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Success with cover crops comes with experience. Start on a small scale until you see how cover crops behave under your unique garden conditions.

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Cover Crops for the Home Garden

Cover crops are grown to enrich soil, improve its structure, enhance growth of subsequent crops, and reduce erosion by protecting the garden surface from wind and rain. They are planted during intervals in the growing season when traditional garden crops are not present, and they are of particular importance to people interested in intensive gardening—a style of gardening that requires the very rich soil that cover crops can help create.

Cover crops enrich soil by improving its ability to retain nutrients and by contributing organic matter. As cover crops grow, their roots loosen tight or compacted soils, and when these crops are cut and tilled back into the soil they decompose and add nutrients. Cover crops also disrupt disease cycles, suppress weed growth, and provide habitat for beneficial insects.

Why should I use cover crops?

Foot traffic in the garden during tilling, weeding, and harvesting can compact garden soil. And continual use of a garden plot to grow fruits and vegetables can deplete soil nutrients and allow disease and weed problems to build. (Although many careful gardeners remove plants after harvesting in order to prevent diseases, doing this can rob the soil of the fresh organic matter it needs to stimulate biological activity that will enrich it.)

Cover crops can help loosen and revitalize your soil, making it more productive for subsequent crops, and they can reduce the need for pesticides and fertilizer. In addition, cover crops can be very attractive. And many are edible.

Devoting space in a home garden to cover crops is a commitment. It will entail some planning and effort, and can take a portion of the garden out of production for a period of time. There are ways, however, to make use of cover crops and not lose time or space for growing your favorite vegetables. If your garden space is limited, it is best to plant cover crops at the beginning or end of the growing season, thus allowing full use of your plot for summer vegetables and flowers.

Which cover crops are best for home or community gardens?

There are many different types of cover crops. Most are either grasses (such as rye, barley, and oats) or legumes (clover, peas, beans, and vetch). Legumes are unique in their ability to fix nitrogen in the soil so that this important nutrient can be used by subsequent crops. Other cover crops include buckwheat and radishes.

Different cover crops produce different quantities of *biomass*—that is, different quantities of plant material. Those producing relatively modest amounts—or that can be managed so they produce only modest amounts—are easiest to deal with in a home garden. Too much cover crop plant material can become a problem when it comes time to cut it, chop it, and cultivate it back into the soil.

GROWING TECHNIQUES

Commercial vegetable producers use an array of cover crops, but many of these require herbicides or large-scale equipment to manage, and therefore are not recommended for the home garden. Winter rye and hairy vetch, for instance, are excellent for field-scale production, but they can be hard to cut and hard to till into the soil. We recommend that home gardeners use annual species for which seed is easily available, and species that are easily established and managed, easily incorporated into the soil, and unlikely to create insect, weed, or disease problems for other crops. Here is our short list of good home garden cover crops that meet those requirements: buckwheat, oats, berseem clover, soybeans, and oilseed radish.

Buckwheat is a tender annual broadleaf that, despite its name, is not related to wheat. It germinates readily and grows quickly, making it an ideal crop to smother weeds. It has a fibrous root system which loosens tight soil, making soil friable and easy to work for the next crop. It flowers early and should be cut and tilled into the soil before it produces seed, lest it become a weed. Mowing seven to ten days after flowers begin to appear will prevent viable seed from forming. Bees and other pollinators are attracted to buckwheat, as are beneficial insects such as ladybugs and lacewings. However, it also attracts Japanese beetles, a fact that should be considered if you plant species susceptible to Japanese beetle damage, such as raspberries, strawberries, eggplant, and—especially—roses. Buckwheat can be planted anytime from late spring to mid-August. It will die with the first frost. Buckwheat performs poorly in heavy soil, or in soil with pH above 7.0. Soil pH can be determined by routine soil testing. (For information on soil testing, contact your County Extension office or refer to UW Extension publication A2166, listed in the *Resources* section on page 6).

Buckwheat smothers weeds and loosens soil.



Oats is a fast-growing, cool-season grass with fibrous roots that hold the soil and add organic matter. Both “feed” and “seed” oats are acceptable as a cover crop, and seed for both is relatively inexpensive. Oats can be planted in the early spring or fall. It is often planted in combination with a legume that can fix nitrogen.

Oats can be mowed before the seed heads emerge in order to stimulate regrowth while managing existing biomass—that is, while keeping the straw at a manageable level so that it can be chopped and incorporated back into the soil.

Mowing will kill plants that have already developed a seed head, or “headed out.” Oats will survive frequent mowing if a shorter cover is desired. This cover will survive the first few frosts in the fall. Growth should be monitored closely so it doesn’t get out of hand. Oats planted in late summer will produce a large quantity of dry matter, but will be killed by winter and easily tilled into the garden in spring—especially if it is first chopped with a mower.

Berseem clover is a rapid-growing, tap-rooted annual legume capable of fixing nitrogen. Most clovers are not recommended for the home garden because they are slow-growing initially, and more difficult to establish than the other crops discussed here—and because they are difficult to kill. They are biennial or perennial, and have a high percentage of hard seed which will germinate for years to come. But berseem clover, because it is an annual, does not have these problems and works well in home gardens.

Berseem can be mowed before flowering to manage the biomass and to stimulate regrowth of succulent young tissue. Cutting after flowering will kill the plant. Its tissues are higher in nitrogen than the tissues of other recommended species, so its residue will decompose more rapidly, releasing nitrogen into the soil in plant-available form for the next crop. Berseem clover usually tolerates light frost. Make sure you purchase seed that has been inoculated with the proper *rhizobia* bacteria so that the clover will be enabled to fix nitrogen; or inoculate it yourself.

Soybeans are a unique and useful cover crop in the home garden. Not only do they fix nitrogen but they can provide a tasty, edible crop if the right variety is planted. Edamame (eh-duh-MAH-may) soybeans from Japan have become a popular vegetable in recent years. Often referred to as “edible soybeans” or “fresh/green soybeans,” they may be boiled and salted in the pods and eaten as an appetizer, or shelled and added to salads. Soybeans planted for harvest are normally grown in rows, but they also can be broadcast-planted to form a solid stand. The beans can then be harvested in late summer or early fall.

Plant soybeans after the soil has warmed in late spring to midsummer. If not intended for later harvest, soybeans can be mowed to manage the biomass, although this can be risky. Plants must be cut higher than other species because regrowth is initiated from axial buds. Also, mowing will stress the plant for a variety of reasons, which will slow growth. Soybeans will be killed or severely injured by the first frost. Like clover seed, soybean seed should be inoculated before planting.

Oilseed radish is a recent arrival on the cover crop scene. This radish, commercially available with names such as “Tillage” and “Groundhog,” has been selected for larger roots that penetrate the soil to depths greater than six inches, breaking up compacted layers. Like soybean, this cover can provide a harvestable crop, for its roots are edible. A word of caution: decomposing radishes produce a strong odor which some people find objectionable.

Radishes are a cool-season crop and do best when planted after August 1. They grow rapidly in fall and will survive several frosts. The size of the root depends on the seeding rate. Lower rates result in larger roots but less initial cover of the garden surface. As plants become larger, the top growth spreads out, ultimately protecting the soil surface. A common practice among farmers who want very large roots to relieve compaction is to seed another cover crop that will fill the gaps between radish plants and protect the soil surface until the radish tops spread out. See below for a discussion of cover crop mixes

Selecting which cover crop to use

All species recommended for the home garden will produce cover to protect the soil surface, although some more rapidly than others. Therefore, additional benefits should be considered when selecting which cover to plant. The choice of cover crop species should be made based on answers to the following questions.

1 When are you planting?

Time of planting will dictate which covers will perform better. Cool-season species do not grow well in hot conditions; warm-season species do not grow well in cool conditions, especially when nighttime temperatures drop. Also, warm-season species will be killed by the first frost, which means that if they are planted late in the season they will produce limited soil cover and biomass. In general, warm-season cover crops are planted June through mid-August, cool-season species the remainder of the growing season. Mid-September is the practical cut-off date for planting cool-season covers in Wisconsin, if appreciable growth is desired.

2 Do you need to replenish nitrogen?

Nitrogen is often the essential nutrient most lacking in garden soils. Nitrogen fixation is a biological process in which plants and *rhizobia* bacteria work together to convert atmospheric nitrogen into plant proteins. Only legumes like clover and soybeans can fix atmospheric nitrogen. This nitrogen is ultimately released to the soil in a plant-available form when the legume decomposes. Legumes are the appropriate choice if you plan to rotate to a crop that requires lots of nitrogen, such as potato, sweet corn, tomato, squash, or pumpkin.

3 Is your soil tight or compacted?

Fibrous-rooted covers will relieve tight soils and improve tilth, while tap-rooted species will help break up deeper compaction. Fibrous roots also explore a large soil volume and do a good job of scavenging unused nitrogen.

Once you have answered the questions above, use table 1, the cover crop selection matrix, to help you decide which cover crop to plant.

Table 1. Cover crop selection matrix

Planting time	Goal	Best option
In the warm season	to smother weeds and loosen tight soil	plant buckwheat
	to fix nitrogen	plant soybeans
In the cool season	to loosen tight soil	plant oats
	to alleviate deep compaction	plant oilseed radish
	to fix nitrogen	plant berseem clover

Cover crop mixes

Cover crops are often planted as a mix of species. This is done to combine the benefits of individual species and reduce the risk of complete cover crop failure, should growing conditions for one species turn out to be unfavorable.

- Oats plus berseem clover is a mix of a legume with a nonlegume that also combines tap and fibrous root systems. Oats grow more rapidly than clover and can help suppress weeds while the clover becomes well established.
- Oats plus oilseed radish is also a combination of root types. The oats provide soil cover between the radishes until the radishes dominate.

Buckwheat and soybean perform best when planted by themselves.

Planting mixes in a garden situation is relatively easy because seed is often broadcast by hand, eliminating the complications involved when two seeds of differing size are planted mechanically. To ensure that neither crop in the mix is too competitive with the other, reduce the seeding rate for each by one-third to one-half. Planting a mix of crops requiring different planting depths does present a complication, which is discussed below.

Seed sources

It can be difficult to find cover crop seed in small quantities for the home garden. Some mail-order and Internet catalogs offer cover crop seed in small quantities. The Internet search words “cover crop seed suppliers” will reveal many Midwest suppliers. Other sources for seed are local garden centers and feed or farm supply stores, which often sell bulk seed by the pound.

Planting and management

Successfully establishing cover crops does not require extensive soil preparation as long as sufficient seed-to-soil contact is achieved. In fact, overworking the soil will destroy its surface structure, which may negate the soil-improving benefits you are trying to achieve.

Here is the recommended procedure for seeding a cover crop.

1. Rake the soil smooth, removing any significant debris from a previous crop.
2. Broadcast the seed by hand or with a broadcast seeder. (Planting rate recommendations are listed in table 2.)
3. Rake the soil again to cover the seed to the appropriate depth (see table 2).
4. If using a mix that requires different planting depths, sow and incorporate the deeper-seeded species to the desired depth first, then repeat for the second, shallower-placed seed. Planting depth is based on seed size. In general, the larger the seed, the more soil cover it requires. However, planting too deeply will reduce the number of plants that emerge.
5. Water if necessary. But if the soil surface is fine, take care not to create a crust. Crusted soil will reduce emergence of the finer-seeded cover crops. You can try to avoid crusting by not tilling too much (this creates a layer of fine soil particles near the surface) and by not applying a lot of overhead irrigation if you do have fine soil particles.

Planting tips

Seed of fine-seeded species such as berseem clover should be mixed with a carrier of similar particle size and density to aid seed metering and distribution. Examples of carriers include commercial fertilizer and ground corncobs. The problem with fine-seeded species is the relatively small volume of seed (compared to larger-seeded species) that needs to be spread over the area to be planted. It is easy to apply too much small seed and run out before you are finished. Adding a carrier increases the total volume to be spread, reducing this risk. If you use fertilizer as a carrier, prevent salt burn by mixing the seed and fertilizer just before broadcasting. (Salt burn occurs when fertilizer draws moisture out of plant material, either the seed or the vegetative tissue.)

Double-broadcast seed at one-half the planting rate to ensure even coverage over the entire area. To do this, divide the seed lot in half and broadcast the first lot over the entire area, then repeat with the second lot. If you run out of seed the first time (planting too heavy), use some of the second lot at the same rate to finish, and then reduce the rate on the second pass. If seed from the first pass is left over, combine it with the second lot and increase the seeding rate on the second pass. This may seem like extra work but this technique is used by most experienced practitioners.

Table 2. Approximate seeding rates and planting depth

Cover crop	Per 1,000 square feet				Planting depth (inches)
	Pounds	Ounces	Grams	Cups*	
Buckwheat	1.2	19.2	520	3 $\frac{2}{3}$	1
Soybeans	1.7	27.2	780	5	1
Oats	2.1	33.6	936	13	1
Berseem clover	0.3	4.8	125	$\frac{2}{3}$	$\frac{1}{4}$
Oilseed radish	0.2	3.2	104	$\frac{2}{3}$	$\frac{1}{2}$

*Values rounded for ease of measurement. Weights will vary with different seed sizes. These rates should provide good stands with normal seed sizes.

Legume seed (soybean and berseem clover) should be treated with inoculant just before planting to ensure effective nitrogen fixation. Commercial inoculant products are available through seed suppliers and at some garden centers. These products come in strains specific to certain legumes. Make sure the strain you use matches the species you are planting. To ensure the inoculant's viability, refrigerate it or store it in a cool, dry place until you are ready to use it. Follow package directions for mixing it with the seed.

Residue management

Before you plant, evaluate your ability to manage cover crop residue. Given enough time, these covers can produce a significant amount of biomass and attain heights in excess of two feet. Ask yourself if you will be able to mow it and incorporate the residue into the soil. If not, will surface residues interfere with next year's production? Residue left on the surface will be pressed into a mat by snowpack, which will slow soil warming and drying in spring.

Mowing tall covers with a push mower can be physically demanding as well as frustrating. Using power equipment such as a riding lawn mower will make residue management easier. Mowing the residue to chop it into smaller pieces is easier after the cover crop has died and dried down.

In this mix, oats germinate quickly to provide cover while peas add nitrogen to soil. Both are killed by winter, making them relatively easy to till into soil in spring.



Berseem clover, buckwheat, and oilseed radish create fewer spring garden preparation problems than other cover crops, for their residues break down rapidly after mowing or winter-killing. Oat residue, on the other hand, decomposes more slowly, and the longer stems easily tangle in rototiller tines, so it is important to mow oats before tilling.

If dealing with excessive residue presents a challenge, cut the cover crop frequently during the growing season to keep it short, or plant it later to limit plant height at the time of a killing frost.

Using cover crops

In general, there are two strategies for cover cropping in a home garden: plant cover crops in an area only after vegetable crops have been harvested from that area, or plant as many as three cover crops in succession in one area of the garden throughout the growing season. Each strategy has certain advantages and each can improve the soil.

Planting cover crops after vegetables

Following vegetables with cover crops makes for efficient use of garden space.

After spring crops such as peas, spinach, radishes, and lettuce are finished, plant a warm-season cover. It will scavenge for soil nutrients, especially nitrogen, and prevent weed growth. Similarly, replant summer vegetable ground with oats in late summer or early fall. While crops such as broccoli or peppers are still growing it is possible to under-seed them with oats by scattering oat seed and lightly raking it into the soil. Avoid planting oats into crops that are susceptible to leaf rusts, such as tomato, unless you do this late in the season.

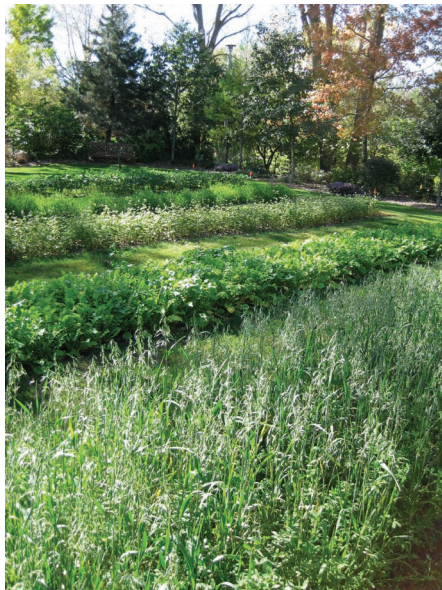
Planting cover crops in succession

Keeping a portion of your garden in cover crops for an entire season is less space-efficient than planting cover crops after vegetables, but may lead to more rapid soil improvement. This strategy is very useful for reducing weed pressure and is commonly employed by organic growers when they transition land into organic production. The combination of tillage and competition from the cover crops encourages weed seed to germinate, then suppresses the weeds and prevents production of new seed.

If you have ample room, plant one-half to one-third of your garden with a succession of covers: cool-season, warm-season, cool-season. The following year plant vegetables in that area and rotate another area into cover crops. Alternatively, plant edamame soybeans and enjoy a late, tasty harvest before incorporating the crop residue into the soil to prepare the area for planting the following spring.

Here is an example plan if you are dealing with a new garden area or one that is very weedy:

- Plant oats in the spring after tilling.
- Cut and incorporate the residue in early summer and allow the soil to rest until the first flush of weeds germinates.
- Cultivate shallowly to remove these weeds when they are small, and then plant buckwheat.
- Mow and incorporate the buckwheat as it flowers and again allow weeds to germinate.
- After another shallow cultivation, plant oats again.
- Allow the oats to grow and winter-kill, leaving the area ready for a more prosperous, cleaner garden the following year.



Start small and experiment

The recommendations in this publication will help you get started; with some experience, you will soon see opportunities for employing the unique characteristics of each cover crop to improve the soil. And don't be afraid to experiment once you are comfortable growing covers. Most of the tried and true practices of successful growers resulted from experimentation.

Resources

Managing Cover Crops Profitably, 3rd edition, 2007, USDA SARE handbook series: www.sare.org/publications/covercrops/covercrops.pdf.

Cover Crops on the Intensive Market Farm, 2003, University of Wisconsin Center for Integrated Agricultural Systems: www.cias.wisc.edu/wp-content/uploads/2008/07/cvrcrop.pdf.

Midwest Cover Crops Council: www.mccc.msu.edu/.

Sampling garden soils and turf areas for testing, 2008, University of Wisconsin Extension publication A2166: <http://learningstore.uwex.edu/Assets/pdfs/A2166.pdf>.

Nutrient Application Guidelines for Field, Vegetable, and Fruit Crops in Wisconsin, 2006, University of Wisconsin Extension publication A2809: <http://learningstore.uwex.edu/Search.aspx?k=a2809>



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