

# Flood Recovery for cropland

## Cover Crops for Soil Health

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As the Missouri River's water recedes from fields, producers may need to do some field repairs, dealing with sedimentation, eroded or scoured areas, deposited debris, and still standing water. As harvest of their remaining 2011 crop nears, this work may not seem pressing. However, establishing a cover crop as soon as possible on these fields will aid in recovering and rebuilding the soil.

### Cover Crop Benefits

Cover crops can be used for a variety of purposes including protecting the soil, improving soil structure, fixing nitrogen, feeding soil biological life, and managing soil moisture. Fields that were flooded in summer 2011 need cover crops for all of these reasons since a crop wasn't grown in them this year. A key soil quality concept is that there should be something green and growing during as much of the year as possible. This is important to protect and feed the soil system, especially arbuscular mycorrhizae fungi. (See the *Flooded Soil Syndrome* factsheet in this series for more information.)

Without a crop on these fields in 2011, there will be little residue present in 2012 to protect soil from the rain-drop impact that can cause erosion and crusting, or sun and wind on the soil surface that can cause wind erosion and soil water evaporation. While producers may want the soil to dry out now, without residue cover, evaporation will take place from the soil surface all year long, resulting in less water available for the 2012 crop. Research has shown that while a cover crop uses some soil moisture as it grows, it tends to use less water than is lost to evaporation from a bare soil surface.

Grasses provide the longest lasting residue cover because they have a higher carbon to nitrogen ratio in their biomass compared to non-grass species. In addition, they improve snow catch in the winter and reduce wind erosion in the spring compared to bare soil. Taller brassicas and broadleaves like rape, canola, Ethiopian cabbage, and sunflowers will also stand nicely to reduce wind erosion and catch snowfall, but they provide less residue.

With the saturated soil conditions during flooding, most of the residual nitrates in the soil were lost to either denitrification or leaching. A cover crop will scavenge any remaining residual nitrates for its growth, reducing further losses. However, if there are no residual nitrates, cover crop growth may be slow, with non-legumes showing nitrogen deficiencies. Some producers apply some nitrogen fertilizer to encourage cover crop growth which is later recovered as the cover crop residue breaks down. Producers should use legume cover crops to fix some nitrogen for the next crop and to feed the soil system. Legumes should be double inoculated with the proper inoculate for the species as flooding will have decreased the natural population of any rhizobium bacteria.

The cover crop will add organic biomass both above and below ground and the growing roots will help rebuild soil structure. The fibrous roots of grasses help build soil stability near the surface. The deeper tap roots of broadleaves, especially brassicas, penetrate and open up tight soils, improving infiltration. The finer roots of legumes feed the soil microbes while the tap roots grow downward. Any root growing in the soil helps dewater excess soil moisture, provides some structural stability to the soil, and helps the mycorrhizae fungi recover. When using winter annual cover

crops, these benefits can become very important if spring 2012 is wet. If the spring looks like it will be dry, the cover crops need to be killed in a timely manner so as not to use too much soil moisture.

Cover crop cocktails, a mixture of several species and plant types, provide different rooting patterns and varying plant architecture to add diversity to the system. The diversity is valuable for restoring microbial and physical soil function. Mixtures also provide good soil cover across a variety of conditions as the different cover crop types respond differently to varying soil and weather conditions. As an example, a mixture of a cool season grass (oats), a winter annual grass (cereal rye), a winter annual legume (hairy vetch), and a brassica (radish) would provide some quick cover in the fall, some nutrient scavenging, some nitrogen fixation, and more cover in the spring, while helping the soil system recover. Cover crop cocktails should be used as much as possible to accomplish multiple objectives.

## Seeding Methods

### Aerial Seeding

While a grower's first impulse may be to use aerial seeding as fields may be too wet to drive on, this may not be very effective. If the field has a crust on it or has been scoured down to a firm layer, the seeds will land on dry soil. While a timely rain may germinate them, they may dry out before the plant becomes established if rains aren't consistent. Seeds require good seed-to-soil contact for establishing growth. Many of the winter cereal grains and winter annual legumes must be planted into the soil at a depth great enough to survive the winter. In addition, some seeds may fall on a layer of debris and may not even touch the soil. For some cover crops, the aerial seeding rates are increased by 50 to 100 percent to partially make up for the lack of stand establishment under these conditions.

Depending on how fast the water recedes, some areas of the field may need the cover crop weeks, or even months, before the entire field is ready. It may be difficult to get an aerial applicator to come to the same field several times just to seed a small strip at a time. The cover crop species selection and seeding rate will probably have to be changed with each successive strip as the seeding date becomes later. While this may still be a problem with the other seeding methods, it may be easier for a producer to schedule the other methods.

### Broadcast Seeding

Broadcast seeding followed by a light tillage operation may be an option for small seeded cover crops like oats and clovers, especially if some tillage is needed to deal with erosion, scouring, or sedimentation. Most producers have access to a dry fertilizer applicator which could be used to distribute the cover crop seed. Depending on fertility needs, the seed could be mixed with dry fertilizer to accomplish

two things in one trip while improving seed distribution. The light tillage with a spike-tooth harrow, Aerway, coulter tillage tool, or other similar fluffing harrow would incorporate the fertilizer and provide some seed-to-soil contact and smoothing of the soil surface. If the soil is dry enough, deeper tillage with a disk or field cultivator could be performed to level the soil surface and better incorporate larger seeded cover crops, but compaction and soil smearing is a risk if the soil is wet. Depending on the soil moisture situation and the depth of tillage, the broadcast seeding rates for some cover crops may be increased by 50 percent compared to drilling.

### Drilling or Air Seeding

For most effective cover crop seeding, especially to establish winter annual cover crops, a drill or air-seeder should be used to place the seeds directly in the soil. The drill will provide some soil smoothing and cut up some surface debris. Compaction will be less than with tillage as most drills and air-seeders are pulled with smaller tractors than are required for tillage equipment of the same width. In addition, the seed metering, seed distribution, seeding depth, and seed-to-soil contact will be more uniform, providing a better cover crop stand.

## Cover Crop Types and Time of Seeding

The choice of cover crop depends on the purpose, the method of seeding, and the time of year.

Cover crops are usually classified as cool season, warm season, winter annual, biennial, or perennial and as grass, legume, brassica, or other. Often cocktail mixes of the various types are used to ensure success or to achieve a variety of goals as the diversity of the mix adds to the benefits. Selecting a single cover crop, the seeding rate, or the amount of any type in a mix would depend on the goals and the time of seeding (see *Table 1* for some suggestions). Most cover crops need at least 30 days of growth to start being effective and many should have 60 or more days to achieve full benefits. Again, if a field is seeded in successive strips as the water recedes, the cover crop species selection and seeding rate should be changed as the growing conditions change.

### How Timing Affects Selection

As examples, a warm season grass like sudangrass will give quick cover if seeded in August but would be killed by light frost before it did much good if seeded in late September. A cool season grass like oats would work better in September since it will continue growing after a light frost and wouldn't be killed until there was a hard frost closer to November. A winter annual grass like cereal rye or winter wheat could be seeded in October, become established in the cool fall, and continue growing once the spring warms up. However, it would have to be killed before planting

**Table 1. Some of the cover crops suitable for flooded fields and seeding suggestions**

Cover Crop	Type*	Full Seeding Rate** (lb/ac)	Planting Date	Seeding Depth (inches)
Oats	CG	30-75	8/1-9/15 or 3/1-4/1	0.5-1.5
Cereal Rye	CG	50-100	8/1-11/1	1-2
Winter Wheat	CG	50-100	9/20-11/1	1-2
Winter Triticale	CG	50-100	8/1-11/1	0.75-1.5
Winter Barley	CG	50-100	8/1-10/15	1-2
Sorghum/Sudan	WG	5-25	7/1-9/15	0.75-1.5
Spring Peas	CL	50-100	3/1-4/1	1.5-3
Spring Lentils	CL	20-40	3/1-4/1	1-1.5
Chickling Vetch	CL	50-90	3/1-4/1	0.75-1.5
Cowpeas	WL	30-90	6/1-9/1	1-2
Hairy Vetch	CL	15-20	7/1-9/1	0.5-1.5
Winter Peas	CL	50-100	9/15-10/15	2-3
Mustard	B	4-6	3/1-4/1 or 8/15-9/15	0.25-0.75
Rape/Canola/Turnips	B	4-6	7/1-9/15	0.25-0.75
Oilseed Radish	B	8-12	7/1-9/15	0.25-0.75
Oats/Forage Pea Mix		30/30	3/1-4/1	1-2
Cereal Rye/Hairy Vetch Mix		50/20	8/1-9/15	1-2
Cereal Rye/Winter Pea Mix		50/50	9/15-10/15	1.5-2.5

\* B = brassica, C = cool season, G = grass, L = legume, W = warm season

\*\* Use the higher rates when broadcasting or aerial seeding. When used in a cocktail, divide the full seeding rate by the number of species in the cocktail.

the next crop. Mixing oats and rye would give some quick growth in the fall, some additional growth in the spring, and improve the soil recovery.

In another example, a warm season legume like cowpeas or soybeans could provide good cover and fix considerable nitrogen if seeded in early August. But if seeding in September, a cool season legume like forage peas or spring lentils may be a better choice as they can survive a mild frost. Seeded in October, a winter annual legume like Austrian winter peas or hairy vetch would be better, but would have to be killed in the spring before planting the next crop. Mixing a grass with the legume would provide more cover and increase the diversity.

While most brassicas are cool season annuals, they are most effective if they have 45 to 60 days before a killing frost to allow the tap root to penetrate deeper into the soil. They shouldn't be used as a single species cover crop after flooding because the residue breaks down rapidly, they don't fix nitrogen, and they aren't very mycorrhizae friendly. Many producers include them in cover crop cocktails as the seeding rate is fairly low and the benefits of the large tap root are great, if the killing frost comes later in the fall. However, after mid-September, the odds are not good.

### Spring Seeding

If the fields are too wet to seed any cover crops in the fall, one seeded in the early spring of 2012 would still provide benefits. For a spring seeding, consider cool season grasses and legumes, like oats and forage peas, to help rebuild the soil and use excess soil moisture. Often these spring cover crops are seeded as soon as the soil conditions allow, before the spring rains really start. Brassicas and other cool season broadleaves can be used in the spring, but they won't develop the large tap roots that they would if seeded in the fall.

Frost seeding of oats, mustards, vetches, or clovers also may be an option, once the temperature drops and the soil firms up. These cool season cover crops will then germinate and grow in the spring, providing some cover and feeding the soil system. However, they may start growing early and be killed by a frost later because of the lack of residue to help protect them from temperature fluctuations.