

Growing Buckwheat for Grain or Cover Crop Use

Buckwheat (*Fagopyrum esculentum* Moench.) is a fast-growing crop most often found in northern temperate regions, such as the northern tier of U.S. states. It is native to southwest Asia, and is currently grown most extensively in Russia and China. Buckwheat is also grown in Japan, the Korean peninsula, Europe, Canada, and a number of other countries. Several million acres of buckwheat are grown worldwide.

Buckwheat plants produce seed faster than any other grain crop, making it particularly well suited to regions with short growing seasons. For this reason, in the U.S. it has tended to be produced in areas with short summers such as North Dakota, Minnesota, New York, and other parts of the Northeast. However, it can easily be grown in more southern areas, and in places like Missouri it has been grown periodically for more than a century. In the early 1900s, there were close to a million acres of buckwheat in the U.S. at peak production, but today the number of acres in the U.S. is normally in the tens of thousands rather than hundreds of thousands.

The profuse white flowers on buckwheat make a field of it quite striking, and the flowers can be produced over a several week period, providing an extended period of pollen and nectar to support pollinators. Buckwheat is considered a warm-season summer annual crop, meaning that it's typically grown in the warmest part of the year unlike cool season spring crops such as oats and flax. Farm fields of buckwheat grown for seed harvest are planted in narrow rows with a grain drill. In the garden or for cover crop use, it can be broadcast on the soil and raked or tilled in. Buckwheat plants reach about 3 feet tall if planted in early summer (on occasion can get up to 3.5 to 4 feet), and will be shorter planted in later summer (often only 2 feet). As described in the planting section of this publication, highest seed yields in Missouri come from planting in mid- or late summer so that flowering and seed set occur as nights are starting to cool down. Buckwheat reaches maturity in about 11 to 12 weeks when planted in early summer and in about 10 weeks when planted in late summer.

New trends in using gluten-free foods, cover crops, plants that support pollinators, and greater biodiversity



Figure 1. Buckwheat field in bloom. (Photo credit: R. Myers)

in crop rotations have all contributed to renewed interest in buckwheat. Buckwheat is often lumped in with a loose group of foods known as ancient grains, which have gained popularity in the food marketplace. The term ancient grain generally refers to a grain first domesticated thousands of years ago (8,000 years ago in the case of buckwheat, likely in southwest Asia) and then grown only as a minor food in the modern era before being “rediscovered.” Buckwheat was never really forgotten, but one could argue it has not gotten as much attention as it should have in modern Western farming. As a versatile food crop that can provide benefits to soil, wildlife, bees and other beneficial insects, it is worth considering for a place on both farms and gardens. This publication addresses buckwheat’s use both as a grain and as a cover crop grown for conservation benefits.

Uses of buckwheat

Buckwheat grain

True cereal grains such as wheat, oats, barley, and rye are all grasses with a particular type of seed. Buckwheat is a broadleaf plant and not a cereal grain, but its seeds are used for flour and many of the same uses as a cereal grain, so it is often referred to as a pseudocereal (amaranth and quinoa are two other broadleaf plants

called pseudocereals based on the way their seed is used). Buckwheat grain or seeds have a hull, somewhat similar to a sunflower seed hull, that is normally removed before the seeds are used in foods. The dehulled portion of the buckwheat seed is referred to as a groat. Buckwheat hulls are normally brown or brownish-black in color when mature, whereas the groat is a lighter color, typically greenish-tan at harvest and over time losing the green and turning tan or light brown color (groats continue to darken some with age).

Whole groats can be used in some food preparations. In Asia and elsewhere, whole groats are used to make a food called kasha. Kasha can be prepared very simply by boiling buckwheat groats in water for about 20 minutes and adding a little butter and salt or other spices. Some people optionally toast the groats before cooking, which can be done by heating the groats in a dry skillet on medium heat for about 5 minutes until golden brown in color (or some stores sell buckwheat groats already toasted). Preparing and eating kasha is considered by some people the equivalent of cooking and eating white rice, but kasha is considered a more nutritious meal. Buckwheat is relatively high in protein, fiber, Vitamin B6, iron, and magnesium. It also has significant levels of other minerals such as zinc, copper, and manganese.

Buckwheat flour, pancakes, and soba noodles

Most buckwheat used for food is first ground into flour after dehulling the seed. Dehulled buckwheat flour should be a tan or light brown color – if darker pieces are seen in the flour, those are typically bits of hull that were not completely removed in the processed. The hull pieces are not harmful, but don't add much nutritionally other than some fiber. Since buckwheat flour is gluten-free, it's often found in a gluten-free breads, granola bars, crackers and other snacks. The functionality of the flour is similar to wheat flour except you can't make a raised loaf of bread exclusively with buckwheat flour due to the lack of gluten. Home bakers can buy buckwheat flour in most grocery stores. Buckwheat flour is also found in buckwheat pancake mixes. While some U.S.-produced buckwheat is used domestically, much of it is sent overseas, especially to Japan, where buckwheat flour is used to make soba noodles.

Livestock feed

Either whole grain buckwheat or buckwheat groats can be fed to most livestock, but should be limited to part of the ration. If fed at too high of a percentage, such as 30 percent or more, the buckwheat can cause photosensitivity in light-skinned hogs and cattle, leading to skin rashes when the animals are out in sunshine.

On occasion, buckwheat plants are harvested for hay, since the hay is very palatable to cattle. However,

buckwheat hay is deficient in protein for a cattle ration, so a supplemental protein source is needed. As with other hay harvests, it works best to let the buckwheat plants field dry after cutting before being baled as hay.

Food source for bees and other pollinators

Buckwheat has long been a popular plant with beekeepers due to its long flowering period of 6 to 8 weeks, especially during times when few other plants may be pollinating. Buckwheat flowers contribute to making a good honey, though darker and somewhat stronger flavored than the more common clover honey. Honey bees aren't the only insects that take advantage of buckwheat nectar and pollen. Many other pollinators and beneficial insects are attracted to buckwheat, leading to the use of buckwheat in pollinator planting strips, such as in horticulture operations where attracting pollinators and beneficial insects is particularly desired. For example, some species of beneficial wasps that help control pest insects will be attracted to buckwheat. Buckwheat is sometimes planted in rows next to fall plantings of cabbages or other Brassicas; the buckwheat attracts beneficial insects that eat aphids, preventing the aphids from infesting and harming the cabbage.

Wildlife planting

Landowners interested in attracting wildlife will occasionally plant buckwheat, either in pure stands or more often mixed with other grains that produce seed for game birds and other wildlife while providing some habitat cover. Wild turkey, pheasants, and sometimes quail have been observed eating buckwheat seeds, which will fall to the ground when mature, particularly after a storm or a frost. Deer will browse on buckwheat, though other plants such as soybeans and clover are preferred deer food sources. Buckwheat attracts many insects, creating a food chain for song birds and small mammals that rely on insects for part of their diet. Because buckwheat is fairly easy to grow, it can be established by most landowners with a minimum amount of equipment (see planting section for more details).

Use for pillows

One of the interesting uses of buckwheat is for pillows. The buckwheat hulls left after groats are removed have been used for pillows in Japan for centuries and have recently gained a degree of popularity in the U.S. The hulls create a somewhat crunchy pillow that reportedly stays cooler than foam pillows. The buckwheat hulls certainly create a different type of pillow feel than a traditional foam or down pillow. Buckwheat pillows are now sold by a variety of retailers in the U.S.

Cover crop use and soil improvement

Cover crops have a long history of use in the U.S. in elsewhere, and at one time were common before the advent of modern farming practices in the mid-1900s. Cover crops are plants grown for their ability to protect and improve soil during times when no cash crop is in the field. The cover crops are not harvested for cash sale, rather they provide conservation benefits, and may help reduce input costs. Sometimes cover crops can be used for grazing. In recent years, cover crops have made a strong comeback, with well over 10 million acres being planted each year and annual increases in the number of farmers making use of them. Buckwheat has gained new popularity as a cover crop, in part due to its fast growth and ability to cover the ground quickly, particularly in mid-summer.

Vegetable farmers were some of the first to make extensive use of buckwheat as a cover crop in the U.S. because the growing season of buckwheat fits in well after early vegetables such as potatoes and spring greens and before fall-planted vegetables or winter annual covers. As mentioned above, vegetable growers also like the way that buckwheat attracts pollinators and beneficial insects while providing a quick ground cover. Moreover, buckwheat is easy to manage on a small scale on a vegetable farm since it can be broadcast-established and easily terminated (killed) by mowing, rolling, or tilling.

Grain farmers have started using buckwheat as a cover crop, particularly in the last decade, often mixing it with other summer annual cover crops. It is most often used as part of a cover crop “cocktail” mix planted after winter wheat harvest. Such a mix might include other warm season summer annuals like sunflowers, sorghum sudan grass, sunn hemp, cowpeas, foxtail millet or pearl millet. More complex cocktails or mixes will include both warm season and cool season covers (such as clovers, vetches, radishes, rye, oats, etc.), the idea being that the warm season covers will predominate in summer months and then the cool season covers will grow more in the fall, surviving the first fall frost. The hardiest cool season covers will survive through the winter and gain additional growth in the spring before a cash crop is planted.

Using a mixture of covers will lead to different results in different years based on weather conditions, but a benefit of the mix is that at least a few of the species usually grow well. Cover crop mixes are also valuable because of the biodiversity they provide in what may otherwise be a grain field with little diversity. The biodiversity of plants helps not only beneficial insects and wildlife, but also an incredible diversity of below-ground organisms. Studies have shown that the number of microbe species and the quantity of below-ground

organisms increases with a greater diversity of plants grown. Thus, a mix of cover crops often contributes to soil health, as does keeping living roots in the soil for as much of the year as possible. Buckwheat is a good companion in a cover crop mix because of its prolonged flowering, the fact that it grows quickly but does not crowd out other cover species, and its soil improvement properties.

The soil improvement provided by buckwheat has long been noted but could use more research. Buckwheat appears to be uniquely good at making phosphorous more available in the soil; phosphorous is one of the three main soil nutrients that plants need, along with nitrogen and potassium. All soils have some phosphorous in an available form that plant roots can absorb, but the majority of soil phosphorous is in an unavailable (insoluble) form that the plants can't access. Buckwheat roots release acidic compounds that help convert some phosphorous from the unavailable to available form.

Besides making phosphorous more available in the soil to the next crop grown after buckwheat, many farmers have reported that buckwheat improves the soil by making it more mellow. This means that the soil becomes easier to till or plant into. For farmers who minimize tillage of their soil, buckwheat, like other cover crops, can contribute to improvement in soil structure.

In the galaxy of cover crop plants, buckwheat is also known as one of the best for smothering mid-summer weeds. While individual buckwheat plants are not particularly competitive with neighboring plants, a dense stand of rapidly growing buckwheat typically outcompetes the majority of summer weeds. There is some thinking that this is a function not only of buckwheat leaves shading out small weeds, but also the roots having some chemical interactions that suppress at least some weeds. This is another area where more research is needed. Regardless, buckwheat planted in a dense stand can provide good weed control for otherwise bare fields through mid-summer. Be aware that as the buckwheat matures and its leaves start to fall off, some late season weeds may come up through the buckwheat canopy, particularly following a rainy period. If this happens, the whole plant stand can be mowed down, tilled, or otherwise terminated and either a fall cover crop (eg., rye, oats, etc.) or a fall cash crop such as winter wheat, winter canola, or fall vegetables planted.

Place of buckwheat in the crop rotation

Buckwheat works well as a double (second) crop behind wheat because of its fast growth and the fact that it typically yields better in southern Corn Belt states such as Missouri when planted in July than in June. Other

early-maturing crops can work well when paired with buckwheat, such as potatoes, spring greens, or winter canola. On a field scale, the normal practice in Missouri is to plant the double crop buckwheat in July with a grain drill after the first crop is harvest. The buckwheat will then be ready for harvest in October. For areas a little too far north for double cropping soybeans, buckwheat (or sunflowers) provides a viable option for still being able to get a second crop after wheat. After growing buckwheat, either corn or soybeans can be planted. A particularly effective soil health approach would be to grow winter wheat (or winter canola or potatoes), followed by buckwheat. Right after buckwheat harvest, cereal rye could be drilled and serve as a cover until soybeans are planted the next spring. That way, year round cover is provided. The wheat can be fall planted after corn to create a rotation of corn – winter wheat – double crop buckwheat – winter rye – soybeans. After the soybeans, assuming they are harvested by early October, a blend of oats and crimson clover can be planted in the southern corn belt before going into corn again.

Another consideration for placing buckwheat in the rotation is the use of herbicides, specifically residual herbicides for broadleaf weeds. Buckwheat is sensitive to carryover of some herbicides such as Pursuit and Atrazine. Check the label of relevant herbicides to avoid having the buckwheat damaged by an herbicide still lingering in the soil from a previous crop.

Varieties

Relatively few buckwheat varieties are available in the U.S. marketplace. Farmers or gardeners using buckwheat as a cover crop will find that most buckwheat carried by seed dealers will be a “variety not stated” (VNS) type, often called “common” buckwheat. In other words, the variety is not known. Most likely, the common VNS buckwheat is a Mancan or Manor variety, two very similar varieties released in Canada decades ago. Nearly all buckwheat used for cover crop is the common type.

Since Mancan and Manor were released as varieties in the 1970s by Agriculture Canada (both varieties are very similar to each other), a number of newer varieties have been released for grain use, most with higher yield and/or larger seed. Newer varieties include Koto, Koban, Koma, Manisoba, Springfield and Horizon. Some of these are only available through a particular company that also buys back the harvest.

Farmers growing buckwheat for the grain market should be sure to be in touch with the buyer they plan to sell the grain to *before* purchasing a variety for planting. This is because some buyers, particularly those selling for the export market to Japan, will require a particular variety to be grown for them. In fact, some

of the modern varieties are only available from the buckwheat processing companies. Thus, it’s important to have a marketing plan in place before planting a field of buckwheat for the grain market.

Seed sources

Common buckwheat (variety not stated) can be obtained from a number of companies selling cover crop seed in the U.S. In the Midwest, two companies that routinely carry buckwheat for cover crop use are Green Cover Seed (Nebraska) and Albert Lea Seed (Minnesota). Both have websites with price information. Getting named varieties of buckwheat is more challenging, as there are few places to get the newer varieties, and in North America, many of those sources are in Canada. Growers working with buckwheat grain buyers such as Minn-Dak Growers (North Dakota) or Birkett Mills (New York) can normally get seed through those companies.

Planting

Site selection

Buckwheat is sometimes incorrectly called a drought-tolerant crop. Under Missouri conditions, it has not shown drought tolerance, but if planted late (such as mid or late July) it may avoid the worst part of a mid-summer drought, assuming it has enough moisture to get established. Buckwheat readily wilts on hot dry afternoons, though it normally perks back up again in the morning before wilting all over again in the heat of the afternoon. This is a survival mechanism to reduce the amount of transpiration the plant is experiencing. Due to its need for moisture, avoid planting buckwheat in light-textured sandy loam soils that are likely to be short on moisture. It is also best to avoid fields that have compacted soil as buckwheat does not do well in compacted soil. Buckwheat can be a good choice for sloping fields to provide some erosion protection in summer and early fall, but if planted on a slope, it should be followed by a winter cover such as cereal rye to continue protecting the soil; buckwheat residue breaks down quickly so does not provide much long-term erosion protection.

Seeding depth

A typical planting depth for buckwheat is one inch, but this can be adjusted depending on soil and moisture conditions. Don’t plant buckwheat too deep, however, since the seed is not as vigorous as corn or soybean seedlings. Buckwheat can also struggle to get out of compacted tire tracks, so where the drill rows are

running behind the tractor tires, it may be necessary to set the depth shallower for those rows

Seedbed preparation

Buckwheat can be planted into either a tilled or no-till field. If using tillage, care should be taken to prepare a seedbed that allows for good seed-to-soil contact and relatively shallow placement of buckwheat seed at an inch or less. When planting in mid-summer, no-till drilling buckwheat may be a good option for conserving whatever soil moisture is present at that time. A no-till approach can also help with weed control, as described in more detail in the weed management section below.

Seeding dates

For buckwheat to germinate, the soil needs to be around 70 F. or above. Those conditions usually occur in Missouri by mid-May. Buckwheat can be planted and a seed harvest produced in most of Missouri from mid-May until the end of July, or even later in southeast Missouri. However, the best yields have been found to occur when flowering is happening while nights are starting to cool down (or in a cooler part of the country). Planting date studies in Missouri by the author found that planting in the latter half of July normally out-yielded planting in June or the first of July. Just keep in mind that soil moisture may be minimal in late July, which can make it difficult to get establishment of the buckwheat without timely rain.

For cover crop, pollinator, or wildlife use, a wide planting window exists, from about the second week of May (if the soil is warm enough) to late August in Missouri conditions. Planting in late summer will lead to a much shorter buckwheat crop and a shorter period of flowering, but it will still produce some cover. Buckwheat should not be planted in the fall as it will grow little and quickly be killed by the first light frost. It needs the warmer growing conditions found in summer due to its nature as a warm season crop.

Seeding rate

For grain production, around 50 to 55 pounds of seed per acre is a good target, which is about a bushel per acre. Buckwheat seed size can vary by variety and production year, so the 55-pound rate is suggested when the seeds are larger. If seeds are smaller than average (more seeds per pound), the number of pounds per acre can be reduced accordingly.

If planting buckwheat as a cover crop and using relatively inexpensive common seed, a higher seeding rate can be used to ensure best coverage of the soil. Seeding rates of 55 to 65 pounds per acre are appropriate for cover crop use if the cover crop is drilled. If the buckwheat is to be broadcast and then harrowed or

disked in to establish as a cover, use an even higher seeding rate since not all seeds will generate; 70 to 80 pounds per acre is an appropriate target for broadcast seeding.

Row spacing

Individual buckwheat plants do not spread out very much compared to soybeans or many other broadleaf crops, so it really does best when planted in narrow rows. The best yields and most effective weed smothering will occur when buckwheat is in narrow rows of about 6 inches, although a standard grain drill setting of 7.5 inches can be used if needed. Wider rows should not be used as weeds will start to compete too much with the buckwheat. In broadcast seeding, as mentioned above, a higher seeding rate is needed to make sure there are an adequate number of plants established to provide a solid stand and compete effectively with weeds.

Fertility management and pH

Buckwheat will perform best on soils with neutral or slightly acidic soils. It does not grow as well on alkaline soils. Fertility needs are modest. In fact, too much nitrogen can cause problems with buckwheat, causing it to grow more rank and fall over before harvest. In most Missouri soils, nitrogen fertilizer rates of 40 pounds per acre are adequate; if following a legume crop or on higher organic matter soils, no nitrogen fertilizer may be needed. Phosphorous (P) and potassium (K) needs are modest. If test levels of P and K are low, then some supplemental P and K fertilizer is helpful, otherwise it may be fine to go without adding P and K if test levels are medium or above. Buckwheat is not particularly responsive to superphosphate fertilizer but does respond well to rock phosphate fertilizer (an organic form of phosphorous).

Pest management

Weeds

The fast growth of buckwheat allows it to outgrow many weeds. If a sufficiently thick stand of buckwheat is achieved, it can smother most weeds for a several-week period. However, once buckwheat reaches maturity, as leaves start to drop and plants start to lean over, the canopy opens up with light penetration to the soil, allowing late season weeds to emerge if rainfall is occurring. The only registered herbicide to spray on growing buckwheat is Poast Ultra (sethoxydim), which controls only grasses and is best used when grass weeds are still small. Before planting buckwheat, a burndown herbicide application such as with glyphosate can be applied as an alternative to tillage for controlling existing

weeds. It's important to have weeds under control at the time of seeding buckwheat.

If buckwheat is allowed to go to seed, some volunteer buckwheat plants can be expected either later that year or, more likely, the next growing season. However, these volunteer buckwheat plants are easily controlled with tillage, mowing, or herbicides. Buckwheat does not have hard seed and normally just one flush of volunteer plants will occur. For wildlife planting, such volunteer buckwheat plants may be considered desirable as they reduce the need for replanting.

Insects and diseases

Pest problems with buckwheat from insects or diseases are seldom serious in Midwest growing conditions. Some generalist insects like grasshoppers will nibble on buckwheat, but seldom do significant damage. As noted earlier, buckwheat is known more for attracting pollinators and beneficial insects than for having insect pest problems. Plant diseases, while possible under stressed conditions, are also an uncommon problem for buckwheat. Due to the lack of serious pest issues and the goal of promoting pollinators, pesticides are not normally used on buckwheat.

Organic management of buckwheat

Buckwheat is well-suited to organic production for a number of reasons. First, its modest fertility needs can easily be met with organic practices, such as using a legume in the rotation for nitrogen and rock phosphate for organic phosphorus (if phosphorus is needed, which may not be the case). Second, there are few herbicides or pesticides labeled for buckwheat, so management of pests is done primarily by organic means in any case. Third, buckwheat is effective at smothering weeds, provided a good stand is obtained and weeds are under control at the time of seeding. Finally, as mentioned above, buckwheat seldom has serious problems with insects and diseases in the Midwest, making it possible to avoid using synthetic sprays.

Harvesting

Buckwheat can be harvested directly with a combine or harvested by swathing and then picking up the buckwheat plants from the "windrow" about a week after being cut. The advantage of swathing is allowing green seed to finish maturing while in the windrow and potentially having reduced shattering (seed loss) compared to direct combining. Swathing should be done when about 75 percent of seeds are brown (some seed will still be green). Since relatively few farmers in Missouri have swathing units, most Missouri farmers

have direct combined buckwheat. If direct combining, harvest should start when about 80 to 90 percent of seeds are brown. Some green leaves and stems will likely still be present but should pass out the back of the combine. Care should be taken to avoid delaying harvest, as excessive seed loss due to shattering will occur.

Typical combine settings are:

- Cylinder speed: 400 to 500 rpm
- Upper sieve: $\frac{5}{8}$ to $\frac{3}{4}$
- Lower sieve: $\frac{1}{4}$ to $\frac{3}{8}$ inch
- Concave: $\frac{1}{2}$ to $\frac{3}{4}$ inch
- Air (fan) speed: 600–650 rpm (maximum of 700 rpm)

During the first hours of harvest, make sure the buckwheat seeds are not being accidentally de-hulled by the combine; if that is occurring, slow down cylinder speed or try opening up the concaves. Using the combine's manual settings for barley can be an alternative to the guidelines above, then adjusting as needed.

Storage

After harvest, buckwheat grain should be stored at no more than 16 percent moisture. Over-drying can also damage seed intended for the food market, so food grade buckwheat should be kept between 13 to 16 percent moisture (long term storage is probably best at below 15 percent). Periodically applying air with a bin's forced air dryer may be necessary to maintain optimum moisture. Extra heat for bin drying is not typically needed, as most buckwheat field dries well before harvest. The U.S. standard bushel weight for buckwheat is 52 pounds per bushel.

One other important note for food grade buckwheat is not to store it for too long. Buckwheat groats darken with age and some food buyers will reject loads of buckwheat that have darkened too much. Many commercial food buyers prefer to buy buckwheat that is less than a year old. This is another reason why having a plan for marketing the buckwheat is important even before planting the crop.

Markets and economics

A challenge in growing buckwheat for grain is finding local markets. There are relatively few major buyers of buckwheat in the U.S. Birkett Mills in New York and Minn-Dak Growers in North Dakota are perhaps the two biggest U.S. buyers of buckwheat. Both tend to buy from producers within a few hundred miles of their location. However, in some years, they may be willing to contract for buckwheat delivery from customers farther afield. As mentioned in the variety section, buyers may

be particular about the variety being contracted, so it's best to contact potential buyers before even planting buckwheat.

Another market option is to grow buckwheat for the cover crop or pollinator seed market, either as organic seed or conventional. This may allow more local sales opportunities. For either the food or seed market, delivering a clean, weed-free, quality product with good germination is important. Buyers are likely to reject loads of buckwheat seed that have too many weeds or have been stored improperly.

The economics of buckwheat are such that the crop is best grown as a double crop in lower Midwest states. That way, the income from two crops, such as wheat and buckwheat, can improve profitability. Buckwheat grown as the only crop harvested in a single summer is unlikely to produce a profit (the exception is areas with a short

growing season in the northern U.S.). On the positive side, cost of buckwheat production is modest, with the main cost besides land being for seed. Depending on variety used and distance the seed has to be shipped, seed costs can be \$40 to \$60 per acre or more. Little fertilizer is needed and often no pesticides other than possibly a burn down herbicide application before planting. Cost to ship the harvested grain to market can be substantial, which is why finding a reasonably close market is important for maintaining profitability.

More information

MU Extension publication G4161, *Cover Crops in Missouri: Putting Them to Work on Your Farm*, is available online at <https://extension.missouri.edu/g4161>.