Growing Organic Cereal Grains in the Northeast

R. Kersbergen, E. Mallory and T. Molloy
University of Maine Cooperative Extension
Contact: richardk@umext.maine.edu

Introduction

Organic grain production has generated significant interest in the Northeast during the last few years. Organic dairy farmers are looking for ways to grow some of their own grain concentrate to reduce their reliance on expensive purchased organic feeds. In addition, the market for locally grown food grade grain (for human consumption) has expanded for end-products such as breads, pastries, and beer. Food grade grains will usually bring a premium price, but meeting the higher quality standards can sometimes be difficult and requires attention to detail. The cereal grain straw can also serve as a valuable bedding source for direct use on the farm or as another saleable product.

A variety of winter and spring cereal grains can be grown in the Northeast. Oats and barley are spring grains whereas triticale, wheat, and spelt have both winter and spring adaptability. Cereal rye a common cover crop for the area is for winter production only. Winter grains are sown in early fall for a late July or early August harvest while spring grains are sown in early spring for a slightly later harvest. If you are thinking about growing organic grains for any market—livestock or human, realize that grain harvesting, cleaning, drying and storage equipment should not be an afterthought!

New growers should plan ahead for how they will acquire the proper infrastructure required for successful grain production. Don't wait until harvest to decide how to get the crop out of the field and into storage at the correct dry matter to prevent spoilage. Remember that not all fields are suitable for organic cereal grain production. Although not always possible, avoid fields with heavy, poorly drained soils and those with heavy weed pressure. Adequate crop rotations combined with organic soil management can improve overall soil quality and reduce weed seed banks.

Spring Grains	Fall/Winter grains
Oats Barley Wheat Spelt Triticale	Rye Wheat Spelt Triticale

It is always good to make connections with area grain farmers to observe successful production techniques. This fact sheet will outline agronomic practices and recommendations for organic cereal grain production in the Northeast. If you are going to grow organic grains, you should use this material as a general guideline, but seek out more detailed information from other growers, Cooperative Extension and informative websites such as the Northern Grain Growers Association http://northerngraingrowers.org/

Organic Certification

If you sell over $5,000 in organic sales or plan on selling your crop to organic processors or livestock farmers, you will need to become a certified-organic producer with an agency licensed by the USDA (http://www.ams.usda.gov/AMSv1.0/NOP). This includes developing a farm plan that outlines your intentions, along with your plans for managing insect, weed and fertility for your organic crops. Successful organic production relies on managing the farm as a whole system. Diverse crop rotations are integral to reducing weed and pest problems and improving soil health.

To be eligible for organic certification, fields must not have had applications of synthetic fertilizers, pesticides, genetically modified crops and other prohibited materials for at least three years before an organic crop can be harvested. Most certifiers will require a submission of a farm plan during the winter and early spring for organic crops to be grown during the following summer.

Certification also involves an annual farm inspection. The USDA's Agricultural Management Assistance Program, authorized by the Federal Crop Insurance Act, allocates funds to 15 states to reimburse producers for the cost of organic certification. Producers may be reimbursed for up to 75 percent of their organic certification costs, not to exceed $500. The eligible States are: Connecticut, Delaware, Maine, Maryland, Massachusetts, Nevada, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Utah, Vermont, West Virginia, and Wyoming. For more information about organic certification, contact a local certifying agency or the USDA National Organic Program at http://www.ams.usda.gov/AMSv1.0/NOP

Soils and site conditions for small grains

Most small grains prefer soils that are considered to be moderately well-drained to well-drained, with a desirable pH range of 5.8-6.8. Soil testing should be conducted far enough in advance of cereal grain production to adjust soil pH and fertility if necessary. Grain crops such as oats and rye are more tolerant of poorly-drained and low pH soils. Barley and wheat on the other hand are not as tolerant and will do best in well-drained soils with a pH of 6.3 or higher.

When selecting sites for winter grain production, avoid fields that regularly pond during the winter as this can reduce winter survival rates. When selecting sites for spring grains choose fields that can be accessed in early spring (April to early May). Delayed plantings will often result in weed pressure from summer annuals and lower yields. Perennial weed problems are a primary factor in field selection. Fields with high populations of perennial grasses such as quackgrass should be avoided.

Many organic crop rotations involve perennial sod crops. If you plan to follow a sod crop with a cereal grain make sure the sod is plowed under well in advance of grain planting. Our experience with organic grain production suggests that producers should not plant spring grains on fields where perennial sods have been plowed or tilled in the same spring. Fields that are coming out of perennial sods are best prepared in the summer and seeded in the fall with a winter grain or the following spring with a spring grain.

Seed

Organic certification rules require that you try to source organically produced seed before using conventional seed sources. You may also want to purchase "certified seed". Certified seed is seed of a known variety produced under strict seed certification standards to maintain varietal purity. Seed lots must also meet specified standards for other crops, inert matter, weed seeds, and germination. Certified seed is also free of prohibited noxious weed seeds. All certified seed must pass field inspection, be conditioned by an approved seed conditioning plant, and then be sampled and pass laboratory testing before it can be sold as certified seed. If you do import seed that is not certified,

check it closely for weed seeds or mixed grains prior to using. Additionally, non-certified seed may contain genetic lines that are unknown or variable.

In no case is fungicide treated or genetically modified seed allowed in organic production. Many farmers grow and store their own seed for use the following year. In these situations, it is important to clean the seed lot of weed seeds and diseased seeds before using. Producers may also want to do a germination test before planting.

Fertility

A soil test should be conducted to help you identify and correct soil pH and nutrient deficiencies prior to planting. . For organic production, only approved materials can be applied to correct deficiencies. If you are unsure whether a particular material is allowed, check with your certifying agency or the Organic Materials Review Institute (OMRI) at http://www.omri.org/.

What are the N P and K needs of cereal grains?

Usually, phosphorus (P) and potassium (K) needs can be met in part with manure and/or compost as well as other approved sources of these nutrients such as rock phosphate, bone meal and Sul-Po-Mag). Phosphorus and K requirements for fall grains are important for tillering and for winter survival. Deficiencies identified by a soil test in calcium, magnesium and sulfur should also be corrected using OMRI approved materials. If manure or compost is being used for a fertility source you should get an analysis of that material prior to application. The analysis will help determine the application rate needed to meet grain requirements. Standard soil tests provide a recommendation for nitrogen application based on grain species.

In general, spring and winter grains require 50-80 pounds of nitrogen per acre. If you are applying manure or compost as a source of fertility, realize that not all the nitrogen in these sources will be available to the crop during the first season. Actual nitrogen availability is influenced by the type of manure or compost being applied and how quickly it is incorporated into the soil. Nitrogen availability ranges from 35 to 75% of the total N applied for manure and from 10-30% for compost. Plowing down a legume cover or a heavy legume sod can add significant plant available nitrogen to the soil and may meet all your nitrogen needs for a small grain crop. Be aware that organic certification requires a 90-day period between application of animal manures and harvest for grains entering the food grade market.

Planting dates

Spring grains should be planted as early as possible in the spring. In most years, this means mid-April to early -May for Northern New England. Small grains can germinate in cool soil conditions. Early planting favors the development of an increased number of tillers (branches off the main stem). Tillering is an important development stage that allows plants to take advantage of good growing conditions and compensate for low plant populations. Tillers that appear at the time that the fourth, fifth, and sixth leaves emerge on the main shoot are most likely to complete development and form grain. Tillers formed later are likely to abort without producing grain.

Early planting helps control weeds. Most summer annual weeds require warm temperatures to germinate, so having a well developed plant with multiple tillers will help compete against weeds

and quickly close the canopy. If you plant later in the spring (after May 15th), you should increase the seeding rate by 25-50% to compensate for the reduction in tillering.

Winter grains should be sown from mid-September to early-October. Several years of research in Maine and Vermont has shown that grains sown in mid-October have fewer tillers and lower yield, along with a higher potential for winter injury. Late planted grains also suffered from delayed maturity, and in some cases resulted in a complete crop failure in some of our trials.

***Table 1*:**
Late planting penalty, as a percent reduction in yield caused by planting on October 15 rather than September 15

Late Planting Penalty			
	Sandy	**Sandy Loam**	**Silt Loam**
	---------- *Yield Reduction (%)* ----------		
Oberhuas Spelt	31	31	43
Sungold Spelt	3	3	24
Trical 336	39	34	47
Trical 815	53	49	60
Aroostook Rye	31	18	49
Richland Wheat	100	100	100

Seedbed preparation and planting

Seedbed preparation is important, especially if you will be using mechanical cultivation tools such as a Kovar, Lely or a rotary hoe. Depth of planting should be uniform to allow for good soil-to-seed contact and for uniform stands that will allow for effective cultivation.

Planting rate recommendations vary considerably. In general, it is recommended that seeding rates be increased by 25% for organic production to increase crop competitiveness with weeds. Recommendations are often listed in bushels per acre (2.5-4.0) or pounds per acre (130-175). Compounding the issue is that seed sizes and weight can vary significantly, even for the same type of grain. Planting technique can also greatly influence the final stand. Producers should strive to plant 35 seeds per square foot or about 400 seeds per m^2. This translates to 1.5 million plants per acre. You can calibrate your drill by using the table below to count the number of seeds per foot of row. Luckily, the tillering capacity of grains allows them to compensate for various planting densities. Seeding rates for late planted crops (both spring and fall) should be increased seeding rates by 25-50% to compensate for the reduced numbers of tillers.

Target stand (millions/acre) based on 85% emergence	**Seed/feet of row**	
	7" row	**7.5" row**
1.2	19	20
1.4	22	24
1.6	25	27
2.0	32	34

Commonly cereal grains are drilled in rows 7.0 to 7.7 inches apart. Narrower row spacing may improve crop competitiveness with weeds. Growers have implemented various strategies to reduce weed populations. For example, some farmers plant grains with a two pass system, where half the seed is sown in one direction

and the other half is sown at a 45 degree angle to the first. While this adds cost to your seeding, it may increase the grain crop's ability to compete against weeds and fill in a canopy quicker than a single planting. Research at the University of Maine by Lauren Kolb and Eric Gallandt has found that weed biomass in the two pass system was reduced between 25 and 30% compared to standard row spacing, although we saw little impact on yield of grain as compared to conventional row spacing. Additionally, compaction in tire tracks may cause variable germination and plant stand uniformity. Some growers attach a spinner seeder to the front of the tractor and sow half the seed as a broadcast while drilling the other half of the seed with a grain drill behind the tractor. In our trials with this method, we have found a delay in the germination of seeds that were broadcast and those seedlings were more prone to being dislodged during the tine weeding process. Maintaining proper seeding depth (1 to 2 inches, depending on soil texture) below the surface of the soil (not below the residue) is critical to achieving good seed-to-soil contact and proper crown development. Shallow-planted winter wheat is more prone to winter injury.

Weed control

Small grains are very competitive and can withstand some weed pressure without a yield loss. Weeds and weed seeds can become a problem at harvest as they are often moist and green and can impact the dry matter of the grain.

Fall Grains

With proper timing, grain seeded in the fall has few annual weed issues. Most of our research has indicated that, with good rotations, winter grains are not impacted by annual weeds. Often farmers broadcast seed legumes (8-10 lbs/acre) into the winter grain crop in March/April.

This type of underseeding is a low cost method of establishing a green manure or sod crop as well as establishing a weed suppressing cover for mid-summer when the canopy of the grain crop diminishes. Although this strategy is common on organic farms, some growers have reported legume crops growing too tall and interfering with the grain harvest.

Kovar tine weeder

Spring crops

The earlier you are able to plant a spring grain crop, the more competitive it will be against annual weeds. In addition to planting dates many growers utilize tine weeders to control small annual weeds.

This technique is effective if seedbed preparation is good, if the soil conditions dry and friable and if the weeds are in the "white thread" stage (just emerging).

Picture courtesy of E. Gallandt

Harvest and storage

Cereal grains are normally ready to harvest between mid-July and early-August throughout the Northeast region. Harvesting should begin when the grain reaches 18% moisture or less. Storage moisture for small grains should be around 12-13%, so it may be necessary to dry the crop before storage using batch dryers with propane or with heat and air in bin storages. Waiting to harvest the crop until it reaches storage levels is risky as the crop is more prone to shattering during harvest at this moisture level.

Additionally, adverse weather conditions can quickly deteriorate the quality of a grain crop. This is especially true for soft wheat that can easily begin to sprout on the stem after they become mature and imbibe water from a rainstorm. On-farm moisture testers will be an important tool for the farm. However, proper moisture of the grain is not the only factor impacting harvest efficiency.

Harvest equipment should be adjusted to minimize losses in the field. Review combine adjustments with your owner's manual and make sure to constantly monitor for field losses. This is easily done by catching some "combined" plant materials as it is exits your machine. If there is a good deal grain coming out the back it is time to adjust the combine. Often time local growers can provide advice on proper settings for grains.

References:

2009 Cornell Guide for Integrated Field Crop Management. Cornell University Cooperative Extension. B. Cox and L. Smith eds. http://www.fieldcrops.org

Organic Small Grain Production. P. Sullivan. Attra. June 2003. http://attra.ncat.org/attra-pub/smallgrain.html

Organic Grain Cropping System and Marketing. P Michalak. 2002. Rodale Institute

Canadian Field Crop Handbook 2nd edition. Canadian Organic Growers. J. Wallace Ed. 2001.

Northern Grain Growers Assoc. http://northerngraingrowers.org/