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Buckwheat: A Multi-Purpose, Short-Season Alternative

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Most Americans know of buckwheat only from its use in buckwheat pancakes. Those more familiar with the crop know it to be a versatile, easy-to-grow, short-season grain crop adapted to many regions. It tolerates poor soils and is often used as a soil-improving crop, a role it served for such notables as Thomas Jefferson and George Washington on their Virginia farms.

Buckwheat production has been limited by a small market and the crop's relatively low yield. However, it has made a niche for itself because of some desirable food characteristics and its unique status as a short-season crop that can be planted later than any other summer grain crop. In most areas where it is grown, it is used as the sole crop for a field in the summer, often as a late planted alternative after regular crops have failed. In Missouri, however, a real opportunity exists to grow buckwheat as a double crop after wheat, especially where soybeans are not feasible for double cropping.

In recent years, roughly 60,000 to 70,000 acres of buckwheat have been grown in the United States (more than 4 million acres are grown worldwide). Japan is the main market for U.S. buckwheat. Demand for buckwheat in the U.S. as a food source is relatively small, but since the export market is currently strong, the crop is regaining some popularity. Buckwheat was grown on approximately 2,000 acres under contract in west central Missouri in 1993. Contracting is expected to continue due to the strong export market.

History

Buckwheat was one of the earliest crops to be domesticated in Asia. It's earliest use as a food crop was most likely in China 5,000 to 6,000 years ago. It spread through Asia to Europe and was brought to the American colonies in the 1600s.

At its peak in the last half of the 19th century, more than a million acres of buckwheat were grown in the U.S. Historically, the eastern and northern parts of the country, particularly New York and Pennsylvania, have grown the most buckwheat. In recent decades, production has been greatest in the north central states.

Little buckwheat has been grown on Midwestern farms during the last century. Most buckwheat grown in Missouri in recent decades has been on small acreages for special purposes, such as a cover crop, wildlife food, or a pollen source for bees. Research at MU indicated buckwheat has good potential for double cropping in the state, leading to the start of contract production in 1993.

Description

Buckwheat is a broadleaf, herbaceous plant that flowers prolifically over a period of several weeks. The small, white flower clusters quickly develop into triangular brown seeds roughly the size of soybean seeds.

The brown buckwheat grains actually consist of a true seed (groat) surrounded by a thick hull. Buckwheat is sometimes referred to as a pseudocereal because the grain is used in ways similar to cereal grains such as oats, but it is not a true cereal crop due to seed and plant type.

Both the scientific name of buckwheat, *Fagopyrum sagittatum* (Gilib.), and its common name stem from the seed's appearance, which is similar to the seed of the beech tree. The Dutch name, boekweit, means beech-wheat. Buckwheat is a member of the Polygonaceae family, which also includes smartweed species. A weed in the southern and western U.S. called wild buckwheat is of the same botanical family, but is a different genus and species.

Like soybeans, buckwheat produces flowers in an indeterminate fashion, and flowering will often occur right up until harvest or frost. At peak bloom, the green leaves of the crop canopy are almost hidden under masses of white flowers. Flowers are self-sterile and must be cross-fertilized by insects or wind for seed set to occur. Cool, moist conditions also aid in seed set, but many flowers will abort in any case.

Buckwheat emerges quickly in warm soil conditions and reaches a height of 2 to 4 feet. The plant has a fairly small, shallow rooting system, and thus is not particularly drought tolerant (but it may avoid midsummer droughts if planted late). Buckwheat sometimes temporarily wilts during hot, dry afternoons. Branches form primarily in the upper canopy. Leaves are alternate and heart-shaped, usually 2 to 3 inches in length. When seeded in narrow rows, a thick crop canopy develops within a few weeks of planting.

Uses

Food

In the U.S., most buckwheat is sold as processed flour or in pancake mixes. The Japanese use buckwheat flour in noodles and other products. In eastern Europe, buckwheat groats (dehulled seeds) called kasha are cooked and served like rice. The groats are sometimes used in the U.S. as a breakfast cereal.

Buckwheat flour can be light in color if hulls (one-fourth of the grain in weight) are completely removed before grinding the groats, but often some hull fractions remain in the ground material, giving the flour a dark color. Whole-grain buckwheat is about 11 to 12 percent protein, but after removing the hull, the remaining seed is about 15 to 17 percent protein with 3 percent fat.

Other uses

Buckwheat is used most frequently in the U.S. for soil cover as a green manure crop or smother crop on gardens or small fields. As a green manure crop, buckwheat produces only modest biomass but offers rapid growth, improves soil tilth and makes phosphorous more available. Quick, aggressive growth accounts for its success as a smother crop for suppressing weeds, particularly in late summer.

Buckwheat is popular among beekeepers. It produces a dark-colored honey with a distinctive flavor. An acre of buckwheat can support a hive of bees producing up to 150 pounds of honey, if prevailing weather conditions are suitable for good nectar production (reportedly, sunny days and cool nights are best).

Buckwheat has long been used as a livestock and poultry feed. Unfortunately, little data is available on use of buckwheat as a feed source. Nevertheless, the literature suggests that buckwheat has reasonable feed value, roughly comparable to oats. The main value of the grain is that it is high in lysine, an essential amino acid that most grains are deficient in.

Several research reports indicate that buckwheat is best used in a mixed feed ration, often as no more than one-third of the total mix. Although buckwheat has often been fed to hogs, it is considered more suitable for cattle. Light-skinned livestock (and humans) can develop a rash and possible complications if they are

exposed to sunlight after eating a large amount of buckwheat. Dehulled buckwheat may be less likely to cause this photosensitive reaction.

Marketing and economics

Making a profit from buckwheat in Missouri requires growing it as a double crop, keeping input costs low and obtaining average or better yields. By growing buckwheat after wheat, the land charge and fixed costs can be covered by the return from the wheat crop. Then the buckwheat return will only have to cover variable costs associated with its production.

The biggest expenses will normally be seed, labor and machinery costs. Labor and machinery costs will vary depending on how the crop is planted and harvested. Fertilizer costs can and should be kept minimal. No herbicides or pesticides can be used legally, so there is no cost for those inputs. In most cases, no new equipment should be needed.

Table 1

Estimated variable costs per acre for buckwheat production in Missouri

Seed	\$15 to 25
Fertilizer	\$0 to 20
Machinery operation	\$10 to 15
Labor	\$5 to 10
Transportation cost	\$2 to 5
Drying and/or cleaning	\$3 to 5
Total variable cost per acre	\$35 to 80

With contract price for buckwheat grain normally close to 10 cents per pound, yields of between 350 and 800 pounds per acre or better usually are needed to make a profit (prices may be up to 12 or 13 cents per pound when supplies are short). Such yields are normally quite feasible (production section below). However, buckwheat, like any alternative crop, is somewhat riskier than a traditional crop. Producers should start with a modest acreage to gain experience. Transportation costs can quickly reduce profits if a delivery point is not nearby. On-farm use of buckwheat as a feed source may not be profitable but may help meet other farm goals. It is difficult to estimate the economic benefit to the cropping system and soil by having buckwheat in the rotation, but these benefits should be considered.

How to grow buckwheat

Buckwheat generates only modest grain yields in comparison to many crops, in part reflecting the very limited amount of breeding that has been done with the crop in recent decades. Typical yields are 800 to 1,200 pounds per acre in Missouri, with yields of 1,500 pounds per acre or more under optimum conditions. These yields are comparable to the major areas of buckwheat production in north-central and northeast states. However, a hot, dry period in late August and early September, which would not be unusual in Missouri, could greatly reduce buckwheat yields. Night temperature may be more important than day temperature. Drought can compound the effect of high temperature, leading to poor seed set.

Rotations

In Missouri, buckwheat is economically feasible as a grain crop only if it is double cropped after wheat or planted as an emergency crop when regular crops have failed. Although some have suggested wheat residue negatively affects buckwheat, this has not been documented.

Buckwheat is sensitive to several broadleaf herbicides, including trifluralin, triazine and sulfonylurea products. If this is a concern, hand-plant a small area of buckwheat at least 2 to 3 weeks prior to the target date for seeding a field and check for herbicide injury to emerging plants.

Another consideration in rotation planning is that buckwheat, like soybeans, leaves little residue, so soil can be in erodible condition following harvest. Some growers plant rye after buckwheat as a winter cover crop. A good soil-conserving, two-year rotation option is wheat, double-crop buckwheat, rye for winter cover, soybeans in spring, followed by wheat again in the fall.

Site selection

Buckwheat tolerates relatively poor, infertile soils better than most grains, but yields best on medium-textured, well-drained soils. It is reportedly tolerant of poorly drained soils, but should be avoided on heavy or droughty soils. It tolerates acid soils down to a pH of 5. Soils prone to surface crusting may not be the ideal choice, since buckwheat can have emergence problems when crusting occurs.

Choosing a variety

Relatively few varieties of buckwheat are readily available in the U.S. — most farm suppliers sell a type simply known as "common" buckwheat, genetic material that has not been maintained as a pure variety.

Most buyers, especially those exporting to Japan, will specify the variety to be used as part of the production contract. Larger-seeded varieties are almost always the ones desired for food use. Mancan and Manor are commonly grown, large-seeded varieties developed by Agriculture Canada and available in the U.S. Winsor Royal is a comparable large-seeded type released as a U.S. variety by Winsor Grain, Inc.

Since buckwheat varieties are not hybrids, harvested seed can be successfully used for replanting the next year. However, many companies that contract for buckwheat prefer or require that their growers use certified seed each year (Table 2).

Table 2
Sources of buckwheat seed

Company (varieties sold)	Phone number
In Missouri	
Glasgow Co-op, Glasgow (common)	816-338-2251
MFA, Columbia (common)	573-474-6123
Mangelsdorf Seed Co., St. Louis (common)	800-467-7333
Out of state	
Cenex Land-O-Lakes, Minot, ND (Mancan, Manor)	800-676-6687
Green Thumb Commodities, Oldham, SD (Mancan)	800-843-3322
Minn-Dak Growers, Grand Forks, ND (Mancan, Manor)	701-746-7453

Wensman Seed Co., Carol, Iowa (Mancan)	800-423-9771
Winsor Grain Co., Minneapolis, Minn, (Winsor Royal)	612-332-4370

Field preparation and fertilization

For buckwheat, as with most grains, it is important to prepare a firm seedbed if the field is tilled. When no-till planting, make adjustments to ensure that the soil closes over the seed furrow.

Many growers do not fertilize buckwheat due to its relatively low value and modest fertility needs. However, for optimum yields, some fertilizer may be needed. Nitrogen fertilizer may improve growth, particularly if available soil N is depleted following wheat. Low rates of N should be used, since more than 50 pounds of nitrogen per acre may lead to lodging.

Buckwheat can get by without P and K on soils testing medium to high in these nutrients, but on soils testing low in P or K, application is recommended to achieve optimum yields. Research indicates that buckwheat is effective in capturing soil P, or P from rock phosphate fertilizer, and that P becomes available to the next crop in the rotation as the buckwheat residue breaks down.

Planting

In planting buckwheat, the key is to achieve a solid, even stand, which is mainly a matter of having good soil moisture and planting at an appropriate date. Buckwheat grown for purposes other than grain harvest can be planted at any date after the frost-free date in the spring. For grain harvest, it is desirable to plant relatively late in the summer, since flowering and seed set will then be more likely to occur as the days and nights begin to cool in early fall.

When planted in late July or early August, buckwheat usually matures in 8 to 10 weeks. In the northern half of Missouri, avoid planting later than the first week of August. In the southern half, buckwheat could be planted as late as Aug. 15. At Columbia, highest yields occurred in 1991 and 1992 when buckwheat was planted between July 15 and Aug. 1 (Figure 1). It is possible that an early July date can obtain a good yield, if weather conditions are appropriate.

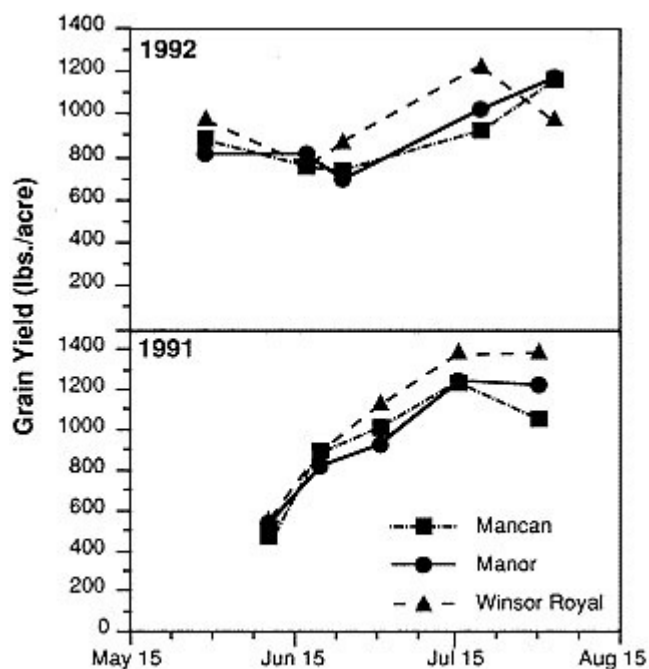


Figure 1
Response of buckwheat varieties to planting date at Columbia, Mo., in 1991 and 1992.

Planting Date

A general recommendation for seeding rate is 700,000 plants per acre, which is about 50 to 55 pounds per acre of large seed or about 40 pounds per acre of small seed. Buckwheat can compensate somewhat for a thin stand by branching more, and as a result studies show little yield response to seeding rate.

Typical seeding depths are 1 to 2 inches, depending on depth to soil moisture. With warm soils, the seedlings will emerge in 4 to 5 days. The crop must be drilled in narrow rows, typically 6- to 7-inch widths, to obtain a good canopy for shading weeds and for optimum yield. Most standard grain drills will work effectively with buckwheat. Broadcast seeding is not recommended unless the plants are just to be used as a cover crop or as a nectar source for honey production.

Weed control

No herbicides are currently registered for buckwheat in the U.S. Growers must rely on sensible field selection, pre-plant weed control and establishing a uniform, dense crop canopy to shade out weeds from late-season rain. Tillage shortly before planting can control existing weeds and provide a good seedbed. However, care should be taken to avoid drying out the seedbed through excessive tillage. Buckwheat will reseed itself, but is easily controlled by tillage or a number of broadleaf herbicides. Thus it is not likely to present a weed problem in a following crop.

Pests

Buckwheat has few reported pests, perhaps because the crop is not extensively grown. Reported insect pests include aphids, wireworms and Japanese beetles. Rhizoctonia root rot may occur, but other diseases are rare. Deer or other wildlife may occasionally cause localized damage. Overall, pests are unlikely to cause any significant loss in a buckwheat field.

Harvesting and storage

In many of the traditional buckwheat production areas, swathing is preferred over direct combining. This reflects the indeterminate nature of buckwheat, with some seeds maturing well before others and flowering occurring right up to harvest. Swathing can reduce the amount of shatter loss and allow some immature seeds to continue ripening in the windrow before harvest. However, growers in Missouri are cautioned that the advantages of swathing have to be balanced with the potential for inclement fall weather, making dry-down and pick-up of a windrow relatively difficult.

If the crop is to be swathed, begin swathing when 75 to 80 percent of the seeds in the upper part of the canopy are mature (brown). If direct combining, harvest when 90 to 95 percent of seeds are mature. In either case, expect the stems and some leaves to still be green at harvest, since the crop has not been bred for complete dry-down like soybeans or wheat.

Combine cylinder speed should be 600 to 800 rpm, and the concave should be set initially at 1/2 inch, then adjusted for seed size. Avoid cracking hulls, especially if the crop is intended for the food market. A discount is usually charged if grain is brought to an elevator at more than 16 percent moisture. Temperatures greater than 110 degrees Fahrenheit should be avoided in drying buckwheat. Moisture of 16 percent is fine for short-term storage. For longer-term storage, grain should be no more than 12 to 13 percent moisture.

Desired test weights vary by company, but are typically 45 or 46 pounds per bushel (historically, buckwheat

test weight was listed as 48 pounds per bushel). Large-seeded varieties will often have a test weight only in the low 40s, so producers should be prepared to take a slight discount on test weight. Smaller-seeded varieties have higher test weights, but are otherwise considered undesirable for food markets.

It is important to sell the crop within a few months of harvest, because the groats will begin to darken (they are light-colored when fresh), and this reduces the grain's appeal to certain buyers in the food market.

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