

Cover crops as a soil improvement strategy

Eric Johnson, 1999, updated 2007, 2010

Why cover crops?

-- cover crops *add organic matter* to the soil when chopped and incorporated. In this way, they create compost 'right where it's needed.'

-- cover crop roots *help to break up the clods in the soil*, and their decomposition leaves behind a crumbly, friable soil that is ideal for vegetables and flowers. Grasses tend to have very fibrous root systems that especially help to improve the top foot of the soil. Other cover crops, such as the vetches and clovers, can be somewhat more taprooted, and assist in breaking up and improving the subsoil. In other words, cover crops help to do the same things that rototilling and/or forking a garden bed will do, greatly improving soil tilth.

-- in symbiosis with specific bacteria, *legume cover crops fix nitrogen* from the atmosphere. Nitrogen is an important plant nutrient that can be used by your garden crops after the legume decomposes. Legume seed should be inoculated with the correct bacteria (purchase from a farm or garden seed supplier) so that it can fix nitrogen efficiently.

-- cover crops *scavenge nutrients from the subsoil*. Deep-rooted cover crops can scavenge minerals from the subsoil and bring them up into the topsoil, where they will be more available to your garden crops

-- cover crops *can make specific nutrients better available to your garden crops*. Buckwheat is adept at extracting hard-to-get phosphorus from the soil. As the buckwheat decomposes, the phosphorus in it becomes available to other crops.

-- cover crops *prevent wind and water erosion*. In the winter, dry weather combined with Boulder's fierce chinook winds can cause wind erosion. Rye or other winter cover crops can help to prevent this problem by protecting soil from the wind. In the summer, thunderstorms can wash soil away quickly. Cover crops intercept the raindrops and prevent soil loss.

Cover crops are one of the top two or three ways to improve your garden soil, and should be part of the yearly cycle of gardening for all successful gardeners!

Where can I find seed?

-- Some kinds of seed (grains, buckwheat) are available from bulk bins at local markets. If buying buckwheat, buy raw, not toasted, buckwheat.

-- Arkansas Valley Seed (I-25 and Hwy. 66, east of Longmont, or approximately Colorado Blvd. and I-70 in Denver) has many kind of cover crops, including hairy vetch. It often also has inoculants for legumes. Open M-F only last time I checked.

-- Peaceful Valley Farm Supply, P.O. Box 2209, Grass Valley, CA 95945 (phone 916-272- GROW, web site <http://www.groworganic.com>) has all kinds of cover crop seeds, inoculant, and many other garden items available by mail order. Their focus is on serving organic gardeners and farmers.

General Cover Crop Strategies

Sow Densely

One of the major reasons to grow cover crops is to protect the soil from wind and water erosion, so it's okay to sow somewhat densely, to get thorough coverage.

Inoculate the Seed (if it's a Legume)

Legumes will produce more abundant biomass AND fix more nitrogen in the soil if they are inoculated with the proper species of bacteria. Bean and pea inoculant is available at garden centers and through seed catalogs. Inoculants for other kinds (clover, vetch, etc.) are available from some of the better seed companies, Peaceful Valley Farm Supply, etc.

Water

When starting fall cover crops, be aware that the water supply may be shut down when the crop is still quite young. Because we often have dry Autumn and early Winter weather, weak cover crops can be severely set back if there isn't enough moisture in the soil. Moral of the story: provide adequate water to get the seeds started, and soak the soil if possible just prior to water shutoff.

Harvest at the Right Time

For maximum biomass production, cut the cover crop when it is in full flower. Legumes have produced their maximum nitrogen at 50 - 100% flower. By all means cut the cover crop whenever works best for you, however. Keep in mind, though, that if you wait too long, the plants may set seed (this may or may not be acceptable to you).

Feed the Cover Crop (When Necessary)

Extremely poor soils cannot usually grow a good cover crop by themselves. If you have a soil like this, an application of compost (and/or other amendments) could be necessary to get good growth from the cover crop. Most garden soils, unless very poor, will grow adequate cover crops.

Cover Crops for the Boulder Area

This information is based on my own experiences and thoughts. It's not meant to be the final answer on any question, but only a guide to point people in what I hope are helpful directions. I encourage you to experiment and find out what works best for you.

Keep in mind that climate change may slowly make these recommendations less useful for Boulder. Staying aware of conditions, trying new cover crops, and modifying sowing dates & other cultivation practices could be a good approach to successful cover crops in coming years.

Winter Cover Crops:

Note: All of the cover crops listed below can be grown individually. Studies in California with fava beans (a winter legume for mild climates), however, show that the best combination of nitrogen fixation (from legumes) and biomass comes when legumes and grasses are mixed. For that reason, my preference is to sow rye or wheat, with clover or hairy vetch, as a winter cover. This year I'm going to experiment with a hairy vetch, wheat, *and* white clover combination.

1. White clover -- White clover (a.k.a. Dutch White Clover) is my new favorite cover crop. When there is adequate winter moisture, it survives and makes incredible biomass in the spring. Unfortunately, it doesn't tolerate much drought and is slow to start. It won't really make good biomass until April or beyond, so it may not be a good choice for beds you want to prepare and plant to vegetables early in the season.

Sowing: White clover should be sown before the end of August, I think, and kept moist for the 3-7 days it takes to germinate in warm soil. As with all legumes, inoculate with (clover) inoculant if available. I purchased seed at Arkansas Valley Seed in Denver (there's also an outlet at the corner of Hwy. 66 & I-25 near Longmont) – and a little goes a long way. If you're just covering one full garden plot at Hawthorne, for example, you'll need far less than a pound. That said, if the seeds aren't well cared-for, and germination/survival rates are low, you'll need to sow more densely. Broadcast fairly densely and scratch in very lightly with a rake. If combining with wheat, rye, or other large-seeded cover crops, sow and rake in (more deeply) the large-seeded stuff *before* sowing and (lightly) raking in the clover.

Care: White clover requires some moisture to do well. Keep your soil watered until shutoff of water at the community garden. If possible, water during dry spells in the winter. Shovel snow onto the bed after a snow storm in winter, if weather has been dry.

1. Hairy Vetch – this is another great winter cover crop for us. It is very hardy and will survive Colorado winters. Since vetch is a legume, it fixes nitrogen, but also generates

quite a bit of biomass if allowed to grow into April. It is also extremely attractive in bloom, and I like to leave a few plants in the garden just so I can enjoy the blossoms.

Sowing: Note that the amount of seed it takes for hairy vetch to cover a particular area is much more expensive than the amount of clover necessary for the same area. Broadcast relatively densely (seed spacing of 1 inch) in August. Rake the seed in to about half an inch or an inch depth.

Care: As with all legumes, inoculate with (vetch) inoculant if available. After sowing, keep the seed moist until germination. Water now and then in the Autumn until the water is shut off in the community garden. This gives the vetch a good start and allows water to be stored in the soil for its use during our (usually) dry late Autumns. In Spring, chop off at ground level and use for compost, or chop it up with a spade and turn it into the soil when you prepare the garden beds in the Spring. Rototiller gardeners: note that vetch can be viny, and will tangle in the blades if not chopped up with a spade first.

2. Winter Peas/Field Peas – these are the same species as our more common garden peas, but are not particularly edible. Fortunately, winter peas are somewhat tougher than garden peas. Mine lived through the winter last year, but it was a mild winter. Severe winters may kill it here in Boulder. It is, like vetch, a legume that can fix nitrogen in the soil, and produces succulent, easily-chopped biomass for incorporating into the soil.

Sowing: Seed is somewhat harder to find than white clover and hairy vetch. Broadcast relatively densely and rake in late August to a depth of approximately an inch.

Care: Inoculate with pea/bean inoculant (this is an easy inoculant to find -- most garden centers have it). It requires the same care as garden peas, without the trellises you might use for garden peas. Just let them sprawl on the ground. Provide occasional water as late in the Fall as possible if weather is dry. Incorporate in the Spring after chopping, or take up the whole plant and compost it. Field peas can tangle in rototiller blades, so chop first if you'll be rototilling.

3. Rye – this is the same plant that produces rye grain. It is exceptionally tough and will survive even harsh winters if it gets a good start. It does not fix nitrogen, but does produce abundant biomass for incorporation into the soil, and the fibrous roots do a great job of breaking up our dense clay soil. As with most cover crops, if you can chop it up it will be easier to incorporate. Of course, it can be 'skimmed off' and composted, too. Note that 'rye grass' is something completely different, which I do not recommend as a winter cover crop.

Sowing and care: *You can buy this stuff very cheaply out of the bulk bins at good natural foods stores.* Just look for the 'rye berries' and buy a few pounds. Sow densely as late as the end of September here, especially if we have a warm Fall. You'll get a better stand if started earlier and kept moist, but you'll usually get an okay stand if sown in late September. I find it easy to scatter it and rake it in to empty beds to half an inch or an inch of depth. Irrigate to get it to germinate, and water occasionally in the Fall if possible.

4. Wheat – buy ‘winter wheat berries’ from the bulk bins of a local market. Winter wheat is nearly as tough as rye, and provides similar biomass. Like rye it does not fix nitrogen. Be sure not to use ‘spring wheat’ – get ‘winter wheat’ berries for use as a winter cover crop.

Sowing and care: similar to rye.

5. Barley -- if our winters continue to be mild, I'm going to start experimenting with barley as a grass component of my winter cover crop mix. Barley is not as winter hardy as rye or winter wheat. However, it makes nice biomass like the other grains, and keeping things as diverse as possible is a worthy goal.

6. Oats – Oats will winter kill in Boulder most seasons, but if started early enough, it provides soil protection without making much biomass. This may be helpful if turning under large amounts of biomass is difficult for you.

Sowing and care for barley and oats: similar to wheat and rye.

Summer Cover Crops:

1. Buckwheat – this isn't wheat at all, or even a grass, but it sure is a great cover crop. It gets three feet high if it does exceedingly well. Fair quality seed can be had from the bulk bins at local health food stores (make sure you don't buy *toasted* buckwheat, though, which is thoroughly dead). The blossoms are very attractive to beneficial pollinating and predatory insects ('insect good guys'). I often let it self-sow and grow next to other stuff in the garden, just because I like the flowers. It produces abundant biomass that breaks down fairly quickly in the soil when incorporated.

Sowing and care: Sow almost anytime from about May 1 to early August. This cover crop does require plenty of water, similar to many of our summer vegetable crops. Chop up and incorporate at any stage of growth, or wait and let the first cold spells finish it off before incorporating. If you wait long enough and sowed it early enough, it'll drop seed that will germinate the next year. Buckwheat tolerates no frost, so keep that in mind when planning a sowing.

2. Various grasses – everything from corn to millet to spring wheat can be used as a summer cover crop for biomass production. I like one called ‘Sudan grass’ that I saw in California and bought by mail order -- it is very vigorous, makes lots of biomass, and has a huge fibrous root system to break up clods in the soil. Sudan grass is probably also available at Arkansas Valley Seed (see "Where can I find seed?" below).

Whatever grass you use, just sow it relatively thickly, keep it watered, and chop down and incorporate whenever you're ready, but before seed formation. Don't sow perennial grass seed of any kind, as this will be harder to kill.

3. Sweet clover – there are white- and yellow-flowered species that are typically, if not always, biennial. If possible, find annual species for summer cover crop use. It is pretty in vegetative growth or in bloom, and the blossoms attract bees. A legume, sweet clover will fix nitrogen if inoculated with clover inoculant. I've seen it get five feet high.

Sowing and care: Sweet clover is a small seed, so don't sow too deeply. Broadcast and rake in lightly. As a shallow-sown, small-seeded plant, seeds may dry out readily, so be prepared to keep your seedbed moist until the seed has emerged. Prior to sowing, inoculate with clover inoculant (or buy pelletized pre-inoculated seed). Provide with adequate water. Cut it down, chop it up, and incorporate or compost it any time, but definitely before the seed forms and dries.

Sweet clovers are also a fine winter cover crop, if biennial types are used and they are sown in August. However, their tough taproot makes incorporating them back into the soil in springtime a challenge.

4. Be creative – any kind of cheap seed can probably be used as a cover crop. How about pinto beans or black-eyed peas (both are legumes that fix nitrogen)? Other clovers? What about radishes? Radish seeds for radish sprouts can often be bought cheaply in bulk.