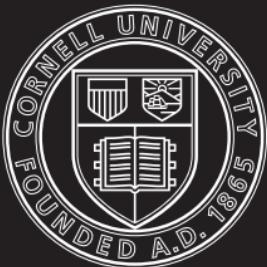
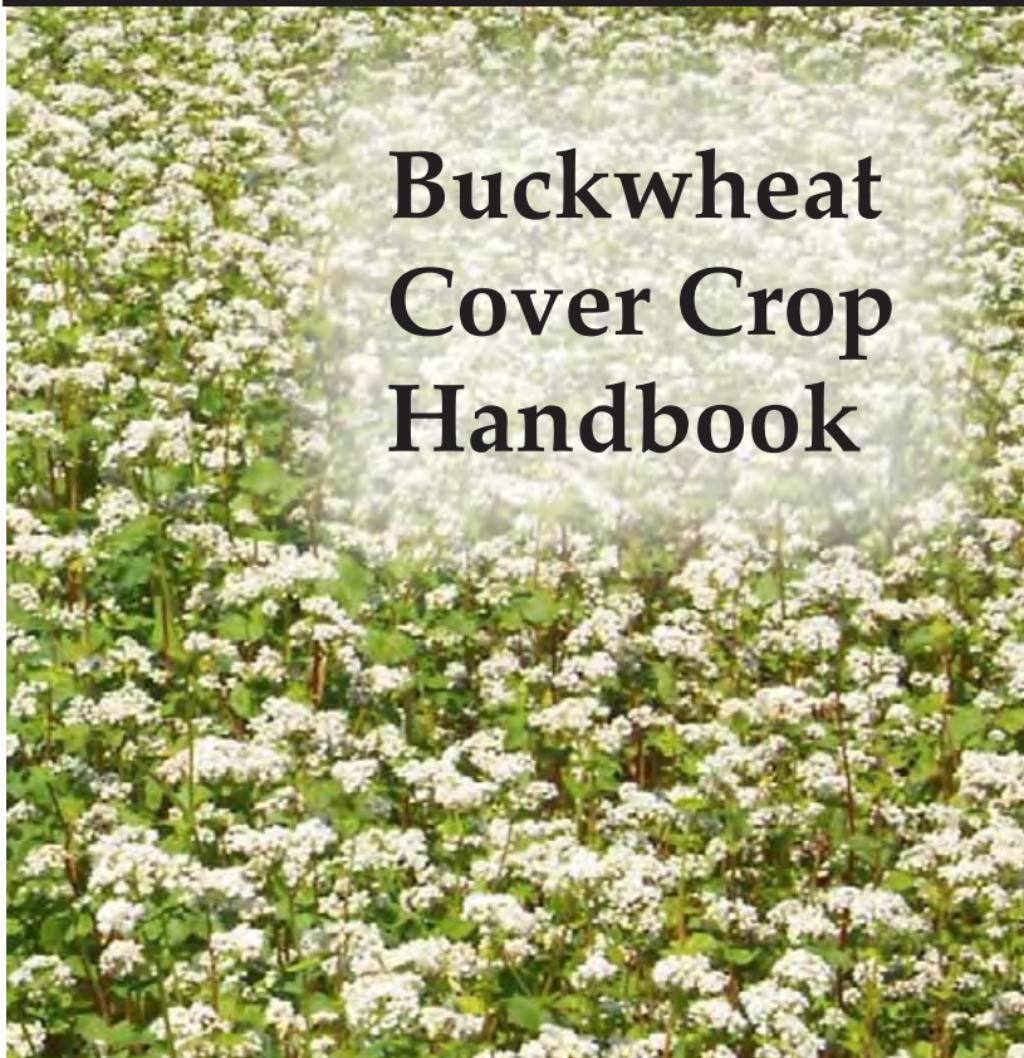




Your keys to success:
A fast start
No gaps
Kill on time



Cornell University



A large, dense field of buckwheat plants, which are covered in small, white flowers. The plants are growing in rows, creating a textured pattern across the entire frame.

Buckwheat Cover Crop Handbook

*A precise tool for
weed management on
Northeastern farms*

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Contents

Introduction	1
Production directions	
Following early vegetables	2
Bringing idle land into production.....	4
Preparing for strawberries	6
Nurse for summer forage seeding	9
Where to buy	10
Winter protection.....	11
Guidance on procedures	
Ground preparation	12
Sowing	13
Killing and volunteers	13
Following crop	14
Expected benefits	
Annual and perennial weeds, Soil health.....	16
Keys to success	17

Introduction

Buckwheat has been used to suppress weeds on Northeastern farms for 400 years. The practice had been used here for a century and a half by the time George Washington and Thomas Jefferson corresponded with each other about how well it worked on their farms. It still works.

On modern farms we have different tools, a different market, and different economic constraints; so buckwheat will be useful in different situations. In this brochure we describe situations where buckwheat has high value on 21st century farms because it controls weeds economically and in a way that adds significantly to the other weed control practices that are available.

This handbook is based on extensive grower surveys, gathering knowledge held by successful growers, material printed in obscure old extension and farm publications, as well as original research to answer new questions. The instructions have been tested by cooperating farmers to make sure they work.

Following early vegetables

After early vegetables have been harvested, the growing season allows excellent cover crop growth to stop the weeds that would grow otherwise, and to improve tilth rather than letting the soil erode.

Goals

- Suppress or reduce weeds
- Improve soil condition

Decision Making

Use buckwheat if the answer to these three questions is Yes:

1. Is your main goal reducing weed pressure or improving soil condition?
2. Is the field open long enough (6–7 weeks between vegetable harvest and fall crop)?
3. Is the field free of herbicide carryover? (See list below)

Don't use buckwheat after using these herbicides on the season's first crop

Atrazine

Pursuit (imazethapyr)

Sandeal and Permit (halosulfuron)

Reflex (fomesafen)

No carryover problem with these materials

Basagran (bentazon) Raptor (imazamox)

Command (clomazone) Roundup (glyphosate)

Dual Magnum (S-metolachlor)

Eptam (EPTC) Sencor (metribuzin)

Prowl (pendimethalin) Treflan (trifluralin)

Buckwheat can be sown after vegetables any time from early June through early August.

Procedure

Give buckwheat an opportunity to out-compete the weeds.

1. Loosen soil, but don't overtill.
2. Wait about a week for decomposition to avoid gaps in a reduced stand. If the soil is dry, irrigate about 1" a few days before planting.
3. Drill at 50 lb/ac, 1 inch deep; shallower if soil conditions allow.

Broadcasting is possible, but to avoid gaps it must be done with great care. Spread evenly using 70 lb/ac. Use shallow incorporation, such as with a drag or chain, to give the buckwheat a faster start than the weeds.

4. After a week, inspect the field and reseed any gaps over 1 foot in diameter.
5. Mow no later than 10 days after plants begin to flower (about 6 weeks after seeding).
Or else, leave to reseed, or to harvest grain.
6. Plant a fall crop, or a winter cover crop to preserve improved tilth (see p.15).

Bring idle land into production

The goal is to bring land into production, especially for vegetables—a high-value crop with low tolerance for weeds. Land that has been idle usually has good soil aggregates, but organic matter needs to break down and weed seed bank needs to be reduced.

Early plan. For most idle ground, use a double crop for best weed suppression.

1. Spring: Till field when moisture is ideal for working the soil.
2. Mid-May: Harrow at about 2 weeks to break clumps and kill weed seedlings.
3. Late May: Harrow after soil is 65°.
Sow buckwheat at 70 lb per acre (broadcast and scratched in) or 50 lb per acre (drilled). Don't leave gaps for weeds to grow.
4. Early July: Incorporate buckwheat 6 weeks after sowing and reseed a few days later.
Or Late July: Incorporate buckwheat 8 weeks after sowing. Let volunteers establish.
5. Fall: Sow winter cover crop into frost-killed buckwheat, or lightly incorporate live buckwheat. If possible, avoid tilling by using no-till drill or broadcasting on surface. Buckwheat should leave the ground mellow enough that the cover crop will take without tillage.

Late plan. For soil that dries slowly in the spring.

Gentle soil handling is followed by a single crop of buckwheat with an option to harvest for grain.

1. June: Till field when the moisture is ideal for working the soil.
2. June and early July: Allow residue to decompose for 3-4 weeks. Harrow at about 2 weeks to break clumps and kill weed seedlings.
3. Early to Mid-July: Sow buckwheat at 70 lb per acre (broadcast and scratched in) or 50 lb per acre (drilled). Don't leave gaps for weeds to grow.
4. Mid to Late August: Mow six weeks after sowing, or harvest for grain 10 weeks after sowing.
5. Late August to early September (October if harvesting grain): Sow winter cover crop into combined or frost-killed buckwheat; or lightly incorporate live buckwheat and wait one week. Sow winter cover crop with no-till drill or broadcasting on the surface. Buckwheat should leave the ground mellow enough that the cover crop will take with minimal tillage.

Prepare for strawberries

Full growing season before establishing strawberries.

Requirements

- Management that allows few weeds.
- An open field in spring

Procedure

1. Till the ground some time in mid-spring when the soil works up easily.
2. Plant in late May or early June. Prepare a good seedbed so the soil is loosened several inches deep and not lumpy. Drill 50 lb/ac, 1 inch deep or less. Broadcasting is possible, but to avoid gaps it must be done with great care to spread evenly using 70 lb/ac. Use shallow incorporation, such as with a drag or chain, to give the buckwheat a faster start than the weeds. Good ground cover is a must for weed suppression.
3. Mow after 45 - 50 days, after immature seed have begun to form.
4. Replant as before, or if the soil is moist and there is time, allow second crop to grow from volunteers. If the soil is dry, irrigate about 1" a few days before planting.
5. Mow the second crop within a week of flowering. Plant a winter cover crop (annual ryegrass, oats) in late August or early September.
6. Till soil the following spring and plant a new strawberry crop.

Replanting. For growers raising only strawberries. This scenario begins at the end of the berry production cycle.

Growers with little land and no opportunity to rotate crops can use the following procedure, but will get a smaller improvement in soil health and weed suppression. This plan emphasizes a tight time schedule, but does not restore productivity like a full rotation. It prevents, but doesn't cure, high weed pressure.

Procedure

1. Harvest strawberries and apply an herbicide to control perennial weeds. After the herbicide has been translocated, till in and allow 10 days to decompose. Cultivate just before seeding to kill weed seedlings and prepare the seedbed. Irrigate dry soil to ensure uniform emergence and good ground cover.
2. Plant buckwheat in mid-July. Drill 50 lb/ac, 1 in deep. Broadcasting is possible, but to avoid gaps it must be done with great care to spread evenly using 70 lb/ac and to cover the seeds lightly (1/2 to 1 in).
3. Mow after 35-40 days to avoid volunteers.
4. Plant a second buckwheat crop immediately (mid-late August) as in step 2.
5. Mow or incorporate the second crop after 35 days. Plant a winter cover crop such as wheat in late September.
6. Till the soil the following spring and plant a new strawberry crop.

Additional notes for strawberry growers

The cover crop procedures described here will let you meet multiple goals.

- Reduce annual weed seed bank and weaken perennial weeds in strawberry beds
- Reduce time spent weeding
- Break disease cycles
- Improve soil health

The summer cover crop works particularly well for growers who control weeds aggressively. It eliminates an opportunity for weeds to escape in many otherwise solid weed control programs. Growers who are less attentive to weeds will often see less benefit. Nevertheless, even a modest reduction in weed pressure can save many hours of hand-weeding.

The protocol for direct replanting of strawberries (p. 7) is for a particular situation that is best avoided. It is generally more profitable to use a rotation schedule of at least five years. This means that strawberries are grown for three or more years (not harvested in the first) followed by vegetable crops in the fourth year (or longer) and the cover crops in the last year. Such a rotation will keep strawberry yields higher by reducing diseases and maintaining soil health.

Nurse for summer-sown forage

Buckwheat can be used as a nurse (companion) crop with summer seedings of alfalfa or alfalfa-grass mixtures much the way oats are used with spring seedings. Summer seedings are typically made in late July through mid-August following winter wheat harvest. Rapid buckwheat establishment will suppress summer annual weeds. Subsequent mowing of the buckwheat provides mulch against establishment of winter annual and biennial weeds.

Procedure

1. Seed buckwheat and perennial forage(s) with one of two options.
 - Grain drill with small seed box. Prepare a firm seedbed by cultipacking and drill buckwheat at 50 lb/ac, 1 inch deep or less, along with alfalfa or alfalfa/grass mixture in the small seed box. Cultipacking after planting should improve germination and establishment of perennial forages.
 - Broadcast buckwheat. Prepare a good seedbed and broadcast 70 lb/ac of buckwheat to obtain a uniform stand. Cultipack to incorporate buckwheat seed and to prepare a fine, firm seedbed for germination and establishment of perennial forages. Seed alfalfa or alfalfa-grass mixture and cultipack a second time.
2. Flail mow buckwheat 40 to 45 days after seeding to stop competition with perennial forage seedlings. Buckwheat straw mulch will suppress winter annual and biennial weeds.

Where to buy

For bulk purchases, the most economical source are the companies that produce their own seed. These include:

- The Birkett Mills (Penn Yan, NY)
- Lakeview Organic Grain (Penn Yan, NY)
- Ernst Conservation Seed (Meadville, PA)
- Lancaster Ag Products (Bird in Hand, PA)
- Bouchard Ployes (Ft. Kent, ME)
- Homestead Organics (Berwick, ON)

Local farm seed dealers often carry seed from one of these suppliers, or can obtain them with advance notice. For a few bags, or when transportation is an issue, these can be the most economical sources.

Mail-order seed houses generally have buckwheat available, but the cost is often several times more than farm sources. These sources make sense mostly for market gardens or home gardens.

Nearby buckwheat farmers can sometimes provide seed inexpensively. Finding such a source often depends on word of mouth. There are two things to be aware of when using seed directly from a farmer. First, seed quality is critical for good cover crop performance. The handling and cleaning requirements are stricter than for grain use. Have a seed test done to make sure that the seeds are vigorous and that they don't contain weed seeds. Second, buckwheat grown on contract is often a protected variety. Growers on such contracts can't sell seed to others.

Use winter protection

Summer buckwheat leaves the ground bare. Use a winter cover crop to protect the soil over the winter and to suppress winter and spring weeds.

There are many good winter cover crops:

Early (Late August to mid September)

- Oats provide dead winter cover and a small amount of soil aggregate stabilization. Good for early spring crops.
- Fall-planted mustards will thrive under cool conditions and often reach the flowering stage. They are killed by heavy frost and the residue provides winter cover. Weeds in the following crop are suppressed by mustards. Do not use mustards if your next crop is a crucifer.
- Hairy vetch with rye or oats fixes nitrogen if left until late May. Only for crops to be planted after June 10. Volunteers are a problem in future small grains. Sow in late August.

Late Mid- to late September

- Rye is best for protecting the ground and stabilizing soil aggregates. There is a risk of excess growth in spring. Large rye plants are hard to incorporate and excess residue can inhibit the next crop.
- Volunteer buckwheat will be killed in first hard frost and leave minimal cover by spring. Light cover allows the soil to dry early, but some weeds will grow.

Guidance on procedures

Step 1. Loosen soil.

Vegetable production leaves the ground too hard for no-till seeding to work. The fine roots need some friable soil volume and percolation below the seed row to grow fast enough to suppress weeds. Incorporating the crop residue may be enough tillage to prepare the ground; plowing is not needed.

Buckwheat should be part of an overall soil-improvement program. Vegetable ground is often over-worked; preserve as much existing soil condition as possible by tilling no more aggressively than is necessary. Over-tilling is expensive and counterproductive.

Step 2. Wait before sowing.

Sowing immediately after incorporating fresh organic matter can result in greatly reduced stands, either from seed rot or predation. A week is a sufficient delay after incorporating pea or bean residue in the summer.

It is also worth waiting if a heavy rainfall (an inch or more) is predicted. Buckwheat seeds are susceptible to rot if the soil is water-saturated even for a few hours. The reduced stand and slower growth can make weed suppression fail.

If the soil is very dry, irrigate a few days before sowing. There does not need to be much water to have a good effect on both the speed of germination and the lack of gaps.

Step 3. Sow.

Choose the method that will work best for you, and carry it out carefully. Sloppy or uneven planting will cause the stand to fail.

Drill or broadcast. A solid stand is essential for suppressing weeds. Weeds tend to grow in gaps more than 8 inches across. Seven-inch drilled rows allow the use of a minimal seeding rate of 50 lb per acre. For broadcasting, an increased rate (70 lb/ac) is recommended to get minimal coverage in the thinner spots. The rate can be adjusted if the uniformity is better or worse than average. Broadcasting is faster, so the savings in time and fuel may offset the higher seed cost.

Rapid emergence is essential for weed suppression. Seedlings emerge faster with shallow seed placement. The shallowest setting that reliably covers the seed is a good target. With a drill, 3/4 inch is reasonable if there are few clods. For broadcasting, some growers have found that a heavy chain or the back side of a drag harrow work well to cover the seed. A disk is usually too deep and works the soil more than necessary.

Step 4. Killing and volunteers.

Most growers find that buckwheat volunteers are not a significant challenge the following season, and that they are eliminated by normal practices. However, others have had trouble, especially when the volunteers go to seed.

Timing is important for avoiding volunteers. Seeds begin to appear about six weeks after sowing. The crop will just be coming into full bloom; on vegetable ground it is generally about 30" tall. *Don't let the plants mature in the fall unless you have a plan that deals with the seeds that are produced.*

There are three steps to avoiding problems. First, minimize seed production. Second, minimize winter survival. Third, kill seedlings in the spring.

1. Minimize seed production with timely and thorough mowing. Some bigger plant parts may survive, for instance in the wheel tracks. Even though they are severed from the plant, some seeds on them will mature. There can be a small amount of regrowth from lower nodes that produces a few seeds. Incorporate immediately if there are immature seeds.
2. Reduce winter survival by leaving mature seeds on the soil surface. Exposed seeds tend to survive less than those that are buried by fall tillage. Some volunteer seed on the surface will germinate in fall rain, but are then killed in the first frost. Animals and fungi also consume seeds over the winter.
3. Spring seedlings appear in mid-May. They are effectively controlled by tillage, cultivation and by low rates of many common herbicides.

Some growers plan on two successive stands of buckwheat, with the second stand reseeding from the first. Others allow the grain to mature, and harvest it with a combine.

Many herbicides used on the subsequent crop will eliminate buckwheat volunteers. Some that have little effect on buckwheat are Dual Magnum, MCPA, Microtech, Outlook and Prowl. If you use these exclusively, an additional control will be needed.

Step 5. Prepare for the next crop.

Getting the most value out of the buckwheat cover crop depends on taking advantage of what it has done. The cover crop will leave the ground with few weeds and will deplete weed seeds. The soil will also have improved aggregate structure.

Weed control is best continued with a winter smother crop and timely tillage in spring. These practices stimulate weed germination and kill seeds, but prevent weed seed production.

The aggregates that have formed will allow more timely operations in the spring and better crop growth as long as they are not destroyed. A grass cover crop will protect and stabilize the aggregates by keeping the soil covered and secreting glue-forming compound from the roots. Work the ground in spring when the soil moisture is appropriate to keep the aggregates intact.

Rye is the classic overwintering cover crop (but also consider triticale or wheat). Oats or fall mustard serve well as winter-killed cover crops.

Expected benefits

These procedures are based on well-established principles, on experimental verification, and on testing by many commercial growers. This section describes why each procedure works and what you might expect as a result.

Goals

Suppress summer annual weeds. Seeds of summer annual weeds germinate but are suppressed, which reduces next year's weed seed bank. A strong stand of buckwheat suppresses all summer annuals. Weeds should be very rare and only a few inches tall. If the buckwheat starts growing slowly, or there are gaps, the weeds that most often escape are redroot pigweed, lambsquarters, and barnyardgrass. Buckwheat is a strong suppressor of ragweed and purslane. It does not control weeds after it has been killed.

Reduce perennial weeds. Some perennial weeds, especially quackgrass, are weakened by mid-summer tillage and recover poorly in a stand of buckwheat.

Improve soil condition. Buckwheat improves soil aggregation through secretions from its extensive network of fine roots, which leaves the soil mellow. The effect is fairly short-lived, so it is worth taking advantage of with the following crop. The mellowing can be stabilized by following with an aggregate-stabilizing crop, such as ryegrass, that has a large mycorrhizal root system.

Keys to success

A fast start.

The buckwheat must beat the weeds. The practices that assure a fast start are:

- letting the soil warm up,
- irrigating if the soil is very dry,
- sowing as shallow as possible while covering the seed.

No gaps.

Weeds will grow in any gaps over 10 inches wide. Most gaps form when the seeder fails, when broadcasting unevenly or covering with a tool that moves the seed, when the seeds are eaten by insects attracted to fresh residue, or when hard spots in the soil prevent germination, and when water puddles in the field in the week after sowing.

The practices that eliminate gaps are:

- Prepare the field to eliminate hard soil and lumps
- Allow crop residue to decompose
- Sow with precision.

Kill on time.

If the cover crop is to be killed by mowing, the effective time is critical. The crop needs to come into full bloom (typically 35 days after sowing) so that it does not resprout from the lower nodes. It should not have started to make seeds (typically 40 days from July plantings, 45 or 50 from June plantings), because they will mature and grow.

Incorporation extends the effective time until the first seeds are viable, about 45 days.