crops
  - To better understand specific nutrient needs of the crop
  - To properly apply required nutrients and reduce waste/ overapplication
- Variable Rate Fertility
  - Targeted reduction in grain lodging and subsequent improvement in harvest quality
  - Used in several instances to specifically reduce synthetic inputs
  - Ideally managing the risks of both under and over application
- Application of compost/ manure
  - Pork, beef, and poultry manure applications have consistent positive results when viable
  - Improving management and productive application wherever possible
    - In-furrow liquid compost during seeding was one application method mentioned
  - Used in many cases to specifically reduce synthetic applications/ dependency
  - Improves general soil fertility and improves productivity of salt-affected soils and eroded knolls
  - Quality of manure was very important to some producers and they defined quality by the ratio of animal solids → straw → water
- Reducing excess/ non-beneficial inputs wherever possible
  - Using the 4Rs (Source, Rate, Time, Place) methodology
  - To save money
  - Overapplying nitrogen seems to be a common waste
  - Trying different nutrient blends and inhibitors
  - Cutting phosphate applications where possible by encouraging more effective natural release
  - Seeding equipment with sectional control allows for reduced over-application of nutrients
- Using Biosols (Organic fertilizer and soil amendment)
- Green manure from terminating forages and cover crop combinations

"We have been trying to increase our organic matter on the farm. It seems our weather may be the biggest detriment to our success. We had a bad drought and then excess moisture all in one year!"

APPLIED SOIL HEALTH PRACTICES

Current on-farm practices that are being applied with soil health in-mind

NUTRIENTS & FERTILITY CONT.

- Addressing nutrient deficiencies
  - Liming for calcium deficiencies
  - Phosphate, humic, sugar, gypsum, elemental sulfur
    - Used for specific problem areas to improve soil fertility
  - Scouting problem soils and keeping track of them year-to-year
    - Soil testing and tracking yield variations
  - Seeding saline soils with feed perennials for livestock and not applying any new nutrients or additives
    - Establishing alfalfa, reducing kochia
- Carbon -> Nitrogen ratio is considered by some to be the most important nutrient balance to monitor
- Haying
  - Applying hog manure to locations that have been previously hayed for livestock to replenish depleted nutrients
  - Many believe bailing is an unnecessary practice in most scenarios and harms soil health/ nutrient density within the soil
- Seeding down salinity spots and buffer zones around sloughs and wet spots and/or removing them from crop production

TECHNOLOGY & EDUCATION

- Contacting several agronomists to receive varying opinions and recommendations when trying a new practice, product, etc..
- Understanding and identifying indicators of soil health (cattle manure, water infiltration tests, C-N balance, trash management, seagulls, pollinators & other fauna as bioindicators indicators via presence, population health, etc..)
- Recognition of land's inherent productivity.
  - Participants indicated that some land is better suited for hay production rather than annual grain crops. While this land can be converted for annual grain production, it may not be economically feasible or sustainable
- Weather stations and soil moisture probes.
  - Soil moisture measurements are used for yield prediction and to inform fertility planning.
  - Weather stations assist with efficiency of equipment operations, by indicating when conditions for applications are unfavorable.
- SWAT Maps (soil, water and topography maps)
  - Used mostly for variable rate applications
- Using RTK equipment guidance to seed precisely between the previous years crop row
- Using near infrared technology (NIR)
  - Used to analyze various aspects of crops, soil, and animal feed

APPLIED SOIL HEALTH PRACTICES

Current on-farm practices that are being applied with soil health in-mind

BIODIVERSITY & CROP CHOICE

- Intercropping/ Polycropping:
  - Multiple combinations being considered
    - Oats and barley & edible peas, oats and maple peas, triticale and maple peas, oat barley and maple peas and buckwheat, corn and sunflowers, beans and corn, faba beans and wheat, buckwheat and oats, peas and canola, and others
    - Very region dependent
  - Forage crops companion cropped with cash crops in the year of establishment
  - Introducing new crop varieties, when possible, to improve biodiversity and associated benefits
    - Beneficial insects, enhanced microbial activity
- Improve soil microbial activity
  - Removing seed treatment over concerns of a significant negative impact on soil protozoa
  - Reducing soil disturbance wherever possible to encourage microbial health
- Maximize biomass/ biodiversity wherever possible
- Incorporation of more diverse crop rotations
  - Some attempt to never plant the same crop back-to-back
    - Others have said planting the same crop for a maximum of two years in a row and then returning later than with annual rotations works best for them (2years->5year break)
  - Establishing Bi-annuals to cover more of the shoulder season
  - Soybeans incorporated into rotation specifically for nitrogen fixing properties
  - Using certain crop rotations to keep roots in the ground as long as possible
  - Many highlighted a noticeable impact on biological health and financial returns after a few years
  - Paying very close attention to yield drag and yield boost from managed rotation(s)
- Precision planting/ direct seeding
  - Row spacing of 7-8 inches in canola saw an 88-92% emergence rate
  - 10inch row spacing and excess seed to grow peas in rotation (4-5years before returning)
  - Attempting to reduce soil disturbance as much as possible during seeding
    - Noted to have a big impact on water erosion
- Integrated livestock management
  - Swath grazing
  - Maximizing the amount of cattle on the land and the time spent grazing
    - Some believe livestock focused farms should have every acre see cattle within the year
  - Forage species selection should be tailored to unique soil conditions for the best results
  - Rotational grazing
    - Cover crops
      - Integration with annual grain cropping to improve soil fertility/ health
    - Critically important practice to maintain pasture health
    - Inherently favors nutrient cycling and prevents excessive nutrient accumulation that may come from grazing livestock in a single pasture over the entire winter

APPLIED SOIL HEALTH PRACTICES

Current on-farm practices that are being applied with soil health in-mind

BIODIVERSITY CONT.

- Growing Perennials
  - To reduce equipment costs and requirements
  - Not bailing perennials whenever possible
    - If they must be bailed it is best to leave them as feed in-situ otherwise you are exporting nutrients/ carbon from the field
  - Balancing perennial and legume rotations over 10-20years if managed well can be very beneficial
  - In a 4-5 year rotation has been noted to
    - Improve water infiltration, break weed cycles, and improve soil fertility
- Cover Cropping:
  - Using rye grass and red or sweet clover as an inter-seeded cover crop
    - Lightly inter-seeded with a deep-row planter to delay emergence
  - Too optimize feed sources for livestock
    - Some plant cover crops as an annual crop for this specific purpose
  - Managing volunteer cover-crops from the regrowth of the regular/ previous crop appears to be a practical method of providing sufficient cover
  - Popular cover-crops options among participants include (Oats, peas, radish, vetch, fall rye, winter wheat) and/ or combinations
    - Lots experimenting with recipes and the best time to grow/remove to not overshadow the beneficial aspects
  - Some covers are under-seeded with cereals. These can be challenging to implement and participants indicated mixed success
- Relay Cropping (two crops being grown simultaneously during a portion of their lifecycle)

"We are applying manure from a local cattle producer a few miles away on some newer purchased land that does not have as good of topsoil and nutrients as the land we have been zero tilling for 15+ years. We would like to do this on additional acres, but there is not additional manure in the immediate area to add."

NEXT SOIL HEALTH GOALS

The next relevant soil health practices & methods that farmers are considering!

PHYSICAL LAND MANAGEMENT

- Ongoing straw management practices to continue to improve soil health (fertility and organic matter) and improve conditions for annual seeding operations
- Continue working on appropriate tillage rate to minimize chemical dependency and input cost while protecting soil structure and biology where possible
  - Working on trying to better understand when and how much tillage will promote health and growth
  - Working to reduce compaction caused from livestock grazing in fields over-winter
- Tillage with a cultivator following grazing can be done to remediate compacted soils, but should only be done when necessary
  - Trying long term zero-till with periodic deep tilling
  - Deep ripping has been used to remediate compacted soils. However, the benefits seem to last only for a 2-3 year period before soils become compacted again.
- Working on improving trash/residue management
  - Chopping straw fine enough to maximize biodegradation and minimize the impact on seed emergence.
  - Trying new chopping systems and direct seeding equipment
  - Working on reducing residue compaction
- Comparison of low → very low tillage disturbance particularly with canola and row cleaning.
- Trying to reduce heavy harrowing by creating better residue management
- Learning more about controlled traffic to reduce compaction issues
  - Finding a way to deal with headland compaction
  - Changing equipment used or reducing passes on the field
  - Reduced passes should also lower fuel costs
- Dealing with hardpan caused by seeding at the same depth

WATER MANAGEMENT

- Planning to add strategic tile drainage and access local spring water to address production concerns
- Using tile drainage for the first time or in more areas
  - Some are looking into it specifically to remediate salinity problems
  - Pattern tile drainage projects (Suited to topography)
- Rerouting water drainage on hilly areas
  - To reduce erosion and nutrient displacement
- Using a mole plow to create an unlined drainage tunnel in the soil for subsurface drainage
  - Especially in areas of high clay content

NEXT SOIL HEALTH GOALS

The next relevant soil health practices & methods that farmers are considering!

NUTRIENTS & FERTILITY

- Focusing on slumped or shallow topography and saline soil patches where there are nutrient imbalances
  - Reclaim or remove them from use altogether
- Trying vermicompost (worm castings)
- Using more manure when affordable over synthetic applicators
- Addressing pH declines in soil
- Removing unnecessary nitrogen inputs wherever possible
  - Continuing to research relation of excess N to disease and pathogen prevalence
- Trying humic acid and molasses for the first time
  - Some are continuing to try these additives to better understand the impacts over a longer period of time
- Working on properly aerating the soil to improve all aspect of soil health (aiming for 20-30% air space)
- Trying biological products
  - With wheat and oats
- Researching better ways to apply additives over simple broadcast applications.
- A liquid solution amendment that would go in with the seed to increase viability and emergence of certain crops
- Using inhibitors with fertilizers to hopefully reduce required inputs and losses
- Some believe a lot of excess salt in the soil is caused form over-fertilizing
  - Aiming to reduce saline problems by increasing fertilizer efficiency
- Finding solutions to sulfur deficiencies
- Reducing glyphosate usage wherever possible
- After using no inputs for 3-years, is planning to try adding some fertilizers again to better understand where and what it directly impacts.

TECHNOLOGY & INNOVATION

- Continuing to develop new ways of evaluating the benefit-costs analysis of on-farm practices
- Address the need for improved data collection, retention, access and ensure the longevity of the data to measure against ongoing practices
  - Better data tracking to “evaluate” and document soil health benefits. Tools are becoming more accessible that help collect data on the farm
- Measuring abiotic stress caused from land management practices
- Trying drones
  - For seeding, surveying, variable applications
  - Rotor wash has been noted as a particular challenge
- Working on building a stronger market for regenerative products and practices
- Improved sectional control of seeders and sprayers to minimize overlap

NEXT SOIL HEALTH GOALS

The next relevant soil health practices & methods that farmers are considering!

PESTS & DISEASE

- Managing perennial weeds
- Using Rye as a form of “herbicide” and using a nutrient application to kill the planted Rye over synthetic chemicals
- Trying different crop rotations to alleviate disease and weed pressure

BIODIVERSITY & CROP CHOICE

- Trying intercropping
  - Peas and canola, corn and vetch, canola and sunflowers, and others
- Taking on new or additional livestock
  - Increase livestock stocking rates -> increased cattle on the land
  - Increasing fiber uptake wherever possible
  - Try grazing on full season cover crops
  - Try new grazing systems (Graze half, rest half -> swapping year to year)
    - Synchronize grazing rotations with cattle digestive process
- Varietal selection that may improve agronomic practices (shorter stronger straw varieties)
  - Planting different species in high vs low ground
- Improving seeding efficiency with sectional controls and precision drill (variable rate seeding)
- Integrating more legumes into rotation
- Trying more spacing between seeds to improve growth and reduce plant competition
- Using harvest to better understand the impacts of seeding rates and distribution
- Better understanding harvesting, seeding, and harrowing angles
  - All impact plant growth
- Building on current crop rotations
  - Adding more crops into rotation to increase biodiversity (I.e. perennials)
  - Try 7-year perennials followed by 7-year cash crop rotations
- Trying alternative legume varieties
- Cover cropping
  - Experimenting with volunteers
- Using cattle to graze cover-crops
- Trying more shoulder season and winter crop varieties
- Experimenting with under-seeding cover-crops that are spring seeded
- Reducing percentage of monocrop acres
- Increase photosynthetic potential of land
  - Currently ~90% of acres only utilize 60 days of photosynthesis
- Improving soil biology
  - Hopefully reduce fertilizer dependency
- Increasing seed application rates to areas of the field with increased seedling mortality due to salt accumulation

BARRIERS PREVENTING CHANGE

Barriers that are keeping farmers from trying new things

PHYSICAL LAND MANAGEMENT

- Local soil types can make reduced tillage difficult to impossible
  - Success is highly dependent on soil types and weather patterns
- Soil compaction caused from livestock grazing under some conditions
  - Most participants, however, feel the benefit outweighs the risk
- Roadways and drainage have been mentioned as a potential cause of salinity issues because they stop water movement under the soil surface due to the compaction and only allow for specific pathways for the water to migrate off the field

WATER MANAGEMENT

- Persistent extremes of moisture make it difficult to work/ incorporate new practices in all aspects of the farm's operations
  - Some years require a different response than what would be preferred in order to salvage a crop and still make profit
- Tile drainage is difficult for some to get approved in their region/ municipality
  - Local policy and farm neighbor implications (where does the water drain to?)
  - Not as feasible for all, but many don't know what the best alternative for water management is
- No cohesive plan on how to manage excessive water in the district. Everyone is dealing with the same problem, but there aren't any discharge sites that wouldn't impact neighbors.
- Some believe wetlands don't filter nutrients, rather they tend to accumulate nutrients.
- Some groups noted that there is no financial support or recognition for producers wanting to keep wetlands.
- Shelterbelt tree rows can cause enhanced water erosion

PESTS & DISEASE

- Weed pressure makes it difficult to implement cover crops
- Several participants indicated difficulty in incorporating pulses in rotation due to disease issues
- Shelterbelt tree rows were noted to be a reservoir for crop pests and diseases
  - Unique risks to be managed

"Most barriers to change stem from the high purchase cost of equipment and technology - such as needing a new air drill to do VR. The other major barrier is that the current landowner does not want to implement change on the farm."

BARRIERS PREVENTING CHANGE

Barriers that are keeping farmers from trying new things

NUTRIENTS & FERTILITY

- Use of Variable Rate Fertility (VRF)
  - Many have tried VRF, but the indices to measure success are not believed to be very clear.
  - Continued use in Alberta in pockets but is not widespread among peer-group attendees
  - Prescriptions are highly dependent on soil sampling quality
  - Many ran into machinery issues that impaired their continued interest in VRF
- Compost/ manure application
  - Supply, timing, and cost are all huge barriers preventing a practical option for soil fertility issues
- Too many biological products are on the market, making it difficult to understand what can provide a return on investment and what can't
- Not enough feedlots for natural amendments/ fertilizers to be used effectively and efficiently
- Too many practices focusing on CO_2 and emissions but ignoring other nutrients and outputs
- No real phosphorus option for organics currently
- Biological inputs don't seem to outcompete synthetic inputs in the short-term making it difficult for some to see the justification
  - Many have stated that after a few years the benefits become more observable

TECHNOLOGY & INNOVATION

- While there are many potential benefits from collecting, analyzing and interpreting data from on-farm beneficial management practices, it can be very difficult to prioritize this data collection and analysis during the other duties associated with operating a successful farm.
- Don't have the right equipment to properly integrate new practices
  - Equipment costs are way too high
  - Most equipment is built for conventional practices
    - This is seen as a significant deterrent for people wanting to try new things
- Credible and easily understood product offerings that have a proven development cycle behind them.
  - Growers have clearly stated they cannot afford to test unproven technologies or products
    - Small scale field trials are hardly a convincing scenario to get growers to adopt potentially risky new technologies (general consensus)
    - Further ground truthing is required
- Sometimes new technologies overcomplicate soil (and farm operations) management or require too much investment before they become a practical tool
  - Many producers are already stretched for time
- Precision and amount of sampling required to fully adopt variable rate technologies
- Precision planters don't seem to provide the implied/meaningful benefits to all who have tried
  - At high speeds, stones are a big problem

BARRIERS PREVENTING CHANGE

Barriers that are keeping farmers from trying new things

BIODIVERSITY & CROP CHOICE

- Incorporating diverse and functional and crop rotations is difficult from a management and marketing perspective
- Removal and timing of inputs are the biggest issues against the viability of cover-crops
- Lack of interest in use of “intentional” cover crop, due to lack of demonstrated benefits and cost/logistical challenges of seeding crop during other field operations
  - Potential may be very regionally dependent
- Direct seeding has been noted to cause delayed emergence due to cooler soils that haven’t been tilled in the prior fall
- Short seeding days (~21) makes it difficult to manage issues that come up and treat each field special
- Restricted crop rotations
  - It can be challenging to incorporate pulse crops in rotation due to poor disease resistance or presence of rocks
- Soil type makes it difficult to integrate livestock grazing options
- Too many logistical challenges with moving cattle onto the land if you are cash crop only. Many are unwilling to add that much complexity even if potential benefits are acknowledged
- Uncertainty around successful implementation of intercropping on financials and logistics challenges limit adoption rates
  - Separating grain from an intercrop increases overall cost and sale viability
  - Herbicide options are limited
- Switching from grain to perennial forages is especially difficult in the first couple years
  - Lower gross revenue but potentially stable and equivalent net revenue
- Many cash crop producers feel cover crops don’t provide any benefit in our shorter season regions
  - Only livestock producers seem to be able to take advantage of this practice through the potential of shoulder season feed

LOGISTICS & FINANCIAL

- Renting property and finding it difficult to invest in intensive processes when the future of the property is uncertain
  - Why do the work if it will just be undone the next year?
  - Find ways to incorporate good practice expectations into fair rental contracts
- Some feel as though farm choices are being manipulated by funding bodies
- Replicating past success with a new practice can be very difficult if not documented accurately. Record keeping as proof of performance matters
- Inherited debts make trying new things next to impossible
- Too many farms focus on yield values over profit margin
  - Some answers may include lower yield but higher net returns
- Many feel the farm should be profitable without subsidies or taxpayer support
  - Crop insurance was brought up many times as an inhibitor for trying new things

BARRIERS PREVENTING CHANGE

Barriers that are keeping farmers from trying new things

LOGISTICS & FINANCIAL CONT.

- Costs and complexities that are difficult to manage on these farm operations
  - Especially with the onset of tariffs and other financial pressures
  - Too much money tied up in the banks and cost of equipment is too high
    - Limits financial flexibility
  - Depending on the scale of operation and manpower, it's difficult to try new practices or methods without serious economic impacts
  - Many feel economic considerations are the primary barrier to adoption.
    - Producers are looking for confidence that a practice or technology will result in a positive return on investment before implementing. Or at least no significant penalty
    - There is an expectation that use of a new management practice should result in a long run return on investment, but this is often not the case in most short term scenarios. Delayed payoffs increase financial risk
- Better communication and knowledge transfer from scientific researchers, institutions and agronomists to producers is needed
  - More input from farmers about the research they need done to help them make the next best steps at the farm level
  - Sentiment from several groups was that policy makers are not up to date and that many researchers tend to be disconnected from what actually occurs on the farm
- Problems balancing yield and profitability with soil management priorities
- Objectives of 'soil health' are not well-defined for agronomist and producer audiences - especially with agriculture production systems in Alberta
- Need more replicated data to prove viability of certain practices
- Larger farms become logistically difficult to micromanage. Scale matters
  - Most feasible soil health practices will need to be simple and easy to implement
- Municipal and provincial policies
  - Creating barriers and preventing producers from trying new practices (i.e crop insurance coverage, tile drainage etc.)
- Environmental NGOs restricting viable land practices & management and/or deciding what practices are "good" practices
  - NGOs don't carry the burden of attempting to keep farms profitable so they should not lead in determining what acceptable practices are
- Younger producers feel significantly impacted by the support or lack-of support from older farmers when trying new things
  - Most feel that new practices need at least 3 years to show potential, but many are written off before this time
  - Patience matters when confirming long term impacts and benefits
- Transitioning to renewable or regenerative practices can be very difficult and turn away the vast majority of people as they can be too complex and too financially risky compared to conventional production practices

RESEARCH REQUESTED FROM THE FARMER

Research ideas presented during meetings that producers feel would benefit them

RESEARCH IDEAS

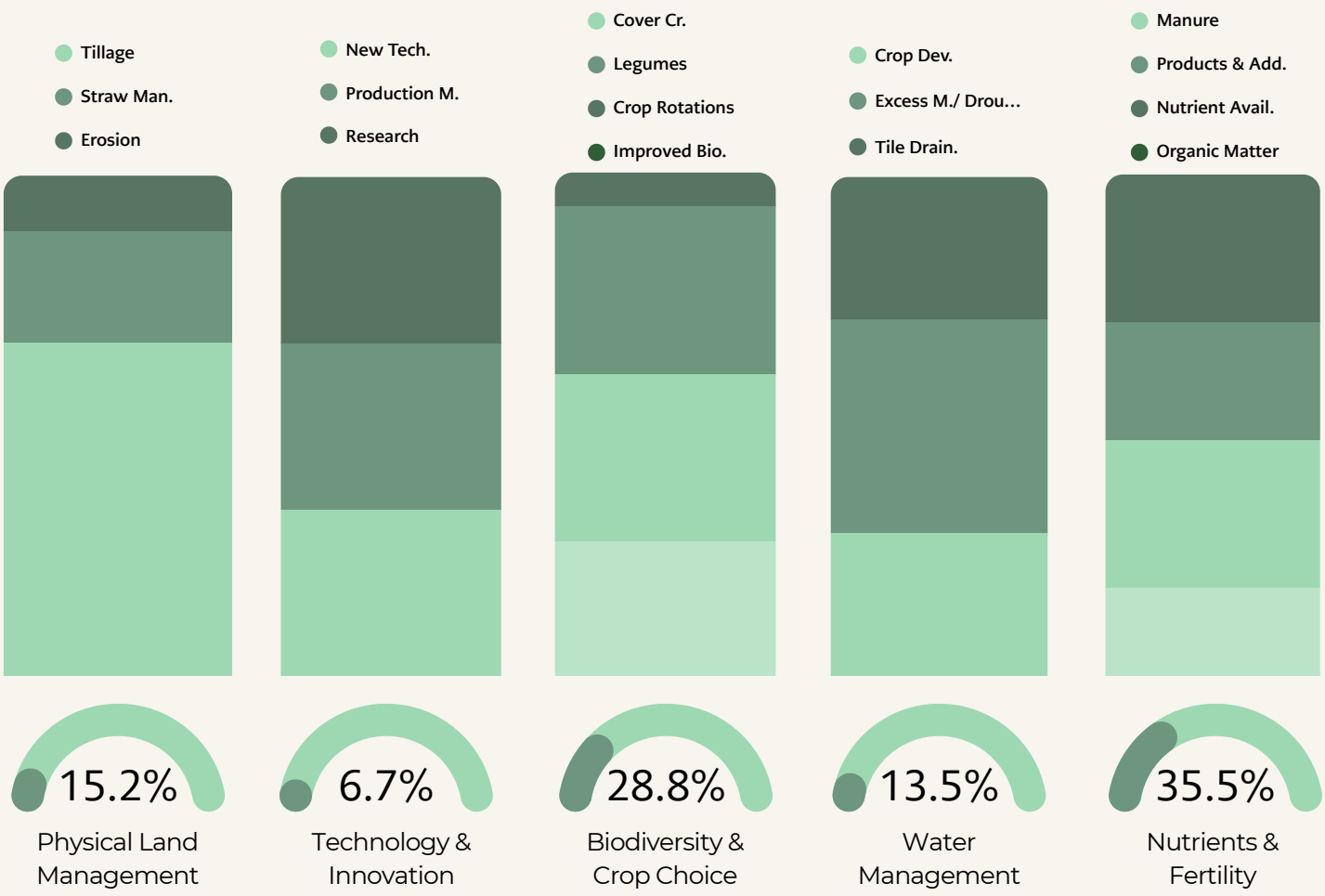
- Need significantly more long-term studies at field scale and not just small strip studies
  - Community funded with a democratic research focus
    - Farmer submitted ideas
    - 3-5+ year studies
- More research on the impact of equipment on soil compaction
- More research needed on varieties that leave more plant mass below ground
- Anecdotal accounts that sub-surface tile installation has reduced soil electrical conductivity by half and remediated salt-affected soils in a period of less than 5 years.
  - Research is needed to validate performance of this practice and to compare its performance to other water management techniques such as construction of surface ditches.
- How can we better identify what's missing to stimulate natural soil biology?
  - How can we make clearer the role of microorganisms in influencing soil-health related factors
- Is it harmful to soil biology to rotate crops too frequently?
- Tillage vs chemicals vs weeds (What's the best combination?)
- How much soil disturbance is healthy and can promote further soil health?
- When planning intercrops, how to you plan proper rotations?
- Not enough non-bias trials and studies in these areas:
  - Intercrops, bio-stimulants, handling nutrient imbalances
  - Typically funded by biased seed and or chemical companies
- There is not enough independent research being done on biological products. There needs to be more significant independent research trials
- More research is needed for using existing synthetic products in soil health-focused systems, such as improving the effectiveness of granular herbicides
- Would like to see research on other nitrogen fixing options besides conventional legumes (i.e soybeans) and current common place practices
- Would like better examples of fertilizer applications/ rates on different crops varieties under varying conditions and at different times of the year.
- Are fusarium outbreaks caused by too many cereal crops planted back-to-back?
- How can we shorten the 6-week no-grow window?
- Corn and alfalfa as an intercrop?
- Practices to extend the life of tame pastures:
  - Fertility and grazing intensity to optimize longevity are potential research considerations
- Performance and economic assessment of drainage by sub-surface tile
  - There is a desire to better understand water quality of tile drained versus undrained runoff water

RESEARCH IDEAS CONT.

- Is the over application of nitrogen masking other poor soil conditions?
- How can cover crops be useful without cows?
- How can we prevent compaction from seeding?
- What are some real solutions to saline soils?
- Targeted use of aggressive tillage (e.g. deep ripping) to improve soil structure and reverse impacts of compaction.
  - Effectiveness as a management practice?
  - How long do the effects persist? How often do you need to implement?
  - What is the appropriate depth?
  - What is the return on investment?
- Nutrient stratification (phosphorus in particular):
  - What management practices are effective in addressing nutrient stratification?
    - perennial forages, strategic tillage
- Crop breeding for increased salt tolerance of peas
- Impacts of saturated soils on soil biology
- Impacts of the “unintentional” cover crop on nutrient cycling
- Agronomic and environmental benefits of opportunistic irrigation?
  - Using drainage to consolidate several smaller wetlands into a larger wetland or reservoir which can be then used for irrigation
  - What is the optimal timing (e.g. growth stage) for opportunistic irrigation to maximize agronomic benefit?
  - Return on investment?
- Optimal crop choice to implement alongside with drainage when remediating salt-affected soils.
  - For example:
    - Which crops are recommended to seed into saline soils after drainage has been implemented, but before excessive salts have been flushed from the soil profile
- Optimal application rate of humic acids to remediate salt-affected soils
- Evaluation of potential strategies to mitigate phosphorus stratification in soil
  - Vertical Tillage
  - Short-term (i.e. 5 year) perennial forage cycle in rotation
- Water quality impacts of drained versus undrained depressions. What is the nutrient load of an undrained basins during a “fill and spill” event?
- Environmental impacts of unmanaged wetlands (e.g. nutrient export from “fill and spill” events, impact on greenhouse gas emissions (e.g. N_2O, CH_4)
- Research to support adoption of intercropping: Potential research topics include:
  - Optimal crop combinations, agronomic practices to maximize production, economic analysis to inform potential return on investment.
- Crop breeding for salt tolerant species

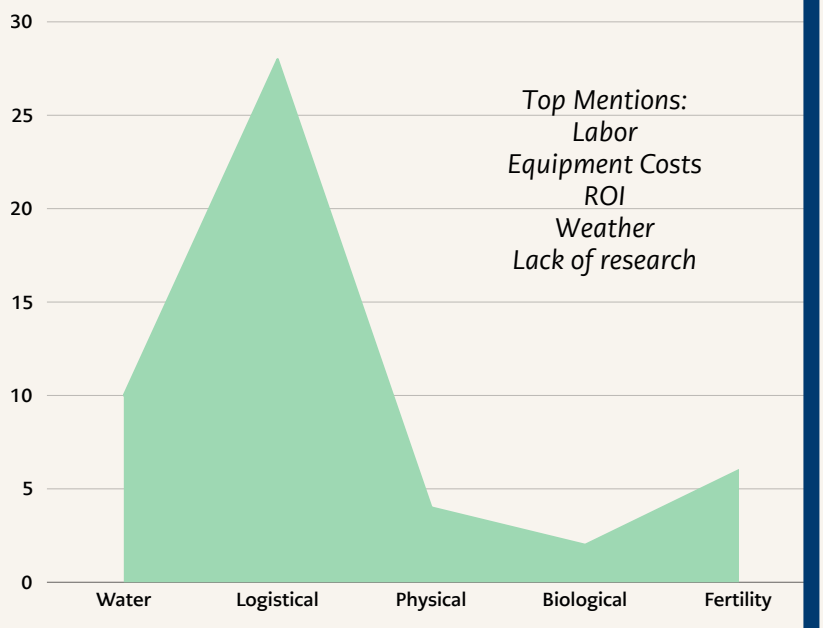
DIGGING DEEPER: CURRENT SUMMARY

% of Soil Health Goals Categorized By Theme & Top 3-4 interests:



15.2%	6.7%	28.8%	13.5%	35.5%
Physical Land Management	Technology & Innovation	Biodiversity & Crop Choice	Water Management	Nutrients & Fertility

Obstacles Mentioned By Theme:



% of submissions by age: