New Grains Northwest Planting Guide: Buckwheat

How to read this guide

This guide summarizes existing information on buckwheat production in the U.S. and the experiences of producers and researchers in Washington state. As a New Grains Northwest field trial host participate in the first production-scale buckwheat variety trials west of the Cascades. While this is an exciting venture, this also means that we still do not know how to best manage this novel crop in our region.

This guide should <u>not</u> be treated as tried-and-true recommendations. Your modifications to these recommendations are part of the process and goals of this project. We are eager to learn along with you. Over the two years of this project we look forward to documenting the lessons we all learn to improve our working knowledge of this crop and establish management recommendations for our region.

Summary

Planting	**Fertility:** First time growers see **Table 1**. More experienced growers with yield goals see Kaiser et al. 2011 Tables 12-14 **Sowing:** Sow into a fine, well-drained seed bed. • **<u>Seeding rate:</u>** ~55 lb ac^{-1} • **<u>Row spacing:</u>** 6-8 in. • **<u>Depth:</u>** 0.5-1.5 in. **Timing:** After last frost and risk offloodingg has passed**.** See **Figure 1** for recommended timeframes. Review potential environmental stressors in **Table 2**.
Swathing	Cut crop high when 70-80% of seeds have turned brown and allow to dry in windrows for 1-2 weeks.
Combine Settings	• **<u>Fan speed:</u>** 600-700 rpm • **<u>Cylinder:</u>** 400-500 rpm (Reduce if seeds in hopper are getting dehulled) • **<u>Concave:</u>** similar to barley, ½-¾ in. • **<u>Chaffer:</u>** 5/8 -¾ in. • **<u>Sieve:</u>** ¼ - 3/8 in.
Volunteer Management	See (Lyon and Waters, 2014) for volunteer management guidance

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Planting

Fertility

Buckwheat is typically grown with minimal added nitrogen (N). This is especially true for buckwheat grown as a double crop with a spring vegetable with high fertility requirements. However, as with any other crop, excessively low fertility will limit plant growth and yield.

There are no existing fertilizer recommendations for buckwheat in Washington. However, the crop overall has modest fertility needs and prefers slightly acid soil conditions, making it an ideal rotational crop for Western Washington. Recommendations from Minnesota, North Dakota, and New York can provide some guidance for fertilizer management. Minnesota and North Dakota provide yield-based recommendations that may be overly complex for the first-time buckwheat grower. New York recommendations are based on the previous management history of the field and soil pH.

We recommend that:

1) first time buckwheat growers follow the guidance from Cornell University (**Table 1**). In cases where phosphorus and/or potassium are not limiting in your soils, omit the recommended amounts below.
2) experienced buckwheat producers who wish to refine their buckwheat nutrient management follow the yield-based guidelines from the University of Minnesota (See Kaiser et al. 2011 Tables 12-14)
3) soil nitrogen supply (including N mineralized from soil organic matter) be kept under 50 lb ac^{-1} to limit lodging

It has been noted that buckwheat is not very responsive to superphosphate fertilizer but is to rock phosphate, possibly due to root acid secretions that solubilize the nutrient from this mineral source. This is great news for those producing buckwheat on organic fields!

Table 1. New York buckwheat fertilizer recommendations, adapted from (Björkman, 2010).

	Highly fertilized rotation land (corn, cabbage, peas)		Managed land with medium fertility (small grains)		Poor soils, abandoned land, old pastures	
	pH > 6	**pH < 6**	**pH > 6**	**pH < 6**	**pH > 6**	**pH < 6**
N (lb ac^{-1})	0	0	0-15	0-20	15-25	25-35
P_2O_5 (lb ac^{-1})	0-15	20	25	30	35	40
K_2O (lb ac^{-1})	0	0	0-15	0-20	20-25	30-35

Field Preparation

- Prepare the field as you would any small grain, ensuring that the soil is worked well enough to prepare an even and well-drained seed bed.

- If you are growing buckwheat following pasture or fallow, cultivate the soil early and allow excessive vegetation to break down before seeding (Björkman, 2010).
- If time allows, work soil several weeks in advance to allow for soil to be prepared while still moist and harrow just prior to planting.

Seeder Settings

- **Seeding rate:** 55 lb ac^{-1} (recommendations range from 40-60 lb ac^{-1} depending on the seed size)
- **Row spacing:** 6-8 in.
- **Depth:** 0.5-1.5 in.

Note to New Grains Northwest trial growers: if seed runs out and the end of the beds and is spotty, those ratty ends can be mowed or plowed to create a clean end. The same for lengthwise between plots. This will help weeds from establishing in spotty edges of the stand and prevent weed seeds.

Timing

Buckwheat cover crops can be planted any time after the risk of frost and standing water has passed. That said, unlike other cool-season cereal grains like wheat, barley, and oats, buckwheat is a warm season crop that reportedly yields better when planted mid-summer after the solstice. Buckwheat responds strongly to day length and does best when grown in short days (early spring) or decreasing daylength (mid to late summer).

Growing a buckwheat crop for seed requires additional consideration to maximize seed set and ensure that the crop matures at an appropriate time. Key planting considerations are summarized below (T**able 2**).

Table 2. A summary of key abiotic stresses for buckwheat seed crops.

Conditions to Avoid	Rationale
Frost	Frosts at seedling and early vegetative stages can kill and/or stunt buckwheat plants (Kalinová and Moudrý, 2003).
Flooded soil	Buckwheat is flooding sensitive but particularly at the seedling stage and early growth stages (Bjorkman, 2001; Murayama et al., 2004; Sakata and Ohsawa, 2006; Choi et al., 2021).
Nighttime air temperatures <45°F around planting	Buckwheat needs a minimum of 45-50 deg F to germinate, grow and develop. Additionally, frost at early growth stages will cause substantial damage (Arduini et al., 2016).
Air temperatures >85°F around flowering (4-6 weeks after planting)	The female reproductive structures of buckwheat are sensitive to temperatures higher than 85°F. Beyond this temp, flowers begin to show signs of heat stress, ovules can be damaged, and the likelihood that forming seeds will abort is high (Michiyama et al., 2007; Kumar and Srivastava, 2015; Płażek et al., 2019).
Excessive rainfall around harvest (10-12 weeks after planting)	Excessive rainfall around crop maturity will limit field activities, the possibility of swathing, and will result in lower quality seed harvest.

Planting in early May	Buckwheat develops more quickly in short day conditions (early spring, later summer). In other regions of the U.S. buckwheat producers typically plant late in the summer to shorten the growing season. Because neither of these time periods are appropriate for most growers in Western Washington and Oregon, we want to allow seeds to set and mature under shortening day lengths to allow for more rapid seed maturity. Planting in June or later allows for flowering and seed development to occur after the summer solstice which will shorten the life cycle of the plant (Quinet et al., 2004; Michiyama et al., 2007; Arduini et al., 2016).

No studies have evaluated optimal planting times for buckwheat crops in western Washington and Oregon. Based on our knowledge of the range of climates west of the Cascades and review of experiments conducted elsewhere in the world we have developed a planting time recommendation flow chart (**Fig. 1**). This chart does not account for the increased incidence of drought and temperature spikes in our region. Recommendations may change with further research and changes in climate west of the Cascades.

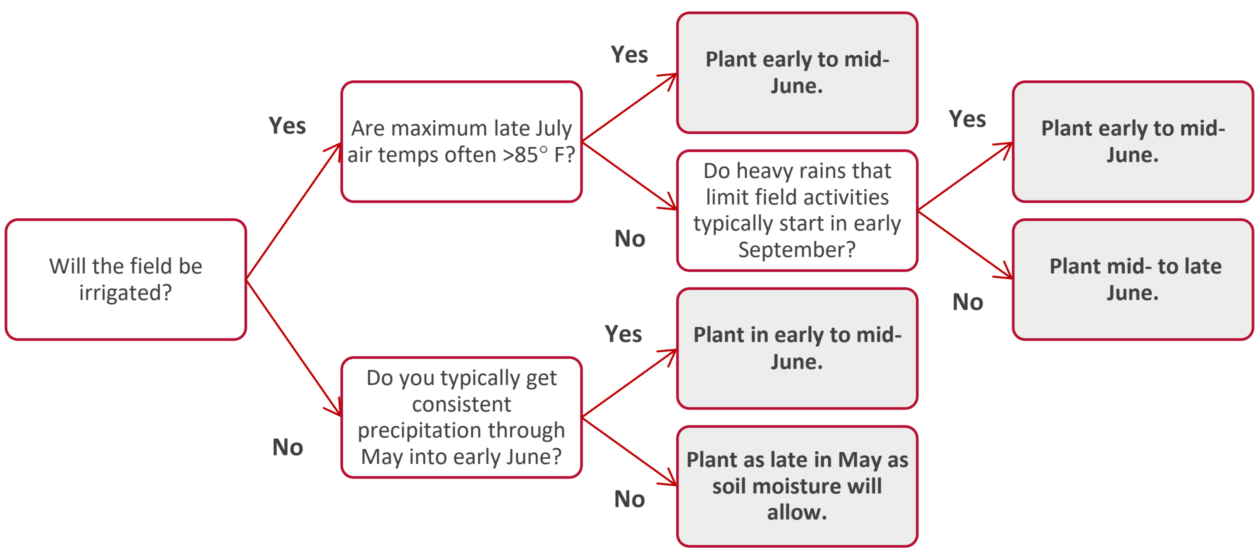

Figure 1. Buckwheat planting time flow chart for production systems in western Washington and Oregon.

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Buckwheat requires relatively little water to complete its lifecycle but is not tolerant of extreme drought. You'll likely notice buckwheat wilting in the afternoon on warm days- this is normal and in fact reduces water loss from the plant. However if the crop does not recover overnight and still looks wilted in the morning, you likely have drought stressed plants.

To reduce your risk of drought stress, consider your planting time and field. Since buckwheat is planted at shallow depths (1-2 in.), you will need to have moist soils or rain in the forecast to ensure that the crop will emerge quickly and compete with weeds. Additionally, be sure to carefully consider your field selection as buckwheat grown on coarse-textured soils without irrigation or in-season precipitation will likely experience drought stress.

Harvest

Swathing

Swathing buckwheat crops is **highly recommended** as this will shorten the growing period, minimize shattering, and maximize seed yield. Prepare to swath when 70-80% of seeds have discolored (i.e. started turning from green to brown, grey, or black). Cutting higher on the plant will enable windrows to dry faster even if they get trained on. If conditions permit, allow the windrow to sit for 1-2 weeks. This allows for biomass to dry and remaining green seeds to mature.

Direct Cutting

Direct combining is also practiced in many regions where there is limited availability of swathers including North Dakota and Missouri. Guidelines from Cornell University recommend the following to reduce combine clogging and maximize cleanliness of seed:

- Wait until most seeds easily come off the plant (but don't shatter)
- Combine early in the morning when dewy to limit shattering
- Cut high to avoid stem wrapping
- Move slow to not overload the combine
- Set the fan as high as possible without losing seeds
- Adjust the chaffer accordingly to minimize seed contamination and loss

Additional guidance on direct combining buckwheat including combine compatibility with direct-cutting can be found here: http://www.hort.cornell.edu/bjorkman/lab/buck/guide/harvesthow.php

Combine Settings

The following settings can be used as a starting point for figuring out the optimal settings for your combine (Myers, 2002):

- **Fan speed:** 600-700 rpm
- **Cylinder:** 400-500 rpm (Reduce if seeds in hopper are getting dehulled)
- **Concaves:** similar to barley, ½-¾ in.
- **Chaffer:** 5/8 -¾ in.
- **Sieve:** ¼ - 3/8 in.

Alternatively, you can start with the recommended settings for barley for your combine and make fine adjustments from there. If you see buckwheat blowing out the back, reduce the fan speed. If you see dehulled buckwheat in the hopper, loosen your concave settings.

Volunteer Management

As with any seed crop, you will need to decide on a volunteer management strategy following harvest. Few experienced buckwheat farmers cite volunteer buckwheat as a major concern in their systems as it has low dormancy and is frost intolerant, so most volunteers will sprout in the fall and be killed by freezing temperatures. Guidance on volunteer management can be found in (Lyon and Waters, 2014). Producers who grow wheat for an export should be aware of the tolerance for buckwheat contamination in their export market to avoid allergen concerns and maintain good relationships with overseas buyers.

Additional Resources:

- NY Webpage: http://www.hort.cornell.edu/bjorkman/lab/buck/main.php
- NY Planting: http://nmsp.cals.cornell.edu/publications/factsheets/factsheet50.pdf
- NY Harvest: http://nmsp.cals.cornell.edu/publications/factsheets/factsheet51.pdf
- USDA NRCS: https://plants.usda.gov/DocumentLibrary/plantguide/pdf/pg_faes2.pdf

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