

THE GROWTH OF

Oats

A PRODUCTION HANDBOOK



GRAIN MILLERS



GRAIN MILLERS

OVERVIEW

Since 1986, Grain Millers, Inc. has been a leading manufacturer of whole grain ingredients used in cereals, breads, bars, snacks, and many other food products served around the world.

As a company, Grain Millers is focused on purchasing oats that are destined for the food grade market. Oats that are marketed as food-grade require special care to ensure that the grain meets specifications. The grain must be clean, with heavy and plump kernels. Oats utilized in the food grade market can be milled into a variety of products. The most commonly produced products are rolled oats, steel cut oats, and oat flour. When partnering with Grain Millers, it is important to remember you are growing: an ingredient and not a commodity.

Over the past thirty-five years, Grain Millers has remained steadfast in our core values and our commitment to grower relationships. This dedication to working alongside and supporting our grower partners led to the creation of the Crop Sciences team. The Grain Millers Crop Sciences team is focused on helping growers achieve their yield and quality goals through resource development, such as this handbook, program initiatives, and on-farm support.



This Oat Production Handbook published by Grain Millers, Inc. is a reference tool for growers in the Upper Midwest of the United States and the Canadian Prairies. The information within the Handbook is believed to be accurate and complete. However, this Handbook is designed for informational purposes only and Grain Millers, Inc. makes no representation, warranty, or guarantee that the information is accurate or that desirable results will always be obtained if the Handbook is followed. Use of the Handbook is at the sole risk of the grower. Grain Millers, Inc. and its affiliates shall not be liable for any damages, losses, or claims arising out of the use of the Handbook, regardless of the legal theory utilized to make any such claim.

VARIETY & FIELD SELECTION

Varietal selection is an important consideration when producing oats destined for human consumption. Varieties will differ in many characteristics including yield, lodging resistance, test weight, hull percentage, hull color, maturity, and disease resistance. In general, later maturing varieties may produce greater yields. However, there may be some negative agronomic characteristics that offset the yield potential. There is not one single variety that is deemed "best" for all situations.

There are different environmental factors to consider when selecting an oat variety for use on your farm. Environmental factors include previous crops, disease pressure, fertility, season length, rainfall, temperature, and soil types. Once these factors have been identified, a Grain Millers representative can assist you in identifying what varieties will be best for your growing conditions and market.

PRO TIP

Oats perform best in well-drained, clean fields, especially when grown in rotation after soybeans, peas, or other leguminous crops."

To maximize yield and quality, potential field selection must be evaluated. Some factors to evaluate include:

- Fields should be relatively free of wild oats and have minimal to no herbicide residue carryover.
- It is best practice to NOT rotate cereals back to back with oats.
- Desirable rotational crops include canola, hay fields, soybeans, and/or other legumes.
- Oats can tolerate cooler and wetter soils than many other crops and can germinate at soil temps as low as 45°F or 7°C.¹
- Early planting will typically help promote a higher quality food ingredient.



1. Peterson, David. "Chapter 4." Oat Science and Technology. 1st ed. N.p.: ASA/CSSA, 1992. 81. Print

FERTILITY

Oats require fewer nutrients than many other crops. To produce 100 bushels of oats, the minimum plant needs are as follows:

Nutrient	lbs / ac
N	73
P ₂ O ₅	27
K ₂ O	18
Mg	4
S	7

These levels are the bare minimum that the crop will remove. To maximize crop potential, ensure that crop nutrient needs are met.

Soil tests are recommended to determine nutrients levels within the soil and accurately determine potential nutrient needs. For a healthy oat crop, with yields over 100 bushels, it is recommended that the soil nitrate test has at least 120lbs/ac in the top two feet. An over application of nitrogen may cause lodging and test weight issues later in the season.

In this section we have some examples of macro nutrient deficiencies and how they can appear in your oat crop. These are meant to be a tool to identify potential deficiencies. Utilize tissue samples and consult your agronomist to confirm these deficiencies.

POTASSIUM

SYMPTOMS:

- Young leaves show bluish green color
- White leaf margins
- Leaf streaking



NITROGEN

SYMPTOMS:

- Chlorosis
- Reduced vigor
- Smaller leaves
- Reduced tillering



SULFUR

SYMPTOMS:

- Stunted growth
- Light green leaves
- Thin spindly stems



PHOSPHOROUS

SYMPTOMS:

- Stunted growth
- Counterclockwise leaf twisting
- Purple tints



SEEDING

It is recommended to use certified seed to ensure purity, germination, and overall quality. Oats need to be in the ground early to provide defense against weeds and weather. In southern U.S. growing regions, oats should be planted between late March to late April with northern regions targeting mid-April to early May. In Canada, growers start planting oats between early May to mid-June.

The recommended seeding rate for oats usually varies between 80 and 130 pounds per acre, depending upon the number of seeds per pound. The goal of this seeding rate is to have a final stand of 20-30 plants per square foot. In both organic and conventional systems it is advantageous to target higher seeding rates. Elevated seeding rates will serve as the primary defense against weed pressure under organic management systems. It is important to calculate the seeding rate using seeds per acre versus solely pounds (lb) per acre, as individual kernel size and kernels per pound can vary greatly among varieties and crop years.

When purchasing new certified oat seed, consider asking your dealer

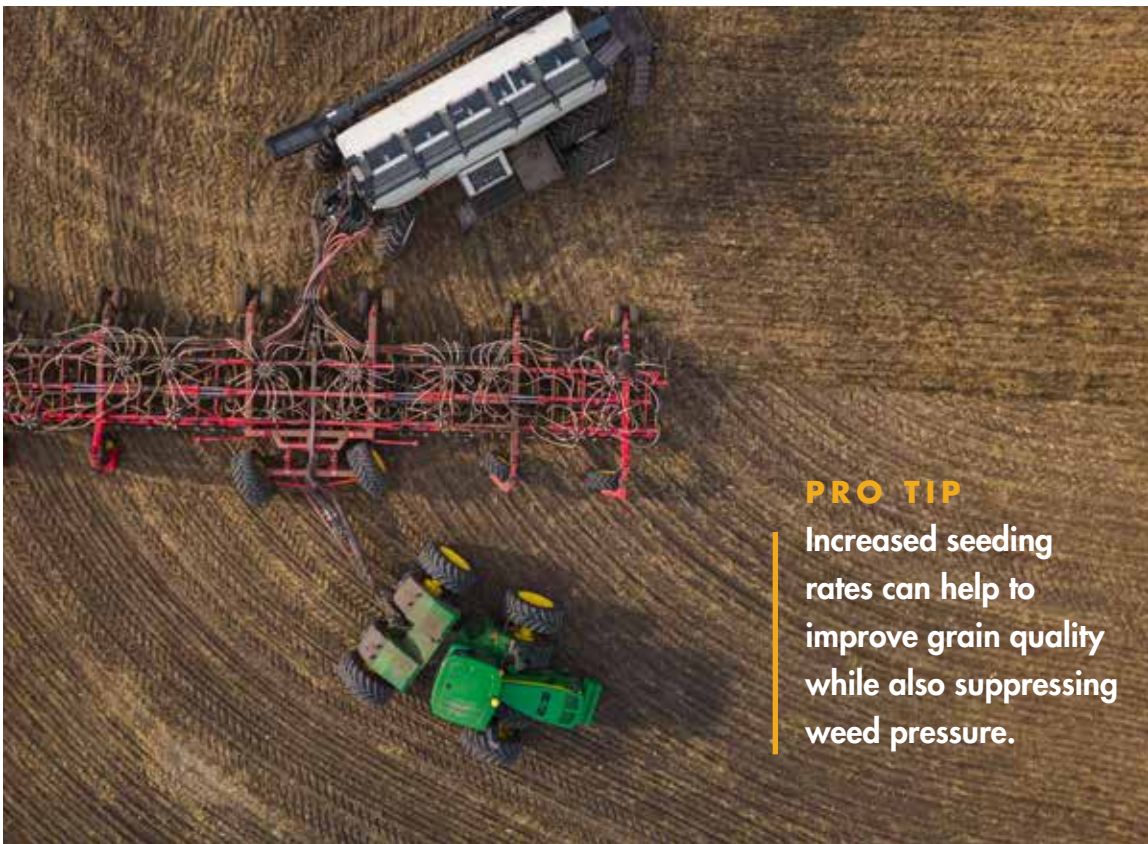
about the kernel size and Thousand Kernel Weight (TKW) of the oats. Research conducted by Dr. Martin Entz at the University of Manitoba has shown larger seeds typically display greater vigor, quick establishment, and stronger competition against weeds.

Although it is somewhat complex, the method described is one tool to calculate the target seeding rate in

pounds per acre while considering your individual seed count. Calculating seeding rate in this manner can help ensure you achieve optimal plant populations, which can reduce tillering and improve both yield and quality. This method accounts for expected stand loss; under normal conditions, growers can anticipate a 95% germination rate, but it will decrease if the soil is wet and cold. To accurately calculate seeding rate, use seeds per pound and the following formula:

$$\text{SEEDING RATE (lbs/acre)} = \frac{(\text{desired stand} \div (1 - \text{expected stand loss}^*))}{(\text{seeds/lb}) \times (\% \text{ seed germination})}$$

*Expected stand loss is used in a decimal form (10 percent = 0.1)
"Desired Stand" is defined as plants per acre



PRO TIP

Increased seeding rates can help to improve grain quality while also suppressing weed pressure.



SEEDING & SOIL TEMPERATURE

Soil temperature should be monitored in the days and weeks leading up to seeding activities to ensure successful germination of the oats. As mentioned previously, oats can germinate when soil temperature reaches 45°F or 7°C. When field conditions are fit for seeding, growers want to plant the oats between 1-2 inches (2-5 cm) below the soil surface, or to moisture. It is recommended that growers do not seed oats deeper than 3" below the surface.



WEED CONTROL

Organic and conventional production systems can implement similar cultural strategies for weed suppression, with early planting being a primary tactic. Timely early seeding allows the crop canopy to close before weeds can establish, cutting off access to sunlight that weeds need to grow. Oats also produce alleopathic compounds - natural chemicals that inhibit the germination and growth of many weed species². In addition, seeding rate plays an important role in weed suppression; a dense, uniform stand provides better shading and stronger competition against weeds. In organic systems, a higher seeding rate can prove beneficial, this strong stand will serve as a primary factor in weed suppression.

Conventional systems allow for the use of herbicides to aid growers in managing problematic weeds if they escape cultural control methods. Universities in the United States such as South Dakota State University along with the Government of Saskatchewan in Canada provide valuable information for approved pesticides, including herbicides. The following resources are helpful guides which are updated annually:

- South Dakota Pest Management Guide for Small Grains
- Government of Saskatchewan Guide to Crop Protection: Weeds, Plant Disease, Insects

Be sure to only use approved herbicides and to always follow label directions for application.



PRO TIP

Utilization of an underseeded species such as clover can help as a means of cultural weed suppression.

2. Managing Cover Crops Profitably, 3rd Ed. 3rd ed. Sustainable Agriculture Network, 2007. 93-97 Print.

INSECTS & DISEASES

Monitoring disease pressure is just as important in oats as any other crop. A handful of diseases bring about the largest area for concern: crown rust, stem rust, septoria, and fusarium head blight. Defense against common fungal diseases begins with strong varietal selection. In conventional systems timely applications of fungicides can be used to treat these diseases. When utilizing fungicides it is important to remember that they are not curative; they require timely

scouting and application. In cases of heavy disease pressure, applications will not restore previously affected plant tissue.

Remember to consider your economic thresholds and, if necessary, receive proper consultation before applying. If you are having difficulties defining disease pressure in your oat crop and would like assistance with staging or plan of action, contact your Grain Millers' Crop Specialist for assistance.

CROWN RUST

Symptoms of this fungal disease consist of red/orange colored pustules forming on the leaves and stems of the oat plant. Growers should begin scouting early and apply fungicide at or before the flag leaf stage, ideally upon disease onset. Once pustules are present on the flag leaf, fungicide efficacy is greatly reduced.



Oats infected with Crown Rust



INSECTS & DISEASES

BARLEY YELLOW DWARF VIRUS (BYDV)

BYDV is a virus that turns an infected leaf shades of yellow to red and causes it to curl toward the midrib. The most common vector for BYDV is the Cherry Oat Aphid. BYDV is best controlled with genetic resistance through varietal selection, since there are no fungicides available for viral diseases. Typically new varietal releases exhibit resistance.



Oats infected with BYDV
From Oklahoma State University

STEM RUST

Stem rust is a fungal disease that can cause significant yield loss and quality deterioration. As with most fungal development, it is favorable in warm weather with frequent moisture. Pustules occur on the stem, but they can also occur on the leaf. The pustules are irregular in shape and dark reddish-brown in color. On the stem noticeable tearing can be observed. Growers should scout and consider fungicide application upon disease onset. Timely application of fungicides at the flag leaf stage can reduce disease severity.



Oats infected with Stem Rust

SEPTORIA

This fungal disease initially appears as small lesions on the lower leaves of seedlings. These lesions enlarge into lens-shaped spots that begin yellow and later transition to reddish-brown³. Symptoms typically develop first on lower leaves within the canopy. Disease progression is favorable in warm, wet, and humid conditions. Fungicide applications have demonstrated efficacy in reducing disease spread and minimizing crop damage.



Oats infected with Septoria
Dept. of Ag. New Brunswick, Canada

FUSARIUM HEAD BLIGHT

The disease responsible for producing the mycotoxin deoxynivalenol (DON), commonly called vomitoxin, often shows symptoms such as pink and tan shading at the base of infected glumes. Fusarium Head Blight is challenging to scout for and detect in an oat crop. Fungicide applications are most effective at heading, and it is important to consider pre-harvest intervals when considering an application.



Oats infected with Fusarium Head Blight
Jafar Razzaghian (NIBIO)

3. "Septoria Leaf and Glume Blotch in Wheat, Barley, and Oats." Agriculture, Food, and Rural Development. Government of Manitoba, Web.

INSECTS & DISEASES

CHERRY OAT APHID

Cherry oat aphids are a primary pest pressure in oat production. These aphids provide the vector for BYDV virus. Aphids must be monitored for throughout the season.

Cherry oat aphids can be identified by their dark olive green color with a "cherry red" rear end. They feature long antennae and two long tube shaped cornicles near the rear of the abdomen. They can be found mainly during June and July during the peak vegetative growth periods of the oat crop.

At high thresholds, fifty to sixty insects per tiller, an insecticide application should be considered.



WIREWORM

Wireworms are the larval stage of various beetle species commonly found in the soil profile. Typically found near the root zone and stem base, they feed on germinated seeds and young seedlings at the start of the season. Adult beetles are typically slender, yellowish-brown in color, and have a glossy appearance. Wireworm feeding can lead to seedling death and a reduced stand count.

When scouting look for areas of the field that may have uneven, patchy, or even no emergence. This could be a sign of wireworm feeding underground. Consider the use of seed treatment to offer below ground protection to your seed after planting.



MATURITY & HARVESTING

Oats, unlike many other grains, mature from the top of the panicle downward. Since 90% of grain is in the bottom two-thirds of the panicle, it is important to ensure proper maturity before harvest.

SWATHING

Ideal grain moisture range is between 20-25%. The greenest kernels should have just changed to a cream color. Swathing the oats too early will have a negative effect on test weight and milling quality. The oats should then dry to approximately 14% in the windrow before combining.

STRAIGHT CUTTING

This should be done once oats have reached full maturity and the grain has dried to a moisture of approximately 14-15%. Oats can be harvested at slightly higher moisture levels if adequate drying facilities are available. If they are not growers should wait until oats approach desired moisture levels.

The desired moisture specification for delivery to Grain Millers' facilities is 13.5%. If there is no on-farm capacity for bringing moisture down (aeration storage, grain dryer, etc.) then target harvest moisture should be 13.5% or less.

It is important to avoid dehulled kernels when harvesting. If conditions are dry, widen concave settings and slow cylinder speeds to prevent dehulling and kernel breakage; perform reverse procedure if threshing quality is poor. Increasing fan speed will provide heavier test weights and higher quality milling oats.

4 May, W.E., Stevenson, F.C., Lafond, G.P., and Mohr, R.M. 2005. Oat quality and yield as affected by kernel moisture at swathing. Canadian Journal of Plant Science. 85; 4: 839-

STORAGE

Storage for oats should be clean and dry; aeration is best if available. The target moisture should be between 11-13% when entering the bin for long-term storage.

If the oats are harvested above 14%, the proper use of a grain dryer is recommended to bring down the moisture to an appropriate level. When drying oats, the dryer should remain at a temperature of less than 160°F (70°C). Grain temperature should not exceed 120°F (50°C) during the

drying process. After drying, the oats should be aerated in order to reduce the temperature for greater quality preservation.

When harvest grain moisture is below 14%, standard aeration can typically reduce grain moisture to levels suitable for safe storage. Be sure to only run fans on cool and dry days. As with all grain, oats should be closely monitored for hot spots or grain quality deterioration.





GRAIN MILLERS

CONTACT

GRAIN MILLERS CROP SCIENCE

CropScience@grainmillers.com

United States: 800.328.5188

Canada: 306.786.5657

10400 Viking Drive, Suite 301 • Eden Prairie, MN 55344

grainmillers.com