

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 last thirty-five years we have experienced a significant amount of growth and expansion. This led to the creation of the Crop Sciences team. This team is dedicated to assisting growers reach the yield and quality goals of their individual operations. One avenue for support is in the form of this production guide. This guide is designed to be used as a resource to aid growers in meeting their yield and quality goals.



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 guide 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 Guide is followed. Use of the Guide 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 Guide, 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 problems, 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, following soybeans, peas, or other leguminous crops.

Oats are a resilient crop. 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, corn, 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 indicate what to look for, speak with your agronomist and use tissue sampling to identify potential 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 and 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. In organic systems elevated seeding rates will serve as the primary defense against weed pressures. 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 seed

dealer about the kernel size/tkw of the oats. Research conducted by Dr. Martin Entz at the University of Manitoba has shown larger seeds typically display greater vigor, quick early establishment, and stronger competition against weeds.

Although it is somewhat complex, the method described below is one tool to calculate the target seeding rate in pounds per acre while considering

your individual seed count. Calculating seeding rate in this fashion can help ensure you achieve optimal plant populations, which can reduce tillering and improve both yield and quality. This method of calculating also accounts for expected stand loss; under normal conditions, growers can anticipate a 95% germination rate, but 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/weeks leading up to seeding activities to ensure successful germination of the oats. As mentioned above oats can germinate when soil temperature reaches 45°F or 7°C. When field conditions are fit, 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 systems can utilize similar cultural weed control practices. The first of these is early planting. Seeding the oat crop early allows the canopy of oats to close before weeds have a chance to establish below. Canopy establishment cuts off valuable sunlight resources that weeds are competing for. Oats are also known to provide an allelopathic (the chemical inhibition of one plant acting as a germination or growth inhibitor) residue that naturally hinders germination of many weed species². Additionally, seeding rate plays a factor in overall weed control. An adequate stand will help shade and create stronger competition against weeds.

In organic systems, a higher seeding rate can prove beneficial as this adequate stand will be a primary factor in weed control.

Conventional systems allow for the use of herbicides to aid growers in managing problematic weeds if they escape cultural control methods. University systems 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 resources are as follows:

- South Dakota Pest Management Guide for Small Grains
- Government of Saskatchewan Guide to Crop Protection: weeds, plant disease, insects (New edition printed annually in March)

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. Although in conventional systems timely applications of fungicides can be used to treat these diseases. It is important to remember that fungicides are not curative, they require timely scouting and appli-

cation. If a heavy onset of disease pressure exists applications will not revert existing damage.

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



Crown Rust in Oats (Swedish U of Ag. Sciences,
Dept of Forest Mycology and Plant Pathology)

CROWN RUST

Symptoms of this fungal disease consist of red/orange-colored pustules forming on the leaves of the oat plant. Fields should be scouted during the late 4 leaf stage and into flag leaf. There is no economic threshold for crown rust. Growers should scout and consider fungicide application upon disease onset. Fungicide control for crown rust is most effective when applied during flag leaf stage.



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 variety selection. The newer varieties typically show resistance.



Oat plant 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. There is no economic threshold for stem rust. Growers should scout and consider fungicide application upon disease onset. Timely application of fungicides at the flag leaf stage can reduce disease severity.



SEPTORIA

A fungal disease that exhibits symptoms first as small spots on the lower leaves of seedlings. Spots grow into larger, lens-shaped lesions which are initially yellow and later turn reddish brown.³ Lesions are first found on lower leaves within the plant canopy. Wet, warm, and humid conditions promote growth. Fungicide applications have been known to help control spread and damage of the disease.



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

FUSARIUM HEAD BLIGHT

Common symptoms are pink and tan shading at the base of an infected glume. This fungal disease is known to produce the mycotoxin deoxynivalenol (DON), more commonly known as vomitoxin. It is hard to scout for and detect within an oat crop. Fungicide application during flag leaf has been known to help reduce effects of FHB.



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 one of the most prevalent pest pressures in oat production. Cherry Oat aphids provide a vector for the BYDV virus. They should be considered a serious problem and controlled at 50-60 insects per tiller. These aphids vary in color from a reddish orange tinted green to a dark olive color. 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 peak vegetative growth periods of the oat crop.



WIREWORM

Wireworms are larvae of several species of beetles. Larvae are often found in the soil around the stem. The beetles are often thin and yellowish, brown in color, with a bit of a shiny sheen. Wireworms can cause the death of seedlings and a reduction in stand counts.

To scout, look for areas of the field after seeding that may have come up patchy and bare; this may be a sign of wireworms feeding underground.



Image Credit: Utah State University



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 head, 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.

It is important to note that 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 moisture is below 14% at harvest, simple aeration may be sufficient to bring down the moisture to storage levels. 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.





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