

# Cover Crops for Wet Soils and Prevented Plant Ground

## North Dakota – Agronomy Technical Note No. 1

In excessively wet years farmers who are unable to plant their intended crop acreage in a timely manner may choose to take the “prevented plant” option for fields that go unplanted. In place of maintaining fields as fallow under prevented plant, producers should consider the option of growing a full -season cover crop as a viable agronomic alternative that will benefit the health of the soil resource. Other potential benefits are wildlife, water quality and flood reduction.



Cover crop on prevented plant, LaMoure County, ND 2009

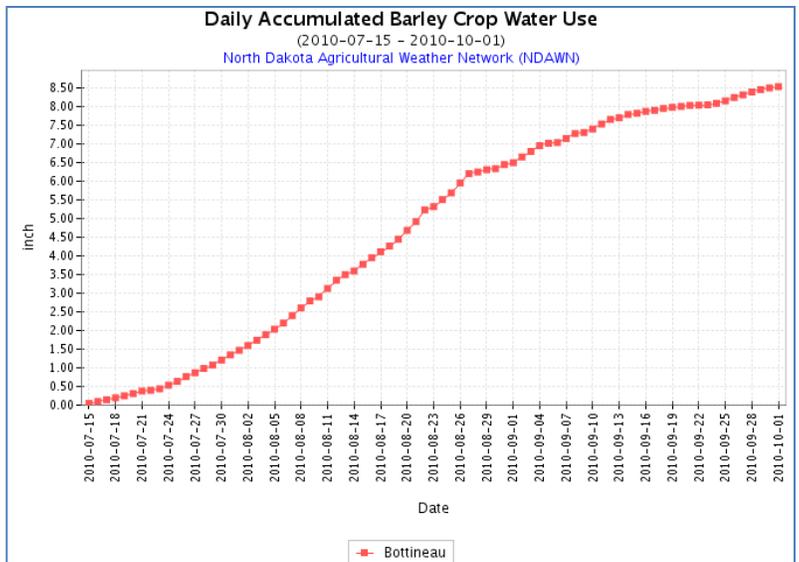
### Positive Soil Health and Agronomic Benefits of Cover Crops Include:

- ❖ Harvesting excess water
- ❖ Controlling erosion
- ❖ Building soil organic matter
- ❖ Fixing and sequestering nitrogen
- ❖ Avoiding or treating compaction from excessive traffic
- ❖ Controlling soil salinization
- ❖ Additional benefits to wildlife and flood water reduction

## Resource Concerns

### Excessive Water and Soil Erosion

The most apparent resource concerns addressed by cover crops are excess soil water and soil erosion. Typically, about one-half inch of water will be lost to evaporation when a prevented plant field is maintained with a tilled, bare soil surface. More soil moisture is evaporated from the soil surface whenever the soil is tilled. However, tillage of wet soil increases the potential for compaction below the tilled zone and makes the soil more susceptible to erosion. When cover crops are grown they transpire (or draw water from the soil) in excess of what would be lost by evaporation alone. For example, a cover crop seeded on July 15<sup>th</sup> in Bottineau County will typically use in excess of 7.5 inches of soil water before killed by frost in late September (see graph). The cover crop will reduce wind and water erosion by providing protective residue or armor on the surface and roots to hold soil in place.



## Soil Organic Matter and Nutrient Cycling

Soils should be managed to increase soil organic matter (SOM) content. Soil organic matter provides many physical benefits to the soil, such as improved water holding capacity, cation exchange capacity (CEC), and pH buffering, while reducing the soils bulk density. A bare soil surface in a prevented plant situation negatively impacts the SOM. Cover crops will benefit the soil by fixing carbon from the atmosphere through photosynthesis. Growing a full-season cover crop can add 5,000 to 8,000 lbs/acre of carbon into the soil on prevented plant acres as compared to summer fallow or tillage. Cover crops also uptake nitrogen, phosphorus and other important crop nutrients, then releasing those nutrients as the cover crop decomposes the following year.

### Nitrogen sequestering and fixation

Nitrogen, when applied as an inorganic fertilizer, can be lost through leaching as water moves down through the soil or as a gas through denitrification when the soil is saturated or where water is ponded. Cover crops are an excellent option for producers to manage or minimize nitrogen losses. Cover crop mixtures can be designed to hold nutrients in plant residue for various periods of time based on the carbon to nitrogen ratio (C:N) of the crop species grown. Cover crop species with a low C:N ratio (below 20:1) will release nutrients faster than a cover crop with a high C:N ratio (above 40:1).

Cover crop mixes that include legumes will fix and add nitrogen to prevented plant acres. The nitrogen added into a cropping system by cover crop mixes containing legumes and seeded by mid-summer can easily pay for the cost of the seed. Generally, legumes add 50-100 lbs of nitrogen when grown until killed by frost. When planting cover crop mixes with low C:N ratios, producers can expect at least half of the nitrogen in the plant residue to become available the next growing season.

### Soil Compaction

Soils are more subject to compaction when wet than when dry. Typically, prevented plant fields are wet, so it is advisable to limit equipment traffic, specifically tillage to avoid compaction. Tillage operations damage soil structure (aggregates) by the processes of disruption and compaction. Formation of compaction layers called tillage or plow pans are a consequence of tilling in wet soils. Tillage pans can result in greater surface water ponding where vertical soil pores are smeared shut and water infiltration is slowed. Poor soil aggregation or soil structure can lead to anaerobic soil conditions and denitrification.



Planting a dense summer cover crop mix on prevented plant acres will reduce the need for tillage or herbicides for weed control. Growing cover crops can use excess soil moisture, drying the soil and improving trafficability across the field. Some farmers are using winter cereals like winter wheat or rye in order to have established growing plants in the spring that will use water and dry surface soils to provide an adequate seedbed for the desired crop such as corn or soybean. Cover crop species with strong, tap roots can alleviate some soil compaction or tillage pan issues by growing through the compaction layers creating pathways and holes for downward water movement.

## Soil Salinization

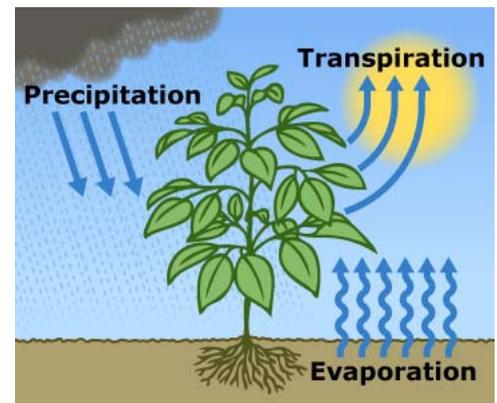
A critical issue facing farmers across North Dakota is the loss of soil productivity and crop production due to soil salinization. In many cases, saline soils are included in prevented plant acres. If prevented plant fields are tilled and left bare, water is removed from the soil through evaporation. The evaporating water leaves behind dissolved salts carried by upward water movement in the soil, accumulating at the soil surface. Increasing salt levels in the planting zone can be very damaging to seed germination and plant productivity. Integrating cover crops into a diverse crop rotation is an important tool for managing soil salinity. Cover crops transpire additional water from the soil, removing excess soil water and lowering the water table in the soil, reducing evaporation that brings salts to the surface.

## Additional Benefits

Critical wildlife habitat and food sources can be provided by cover crops. When wildlife management is the concern, select appropriate cover crop species that can provide cover and food for the desired wildlife species.

Growing cover crops on prevented plant acres may reduce the flood severity in some watersheds. Cover crops will use and transpire soil water into the atmosphere, drying the soil and providing room in the soil profile for storage of water from rain and spring snowmelt. They could also increase the potential for a prevented plant field to be cropped the following growing season.

Certain cover crops species have allelopathic effects that have been observed to suppress crop pests in fields where cover crops are grown. This can result in reduced pesticide use in the following crop. A valuable benefit of a vigorous, growing cover crop mix is the potential competition with weeds.



## Choosing cover crops

Prevented planting provides an excellent opportunity to use cover crop species and crop types that are not typically grown in the rotation. This added diversity results in agronomic as well as soil sustaining benefits. For those operators with cattle it can provide late season grazing opportunities. Final commodity planting dates for insurance purposes vary by crop and location within the state. Producers are advised to check with your crop insurance agent to determine when cover crops can be seeded, grazed or hayed. Cover crops should be seeded as early as practical to ensure adequate time for growth and to meet your resource objectives.



In many cases adding a warm-season grass or broadleaf not typically grown is a good option. Typically, with an early to mid-July planting date warm-season species will transpire a good deal of water, produce significant biomass but will not go to seed before a killing frost. Cover crop mixtures can be designed to manage the amount and breakdown of biomass the next spring where excess crop residue or a lack of residue is a concern. Warm-season legumes will lower the C:N ratio, die from frost early and begin cycling nutrients faster than cool-season legumes. Cool-season legume and brassica species are low C:N ratio plants and will rapidly decompose in the spring. Warm-season grasses have high C:N ratios and will decompose slower.

Table 1 lists some of the common cover crop species and to what major crop type they belong.

<b>Table 1. Cover crop species list for prevented plant by major crop type.</b>			
<b>Cool-season Broadleaves</b>	<b>Warm-season Broadleaves</b>	<b>Cool Season Grasses</b>	<b>Warm-season Grasses</b>
Clovers (red, sweet, Berseem, Persian)*	Cowpeas*	Annual Ryegrass	Millets (German, Japanese, Pearl, Proso)
Camelina	Soybeans*	Barley	Sudan grass
Ethiopian Cabbage	Safflower	Oats	Sorghum-sudan
Field peas*	Sunflower	Wheat	
Flax			
Lentils*			
Rape/Canola			
Radish			
Sugarbeet			
Turnip			
Vetches*			
*N-fixing legume species			

Additional information on NRCS cover crop recommendations can be found at:

[http://efotg.sc.egov.usda.gov/references/public/ND/cover\\_crop\\_340.pdf](http://efotg.sc.egov.usda.gov/references/public/ND/cover_crop_340.pdf)

The Mandan Agricultural Resource Service (ARS) has a Cover Crop Chart that is also helpful in selecting cover crop species. The website address is:

<http://www.ars.usda.gov/Main/docs.htm?docid=20323>

### Final Considerations

- ❖ Herbicide carryover and soil fertility are important considerations when planting a cover crop. Long-term residual herbicides can impact certain species of cover crops. Check with your agronomist if there is a recent history of residual herbicide use.
- ❖ Soils that have been saturated for sometime may have lost nitrogen through denitrification. To ensure adequate growth of cover crops, fertilizer may need to be applied. A soil test can assist the producer in determining if nitrogen is adequate for cover crop growth.
- ❖ Cover crops will use much of the applied fertilizer nitrogen and store it in the plant biomass or organic matter.

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