



by Alice Posner 2012

Using hand methods for tillage in a small garden make it easier to maintain soil health than in larger scale tractor farming systems. The use of mulches, compost and crop rotation are all examples of practices that can benefit soil health. Adding cover cropping to your practices can greatly benefit your results in the school garden.

This guide lays out the many benefits of cover crops, and how they can be used in the school garden. It will offer a sampling of cover crop choices, and give basic information on the factors that go into choosing the best one for your situation. The guide also outlines how to plant and “harvest” their benefits. It also ventures into looking at small grains, which are often the same plants used as cover crops, the difference being they are allowed to reach full maturity, instead of turned under as a soil amendment.

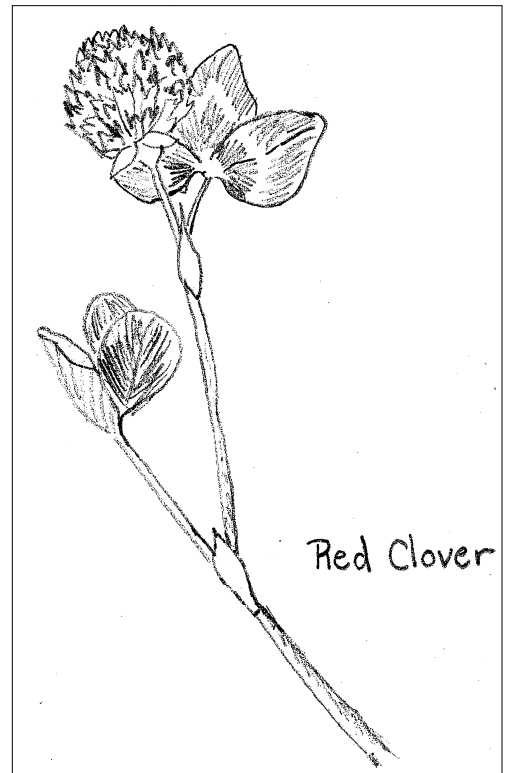
## What are cover crops?

Cover crops are plants that are grown to protect and benefit your garden soil. They are not intended primarily for harvesting for food or other uses. Cover crops literally “cover” the soil. This protects it from erosion, can keep weeds from growing, and maintains soil structure.

However, cover crops can do much so much more; adding organic matter, making nutrients available in the soil, acting as a mulch around established plants, feeding soil microorganisms and more. For this reason, they are given other common names “Green Manures,” “living mulches” or simply “Soil Crops.”

## Why use cover crops?

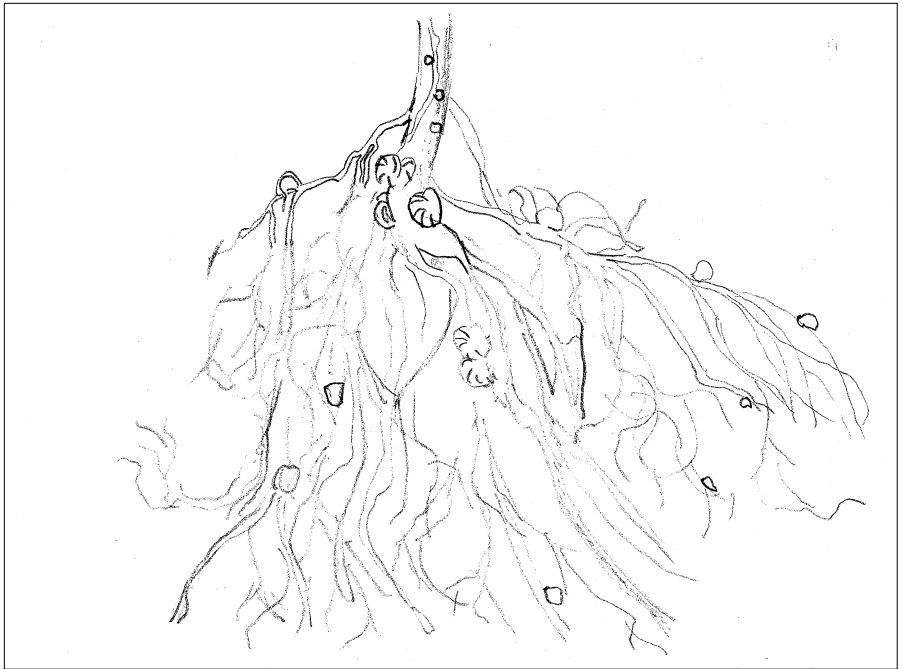
**Improve or maintain your soil structure** by breaking hard pan, reducing surface crusting, reducing compaction and erosion. Hard pan and soil compaction are more problems that come with tractor maintained soils, but may come about with frequent rototiller use, bare soil, stepping on beds, or certain soil types. Cover crops can



help break up compaction with roots that swell and spread in the soil. Cover crops also reduce erosion by protecting soil from rain or runoff, as their leaves intercept rain, and their root system can hold the surface soil in place.

**Suppress weeds** by establishing rapid growing smother crops: Cover crops can out compete weeds if planted at the right time. They do this by blocking sunlight and taking up root space, absorbing available moisture from the weeds present in that bed. They can also prevent the establishment of perennial weeds by covering the soil and preventing the weed seed from getting established.

**Add organic matter:** The basic building block of humus is organic matter. Growing cover crops and either turning them directly into the soil or adding their composted remains to the soil increases the organic matter content of the soil and the eventual humus content. Cover crops provide high biomass with a mixture of quickly and slowly-decomposing parts.



Nitrogen fixing nodules on the roots of a leguminous plant.

**Fix nitrogen from the air and scavenge nitrogen in the soil:** Many plants can benefit from a healthy amount of nitrogen in the soil. Rhizobia are bacteria that encourage cells of leguminous and some other plants into forming galls or "nodules" on roots through the secretion of hormones. Inside these cells, the bacteria carry on a process to "fix" atmospheric nitrogen into plant-available nitrogen. These plants in turn supply the bacteria with the sugars and proteins they need.

**Make more micro-nutrients available:** By bringing them up from deeper soils with deep rooted cover crops, and making them available to shallow rooted plants.

**Maintain or improve biological activity in your soil and garden, and maintain microbial populations:** When soil is left barren of plants, the biological activity slows down dramatically. While some organisms can become dormant until conditions improve, and many populations are lost. Soil biological activity and diversity is important for many reasons including retaining and cycling valuable soluble nutrients, sequestering carbon, keeping pathogens in check, releasing minerals and breaking down organic matter. Soils with healthy microbial populations will grow healthier plants with fewer diseases or nutrient deficiencies. The answer is to keep a succession of plants growing in the soil. Plants secrete sugars, amino acids and other compounds that help these organisms thrive, and allow plants and microorganisms to continue to mutually benefit each other.

**Crear habitat, nectar and pollen for overwintering beneficial insects:** attract pollinators to another plant or reduce harmful pest populations by either deterring them directly or attracting their natural predators. attracts beneficial insects, provides nectar for bees and is beautiful. Some insects pollinators, including bees and butterflies, also live in the soil litter during part of their life cycle. Cover crops also provide food for earthworms.

## Choosing a Cover Crop

Most cover crops are plants in the grass family (Poaceae or Gramineae) and plants in the pea family (Leguminosae or Fabaceae). Buckwheat is an example of a cover crop that is not in either one of these families (Polygonaceae). Other crops that are also used, but not discussed here and not in these families are sorghum, sunflowers, mustards and tillage radish (daicon).

**So how do you decide which cover crop to grow?** It is difficult to make a big mistake with cover crops. Even getting one in that is not ideal for your needs can be better than leaving the soil barren, so go for it! This being said, you can improve the benefits of cover crops in your garden and your success by considering the following factors:

What will the crop put into the soil? What do you need based on your soil tests? What time of year can the cover crop be planted? How long does it take to mature, and how does this work in relation to what you hope to plant in that bed and when. You can also consider the depth of the root system and the height of the foliage, in terms of what is planted around or nearby. Consider what incidental uses it has such as insect forage, edible or medicinal parts, curriculum connections, or beauty. Finally, Cover crops can do well on their own, but combinations of cover crops can combine the spectrum of benefits of each.



Winter Spelt. Belchertown MA

## Table of Common Cover Crops

Plant	When to plant	Rate per 10 SQ. FT.	Family	Notes
Winter Rye	Fall for grain, Spring, summer or fall for cover crop.	0.5- 1oz	Grass	Very winter hardy. Grows fast in early spring!
Crimson Clover	Spring or Fall	.1 - .15oz	Legume	This particular clover is annual, tall and has a dense root system. Medicinal tea. Forage for beneficial insects.
Spelt or Wheat	Fall for grain, Spring, summer or fall for cover crop.	0.5- 1oz	Grass	Winter hardy. Grows a little slower than rye in early spring so easier to incorporate.
Oats	Spring for grain, spring or summer for cover.	.4 - .6oz	Grass	A quick growing summer cover. Milky tops used in tea.
Field Peas	Spring or Fall for winter ground cover.	.3-.6oz	Legume	Can be planted very early spring.
Buckwheat	Spring or summer	.3- .5oz	Not in the grass or legume family	Accumulates phosphorus. A great quick growing weed for smothering weeds. Forage for beneficial insects
<b>Perennials</b>				

Plant	When to plant	Rate per 10 SQ. FT.	Family	Notes
White Clover	Spring or late summer	0.5- 1oz	Legume	Plant in high traffic areas and around your garden beds! Forage for beneficial insects.
Alfalfa	Spring	.15oz	Legume	Significant nitrogen contribution. Great fallow crop. Medicinal tea.

### Combining cover crops- some guidelines

Generally, in choosing a cover crop pairing, you want to look for a combination of a legume and a grass. Adding a beneficial insect forage such as buckwheat, clovers or even annual wild flowers to attract insects is a nice addition. You will want to choose crops that work for the same planting and incorporating times, and will not out-compete each other. Some crops can act as a “nurse” crop for another, slower growing one, such as growing quick growing oats with slower growing red clover. This table can get you started:

### Cover Crop Combinations

Crops	When to Sow	Use
Field Peas/ Oats	Spring	An early planted combination. Field peas fix nitrogen quickly.
Red Clover/ Oats	Spring	A good quick growing combination that can be tilled in for a fall garden. Red clover has good phosphorous accumulation.
Buckwheat/ Soybeans	Spring	The buckwheat is fast growing and accumulates phosphorus, the soybeans nitrogen. Good as a part of a crop rotation and the soy beans may be harvested.

## Planting

**Make a seed bed:** Remove all crop residue and roots from your bed by hand or with hand tools, rake it free of lumps, then make the bed level using a rake.

**Put seed in the bed** as evenly as possible. This can be done in a few different ways:

**Broadcasting:** Get kids to hold a handful of seed in a fist palm up, and to make circular motions with their hand whilst making a small opening in the front of their fist to scatter it. This traditional method helps avoid all of the seed landing in a clump in one corner of the bed!

**Hand Seeding:** Plant as you would any regular seed, in small trenches about 1.5" deep and the seeds 2" apart.

**Mechanical seeding:** Use a Seedway or other push planter, or a crank seeder for large areas. These can be found at your local garden center.

**Cover the seeds** with about 1" of soil. If planted in trenches, simply fill them in. If you broadcasted the seeds, I suggest bringing in a bucket of soil and covering the seeds this way. You can also rake the seeds in, but this is a little harder to maintain even distribution.

**Tamp all over the bed** with the back of a hoe to ensure good soil contact. You can also do this by laying a wide board or plank on top of your bed, and gently pressing. You can cover the area thinly with loose straw or grass clippings to help prevent the soil from drying out before the plants germinate.

**Water in well**, and continue to water often during the germination period of your seeds to prevent the seed bed from drying out.

## “Harvesting”

**Timing is key:** Unless you are leaving your cover crops as perennial fallows, the annual crops should be turned in, mowed or crushed before they go to seed. The nutrients they fix or bring up from deeper soils, and the organic matter they provide can only be made available after they decompose.



**Till your plants under** when they are soft, green and about a foot tall. You can till them under using a spade or hoe and chopping them up as you go. Keep in mind you will want to do this three to four weeks before you intend to use the garden bed.

**Or put in your compost:** If your plants are over a foot tall, or your bed is very small, you may want to remove, chop up and compost the plant material in your compost, and return the decomposed material back to the planting bed this way.

**Or use as mulch:** With tall plants, you can also pull them up by the roots and lay them down as mulch, chopped up or as is. With this method, you can transplant directly into the bed. The pulled up cover crop will decompose on the surface of the soil, either around the plants you transplanted, or as a whole bed sheet-mulch, or in-place compost.

**Or let grow to maturity as small grains!** Many cover crops left to go to seed can be harvested and eaten as they are common cereal crops. Winter planted grains such as rye, spelt and wheat are good examples of this. Keep in mind that if you let your grains head up and reach maturity, you will want to make sure to harvest them before the seeds drop, otherwise you may have unintended seeds in your bed that could be weeds if germinated at the wrong time. Also remember that these are tall plants, and may shade out nearby plants.



## Growing small grains

If you choose to harvest your cover crop as a grain, wait until early summer, and make sure the grains in the seed head are firm and crunchy.

Grain goes through several stages:

The **milk** stage- the seeds fill with a milky liquid.

The **dough** stage- the milk hardens, the grain is easy to dent, and leaves start to turn.

The **mature** stage- the seeds are hard. The leaves will be fully gold/brown.

If you have no summer program, you may have to visit your grain in the summer and cut down the plants for processing with children in the fall, otherwise your grain may drop or be eaten by birds.

## Processing Your Grain

**Cut down the stalks** near the base with scissors or a hand scythe. You may then turn the roots in or pull them out depending on your management plan.

**Bundle the grain into sheaves** by tying into small bundles, and then put into a spread out or upright pile called a shock, until dry. This should be done indoors if you expect any precipitation. You can also just snap off the seed heads and spread out to dry in a basket or on a screen.

**Threshing:** Threshing means separating the wheat from the seed heads and straw (chaff). Bash your grain heads with a stick inside a pillow case or on a tarp. Traditionally a flail is used, which is two sticks with holes drilled in the ends tied together. You can also use a stick or step on it.

**Winnowing:** Winnowing is cleaning the grain. On a breezy day, or in front of a fan, pour your grain/chaff mixture from one container to another. The chaff should blow away and your grain drop.



Laying the “Sheaves” out to dry in a garage



Threshing the grain by flail or by small feet!



**Cooking!:** You can then grind your grain into flour to bake with, cook it like rice, or sprout it. You may want to combine with traditional all purpose flour in your recipes until you get the hang of using your own, fresh school-grown flour! If you instead store the grain for more than a few weeks, the refrigerator or freezer is best.

### Grain Glossary

**Straw:** The grain stem and leaves, cut and dried, without any seeds.

**Hay:** The full grain plant, cut and dried, including the seeds.

**Scythe:** A curved blade on a short or long handle traditionally used for harvesting grain.

**Flail:** Two sticks tied together used for threshing grain.

**Sheave:** A bundle of grain, tied just beneath the seed heads.

**Shock:** An upright pile of sheaves, used to dry grain.



Pouring the threshed grain into a bucket for winnowing.



A traditional winnowing basket and two types of flails. With this basket, grain would be thrown into the air and the chaff would be carried off by the breeze.

## Seed Sources:

Your **local farm supply** - if you have one, will often sell some small grains such as winter rye or buckwheat.

Your **local garden supply** - May sell some things especially annual rye grass, (which remember is different from winter grain rye.)

**Local Farms** may be willing to sell you a small amount of their cover crop, chicken or grain seed. Give it a try!

Your **favorite seed company** - Many garden seed catalogues are starting to carry small grains in garden amounts in their inventory. Johnnies, Seedway or Fedco are examples. Look under the heading “Farm Seed” or “Small Grains” for these multi-purpose cover crop seeds.

**Save your own!** - Once you have grown a grain crop to maturity you can save aside some of the seed to use next year. If you intend to use your grain only as a cover crop, consider letting a few plants at the edge of the bed grow to maturity for this purpose. “Breeding” locally adapted seeds in this way is a wonderful way to promote plant vigor.

**The grocery store!** - Many whole grains such as rye, wheat or spelt may do fine bought from the grocery store. Grains like oats and buckwheat cannot be bought this way as the seed is de-hulled for consumption, but not for planting. The down side of this method is also that your grain may not be a variety good for this area, you probably cannot even find out the variety, and it may be old. Be sure to do a germination test to make sure the grain is not too old, and wash before planting to make sure it has not been treated, or buy organic. Be sure your grain was grown in the U.S. Seed companies test seed for diseases, viability and vigor and are worth it! I wanted to cover this as it has been a common question from gardeners. I only recommend this in a snap when there is not enough time to order seed, in an area with out local farm or farm supplies.

## Sources

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All photos and illustrations by the author.

Arnie Voerainger 1937-2011, for his love and wealth of information about cover cropping systems and small grains, who taught me anything I know about small grains.

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[www.aginclassroom.org](http://www.aginclassroom.org)



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