Prevented Plant Acres in South Dakota Management Scenarios for 2020

How to Determine Your Best Options

Natural Resources Conservation Service South Dakota

Information Update and Talking Points | *March 19, 2020, updated 04/16/2020*

As farmers prepare for the Spring 2020 planting season, many are drawing on the accumulated knowledge gained from the almost 4 million Prevented Plant (PP) acres in South Dakota (SD) in 2019. Here are five PP field scenarios along with lessons learned from each.

The information in this document was developed by the USDA Natural Resources Conservation Service (NRCS) serving SD in consultation with ag producers, agronomists, and soil scientists with the USDA NRCS and South Dakota State University (SDSU) Extension specialists, and with involvement of SD's Conservation Districts, SD Soil Health Coalition, SD Grassland Coalition, and SD Corn Growers.

Previous topic-related updates can be found on our Web page at: www.sd.nrcs.usda.gov, under "Publications."

- Information Update (May 31, 2019): Prevented Planting Issues & Cover Crops: How to Determine Your Best Options
- Information Update (April 17, 2019): Repair Field Ruts – Advice for Farmers 10 Steps to Improved Ruts and Soil Management

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6 Prevented Plant Field Scenarios: Lessons Learned in 2019

1. Seeded to cover crops; left standing through winter.

- Optimizes soil structure and health. Great seeding environment for no-till cropping.
- Provides optimal seeding conditions for spring cash crops after control of any surviving cover crop species.
- Provides soil armor, erosion control, soil structure and organic matter improvement, plant and root diversity, improved water infiltration, nutrient cycling, and soil carbon capture from increased photosynthesis—all work together for higher soil health benefits.
- Avoid tillage this spring as that leads to platy soil structure, reduced water infiltration, and nutrient uptake. Be patient and reap Mother Nature's benefits of healthier soil with more stable aggregate and structure formation.

2. Seeded to cover crops; grazed, baled, or chopped for feed.

- Good for soil microbial and livestock feeding. (Grazing preferred over forage removal)
- Grazing provides excellent results with initiation after 6-8-inches of cover crop growth. Overgrazing causes exposed soil due to a lack of regrowth. Grazing can provide savings toward hay/forage feeding and harvest costs. Avoid grazing excessively wet soils. When soils begin to thaw, do not graze until soil frost dissipates and soil moisture lowers.

- Soil health is greatly improved compared to bare soil with weeds, but not as great as non-grazed, living cover crops. Grazing should increase nutrient cycling of plant nutrients back to the soil from manure; complete soil testing before the following year's crop.
- Baling of cover crops was generally not successful because species in cover crop mixes remained too wet to bale.

3. Seeded to cover crops, killed with herbicide or tillage in fall.

- Considered an "okay" scenario, as it provides more soil armor than bare soil or weeds. However, it reduces opportunities to improve soil aggregation, structure, organic carbon, microbial activity, and improved water infiltration that may have been achieved by allowing continued cover crop growth over winter.

4. No cover crops were seeded, weeds grew unchecked.

- Very few soil health benefits, potentially significant soil erosion and losses, and potential for increased weed pressure if weeds produced seed. This scenario could lead to fallow syndrome in a 2020 cash crop as beneficial fungus and mycorrhizae may have been reduced in the soil.
- Weeds are not cover crops. Prolific weeds such as marestail, waterhemp, and other amaranth species lack the positive soil structure benefits of cover crops. May produce harmful competition from weeds on cash crops and increased weed seed banks (especially herbicide-resistant weed seeds). This greatly outweighs the small potential of soil carbon capture or slight erosion benefits.

5. No cover crops seeded, used tillage or herbicides to control weeds.

- No soil health benefits. High potential for significant erosion and soil loss. This scenario also supports the significant probability of fallow syndrome for 2020 cash crops.
- Multiple tillage passes most likely did not control all weeds and caused more significant soil erosion and degraded soil structure. Tillage and herbicide effectiveness may have been reduced because weeds were often too large for full control.

6. Drowned out, unprofitable areas of fields clearly exposed

- Larger and more frequent rain events continue to expose unhealthy soils that cause greater erosion due to less water infiltration. These marginal crop acres reduce overall profit per acre due to consistent low yields that reduce efficiency of crop inputs, labor, fuel use and machinery.
- Instead of farming unprofitable acres, farmers are rethinking land use by working with NRCS conservationists and other specialists. They create an effective perennial vegetation strategy that meets farmer goals, while exploring cost-share options. Working together with NRCS, landowners and farmers are using a variety of solutions—from installing waterways and buffer strips to grazing/haying areas, managing salinity acres, adding pollinator and wildlife habitat areas, installing prairie strips to improve water quality, and more. Tillage and planting are not sustainable management solutions.

Cover crop species decisions

Numerous challenges with cover crop seed decisions occurred in 2019. Cover crop planting decisions and opportunities were confused by last-minute timing (once a cash crop couldn't be planted), evolving government policies, saturated soils, cool temperatures, seed supplier offerings, species knowledge, and a lack of planning regarding cover crop objectives and goals. Later in the year, problems included lack of weed control, limited cover crop planting window, and continued wet conditions.

The multiple species cover crop mixes offered by seed retailers were designed to deliver optimum plant biomass and root diversity. The mixes were created to increase biomass accumulation and soil organism diversity. Suggested species provided varied root depths to help improve water infiltration and potentially overcome summer drought periods. The diverse species blends also provided soil armor to reduce erosion, increase soil biology, compete with weeds, interrupt disease cycles, and cycle nutrients. Some retailers also offered grazing mixes that included more grasses.

For example, NRCS worked with some seed companies to formulate multiple species cover crop blends containing a legume, brassicas, and cold and warm season broadleaves and grasses: e.g., oats, barley, sudangrass, rapeseed, radishes, turnips, flax, buckwheat, and common vetch.

Lessons learned and future plans:

- Saturated soils can lose beneficial soil biology such as mycorrhizal fungi and rhizobia bacteria. Lengthy saturation periods reduce roots and soil organisms needed to create soil macropores that help cycle nutrients. Excessive tillage continually breaks down soil aggregates, causes compaction, crusting, and increased soil bulk density problems (reduced soil pore space).
- Greater cover crop diversity can lead to more significant soil microbial diversity, but further knowledge is needed on how cover crop species decompose or regrow following winter. Some of the seed blends used by producers resulted in tall and heavy biomass. This concerned new cover crop growers about difficulties in planting 2020 cash crops, so some chose to use tillage or herbicides to reduce the biomass, rather than wait for natural winter decomposition. The tillage of cover crops reduced the soil structure forming benefits of living roots, and significantly reduced the cover crop biomass that used photosynthesis to fix atmospheric carbon into the soil reserves.
- Control weeds, then seed cover crops quickly. If you wait until late July before cover crop seeding, tall weeds, and weather issues can reduce stand success, increase erosion, and weed seed potential. As soon as fields dry and cover-crop friendly herbicides (*https://fyi.extension.wisc.edu/covercrop/herbicide-interactions/*) are applied, establish cover crop living roots to help improve soil health as quickly as possible. While it's not a good practice to allow cover crops to go to seed, most cover crop species will be easy to control next year. Always check the label and other resources, as excessive rainfall can cause some herbicides to breakdown much faster compared to when the soil is dry. Watch also for grazing restrictions. https://ipcm.wisc.edu/download/pubsPM/2019_RotationalRestrictions_final.pdf
- Annual ryegrass and cereal rye are different. Cereal rye is a common cover crop, more cold tolerant to seed later in fall, provides good spring growth to remove excess moisture, and it provides a soil armor mat that can reduce weeds. It's best to terminate before it reaches 16 inches tall in spring, so it doesn't tie up nitrogen. Annual ryegrass (cool-season grass) has good fall grazing biomass if seeded in late summer, consumes less water, extensive root system for erosion control while adding significant organic matter, may winterkill in colder climates, and it's more difficult to terminate during cool weather when glyphosate translocation is reduced.
- Examine the various millet species used for cover crops. For example, foxtail millet is a fast-growing summer cover, while proso millet produces less biomass, and forage-type pearl millet provides the most biomass. *Learn more here: https://extension2.missouri.edu/g4164*

- Have a plan ready for possible PP fields. Decide your cover crop goals by field first (building soil structure, livestock forage, weed suppression, fixing Nitrogen (N), prep for next year's cash crop, etc.). Then match multiple diverse species to fit the goal (*https://www.greencoverseed.com/preventplant/*); assign a budget; learn best planting timing, seeding depths, application methods, soil limitations, etc.
- When selecting cover crop species for PP fields, limit species of the same type as next year's cash crop. **If 2021 crop is corn**: limit warm-season grasses, use low Carbon to Nitrogen (C:N) ratio species like brassicas and a few legumes, add flax and oats that feature high mycorrhizal fungi association to build soil structure. To help manage water, seed winter cereals so living roots can uptake water in the fall and spring—just need to terminate two weeks before planting corn. **If going to soybeans**: limit broadleaves in the mix, use warm and cool-season grasses and some brassicas. Seeding only one crop type (like brassicas) is not recommended. To optimize soil benefits, seed more overwintering crops like cereal rye (not annual rye) or triticale.
- Grab a spade to compare soil structure after a season of cover crops versus a field with no cover crops. Seeing is believing regarding improved soil structure.
- A new brochure "Cover Crops and Crop Insurance" (PDF) is available from USDA's Risk Management Agency (RMA), Natural Resources Conservation Service (NRCS), and Farm Service Agency (FSA) who have jointly developed these guidelines for cover crops across all USDA programs. It is recommended to always check with USDA's FSA and RMA on PP requirements and harvest restrictions for cover crops.

Tips for managing 2020 cash crops in 2019 Prevented Plant fields

Be aware of potential fallow syndrome on corn.

- If no cover crops were seeded on your conventional-tilled or minimum-till PP field (or only brassica cover crops like radish, turnip, mustard, or rapeseed), the soil might lack key beneficial organisms, e.g., mycorrhizae fungi, that support early plant growth. Long-term no-till fields are probably less susceptible to fallow syndrome due to better soil health.
- To overcome this potential soil biology challenge, some agronomists recommend the addition of phosphorus (P) and chelated zinc in-furrow as a pop-up starter or a banded application to minimize early-season growth challenges and potential yield loss from Fallow Syndrome. If that's not an option, broadcast application rates that include an additional 15-20 pounds (lbs.) P per acre will also help, according to Antonio Mallarino, Iowa State University Extension.

Plan for added weed problems.

- If PP fields had patches of possible herbicide-resistant weeds that went to seed, agronomists recommend a soil-applied pre-plant or preemergence residual herbicide to target your weed species. This should also take care of any cover crops that may have gone to seed, unless it was a diverse mix that was planted early. Watch herbicide half-life in the soil if planning to seed cover crops in late summer or early fall. And check labels also for possible grazing restrictions.

Consider leftover fertility from 2019 applications.

- Collect new soil tests to determine your ever-changing nutrient availability. Don't rely on 2018 or 2019 tests. Watch saturated soil test results for accuracy.
- Mobile nutrients, like nitrogen and sulfur, require a deeper soil test – down to 24 inches. Phosphorus, potassium, and zinc, only require a 0-6 inch-deep soil test.

No-till plant into a green cover crop.

- Terminate the cover crop either at planting (soybeans) or two weeks before planting (corn) – ***NOTE**: Check current RMA insurance cover crop termination rules for your area (https://www.rma.usda.gov/en/Topics/Cover-Crops)*. Some growers believe the seedbed is better when planting into a living cover crop, due to less compaction in the seed slot, plus it continues to take up water to reduce wet planting conditions. Growers who plant green (soybeans are easier and more forgiving than corn) enjoy the benefits of better erosion control, greater surface organic matter, reduced soil moisture at planting, and more.
- Adjust your planter. Most important: make sure the planter is running level; row cleaners have broad, shorter teeth and are adjusted to barely touch the soil; make sure opener blades are sharp and seed tube guards are new; adjust downforce pressure for consistent depth, and check seed depth in various field conditions; use seed firmers; select proper closing wheels for your soil/residue conditions.
- For more details, check out this resource https://practicalfarmers.org/wp-content/uploads/previous/2018/02/Improving-Cash-Crop-Stand-Establishment-in-Cover-Crop-Fields-ISA.pdf.

How to reduce the risk of future Prevented Plant fields?

1. More no-till fields got planted in 2019.

The 2019 SD Cropping Systems Inventory proved that in wet soils, fewer no-till acres went unplanted compared to full-width tillage systems. Estimated unplanted acres by cropping system: No-till was 20 percent (%); mulch-till 39%; reduced tillage 38%; and conventional tillage 27%. When no-till is paired with cover crops, a more diverse crop rotation, and grazing, soils become more resilient to droughts and rainstorms for a more sustainable farm or ranch.

2. Invest in cover crops to build soil structure and organic matter.

By investing in cover crops following cash crops, the additional root and plant biomass produced by the cover crops will improve organic matter and soil structure through the formation of humus that aids soil aggregation. That will help aid future planting under wet conditions—reducing PP acres. It's the best option to minimize water and wind erosion, decrease nitrate runoff and leaching, and reduce weed pressure for increased productivity in subsequent years. If you leave the ground idle after cash crops and rely on continuous tillage, it leads to continued declines in soil organic matter, soil structure, and an overall decline in productivity. The following are resources for developing a cover crop seeding plan for SD: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/sd/technical/?cid=nrcs141p2_036589.

3. Begin a transition to no-till cropping with cover crops.

Here are excellent tips from this *Crops and Soils Magazine* research abstract story: "Transitional no-till: What it is and how does it differ from 'true' no-till?"
(https://acsess.onlinelibrary.wiley.com/doi/10.2134/cs2018.51.0603)

- In just over 100 years, tillage has cut soil organic matter by 60% on average in the Midwest. (Note: SD no-till acres have gained some Organic Matter (OM) back, but higher yields are still primarily supported by fertilizer until OM increases and reduce the need for synthetic fertilizer.)
- Once soil OM sources are depleted, N, P, and K cycles cease to operate efficiently without OM to feed the soil microbial cycles. Soil becomes dependent on fertilizer to maintain productivity.
- Long-term no-till is "crop insurance" against drought. The old root channels and earthworm burrows increase soil OM levels slowly over time and store more plant-available water in the soil profile.

- It often takes seven to nine years to correct the "tillage effect" and give the soil time to heal the natural biological communities.
- However, after several years of continuous no-till, soil biology is rejuvenated to a more natural community dominated by fungi. That helps provide increased organic N, P, and K nutrients and other ecosystem services like carbon sequestration, improved infiltration, increased available water capacity due to water-stable aggregates, etc.
- The goal of a true long-term no-till and cover crop systems approach is to restore soil microbial communities, increase plant and soil microbial associations, improve physical characteristics, and improve chemistry to create productive soils.

4. Change land use to perennial grasses.

- Farmers have successfully transitioned money-losing areas of fields by working with NRCS Conservationists to prioritize tasks by field and develop a plan.
- Use of yield data from field maps over several years, matched with input costs, helps define areas of unproductive soils and lost profits. Erosion, salinity, and drowned out areas define themselves after heavy rain events.
- Along with CRP, there are numerous cost-sharing programs (EQIP, CSP, SHIPP) to help fund land improvements that can improve overall profits.
- Connect with other farmers and ranchers on the SD Mentoring Network to share ideas and learn best practices. The South Dakota Grassland Coalition website offers great information and videos to promote good stewardship of grasslands through sustainable and profitable management.

RESOURCES: What are the best management practices for cover crops?

The NRCS SD has an excellent resource you can download that offers cover crop seeding plan and record, cover crop species ratings, recommended cover crop mixes, and aerial seeding strategies. There is also a Resources for Cover Crops in SD Web page that examines species selection, forage selection, profitable management, grazing, and more. Go to www.sd.nrcs.usda.gov, Topics > Technical Resources > Cover Crops. For a free one-on-one consultation about cover crops (not insurance), contact your local USDA NRCS or conservation district office.

The SDSU Extension has a cover crop page with excellent information (https://extension.sdstate.edu/agriculture/crops/cover-crops). When seeding cover crops into crusted, hard topsoil that occurs with prolonged soil saturation, use a drill or planter to achieve good seed to soil contact. For more details, read Delayed Planting Challenges: Cover Crop Considerations by Sara Bauder and Ruth Beck, SDSU Extension Agronomy Field Specialists, Anthony Bly, SDSU Extension Soils Field Specialist, and Warren Rusche, SDSU Extension Beef Feedlot Management Associate (https://extension.sdstate.edu/delayed-planting-challenges-cover-crop-considerations).

Other Online Cover Crop Resources:

- Plant Cover Cover Crops and Insure Your Cash Crop (PDF) USDA's RMA, NRCS, and FSA have jointly developed these guidelines for cover crops across all USDA programs.
- Herbicide Rotational Restrictions for Cover and Forage Cropping Systems: https://ipcm.wisc.edu/download/pubsPM/2019_RotationalRestrictions_final.pdf
- USDA-ARS Cover Crop Chart: https://www.ars.usda.gov/plains-area/mandan-nd/ngprl/docs/cover-crop-chart/

- SARE Cover Crop Learning Center: https://www.sare.org/Learning-Center/Topic-Rooms/Cover-Crops
- Midwest Cover Crop Field Guide: https://ag.purdue.edu/agry/dtc/Pages/CCFG.aspx
- Midwest Cover Crop Selector Tool: http://mccc.msu.edu/selector-tool/

LAND USE & PERENNIAL VEGETATION

Land Use Practices: USDA-South Dakota
https://www.nrcs.usda.gov/wps/portal/nrcs/main/sd/technical/landuse/

The NRCS offers free one-on-one consultations on site to help identify resources and provide options for landowners or managers to consider. To find the contact information for your NRCS in your local USDA Service Center, go to: http://farmers.gov/service-center-locator.

South Dakota Grassland Coalition
https://www.sdgrass.org

"Our Amazing South Dakota Grasslands" short stories on YouTube
https://www.sdgrass.org/amazing-south-dakota/

South Dakota Soil Health Coalition
http://www.sdsoilhealth.net/

Find a SD Soil Health Mentor: **Request a free copy** of the 40-page *"Building Connections"* publication with a directory of SD farmers and ranchers who have volunteered their time and expertise to help others with their soil health experience. Also included in the publication are contact information for subject-matter experts for agronomy, soils, grassland management, and more!

VIDEO: Learn the importance of soil health with a rainfall simulator. The SD Rainfall Simulator provides a "seeing is believing" demonstration of how practices such as no-till farming, cover crops, and prescribed grazing benefit soil health and improve the water cycle on cropland and rangeland across the state. No-till cropland and rangeland managed with prescribed grazing increase infiltration and reduced runoff and sedimentation. View the rainfall simulator in action by visiting the USDA NRCS YouTube Channel: Rainfall Simulator Demonstration (38 minutes) or Rainfall Simulator (Table Top) Demonstration (6 minutes).