Penn State Extension

# Oilseed Fact Sheet: Oilseed Presses

## *Introduction*

An oilseed press (Fig. 1) is the heart of an oilseed pressing operation. This fact sheet focuses on small oilseed presses used for edible oil production or for producing oil for fuel or biodiesel production. Oilseed presses separate oilseeds such as sunflowers, canola, and soybeans into oil and oilseed meal. Pumpkin or grape seeds and brazil nuts are examples of materials that are less known and can be pressed for their oil in these machines.

Oil from the press is raw oil, and is used either as a food product or as an industrial product. Food products include raw oil in dressings or alone, pan frying applications, or in deep fat frying. Soybean oil (usually called "vegetable oil"), corn oil, sunflower oil, canola oil, peanut oil, olive oil, and safflower oil are common. This large range of oils points to the flexibility necessary in an oilseed press if it is to be used to press oil from a wide variety of seeds and nuts. Some presses offer more flexibility than others, so examine carefully the claims of the press manufacturer before purchasing a press for a particular purpose. If possible, conversations with others who have used a particular press will be valuable.

Vegetable oils typically found in the marketplace are RBD oils. This means that the oils have been Refined, Bleached and Deodorized after the initial removal from the oilseed. A separate factsheet, Processing Edible Oils, describes these terms and the procedures that may be used for each process. For a small oil producer, some of these processes may be useful to incorporate into the oil processing line and others may be outside the scope of the operation.

## *Oilseed Presses*

Available small oilseed presses are of two major types; screw presses (expeller press) (Fig. 2) or reducing screw/cage presses. Many are made overseas while at least one is now available from a United States manufacturer. Information about many of the presses used in the Northeastern United States is being collected by this NESARE project and will be available as a separate informational bulletin. Operation of an oilseed press is the focus of this sheet.

## *Oil Production*

Oilseed presses vary in size and the amount of oil expected varies be-

**Fig. 1: Oilseed press**

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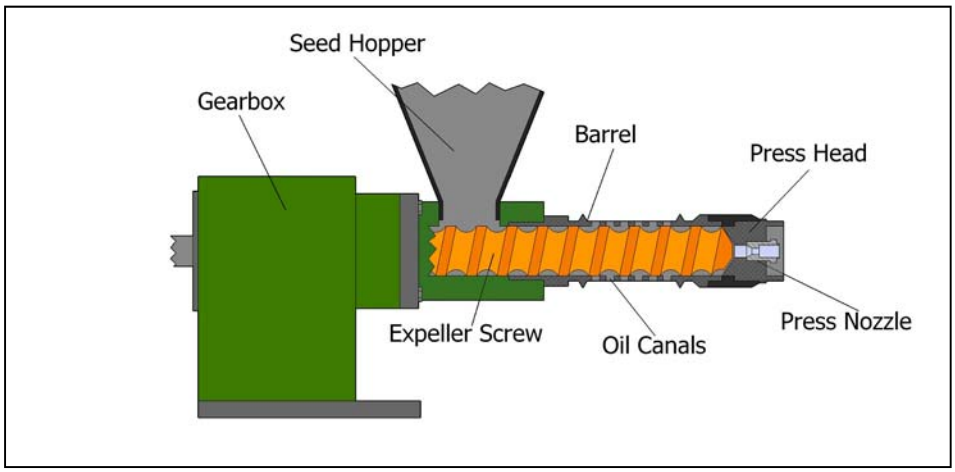


**Fig. 2: Expeller Press (screw press) diagram**

tween seed types. As a result, the capacity of an oil seed press is often given in the weight of seeds that can be processed per hour. Depending on the material processed, the expected oil output will vary greatly. For canola, about 1/3 of the seed weight going into the press will be produced in oil, while the remaining 2/3 will be meal. Other seeds will give different oil and meal ratios.

Presses of these types are typically rated in the 3 kg (6.6 lb) to 100 kg (220 lb) of input material per hour range.

## ***Requirements for Effective Oilseed Pressing***

Information provided in this fact sheet has been gathered from experience and discussions with numerous oil producers and providers of oilseed presses. As experience is gained with a particular press the settings that work best will be determined. Much of this work is on a trial and error basis, and when proper settings are determined they should be recorded so they are saved for reference and as a starting point for the next harvest.

## ***Moisture Content of Seed***

For an oilseed press to operate properly, the incoming seed must be clean and of the proper moisture content. Seed cleaning and storage information is provided in a separate fact sheet, "Oilseed Cleaning and Storage".

Generally 10% is used as a rule of thumb for the moisture content at which to store grain and seeds. While the seed will store well at this moisture content, it most likely will not press well. Seed that is too moist will produce meal that is gummy and will not produce oil as it passes through the press. The moisture in the seed ties up the oil and does not allow the oil and meal to separate as it should.

All grains have moisture contents at which they press best. A general rule to start from is that the ideal moisture for pressing is in the 7-8% range. Experience shows canola presses best in the 6-8% moisture content range, with other oilseeds requiring similar moisture contents. If the moisture content of the seed being pressed drops too low the temperature of the press head increases when pressing and will make it difficult to stay under the 120F (50C) temperature limit for cold pressed oil if that is important to the operation. Lower moisture content seeds result in higher press temperatures and a lower yield of oil.

Moisture content is often the culprit if pressing is difficult. On one occasion, bags of canola at 7% moisture

**Different examples of oilseed, including (from left to right) camelina, soybeans, and canola.**

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content to be pressed were placed on the floor of the pressing area. When pressing time came a week later, the seed would not press. After numerous failed attempts at getting the press started with this seed, the moisture content was tested again and had dropped to 4%. Unknowingly the seed had been stored directly under a heating vent and had dried considerably by heated air blowing across the bags.

For information on moisture contents for pressing, consult someone familiar with press operation. Often an email or phone call to the press manufacturer will help in getting started on a new type of seed. When an opportunity to press Brazil nuts was presented, an email to the manufacturer delivered the news that the press barrel needed to be heated to about 93 C (200 F) for pressing to work correctly with this high oil content nut. Without this information a great deal of time was used unproductively as various lower temperatures, speeds and tip sizes were unsuccessfully tried.

## *Seed Quality*

Seed quality is also important, as seed harvested either before or after optimal ripeness can impart unwanted flavor or chemical characteristics to the oil produced from that seed. When green (not fully ripened) seed is pressed for oil, the smell it produces when pressed is not the same as the smell of ripe seed being pressed. Oil produced from green seed will not have the characteristics such as smell or taste desired in the finished oil. It is difficult to produce high quality edible oils when starting with low quality seed.

Likewise, seed that contains mold from too much moisture during harvest or storage (Fig. 3) will have a noticeable odor and may contain toxins that carry through into the pressed oil.

**Fig. 3: Properly stored seed (left) as compared to moldy canola seed (right)**

## *Pressing Temperature*

When reading the ingredients on food, have you noted how vegetable oils are listed? Sometimes oil is listed as “expeller pressed” or “cold-pressed”. Expeller pressed oil means that the oil is extracted from the seed by a press as described in this fact sheet. Cold pressed adds an additional requirement that the oil is extracted at a temperature of less than 49 C (120 F). Many people believe that the oil produced at a lower temperature have better health characteristics. Additionally, cold pressed oils have a lower phosphorous level which is required if using the oil as straight vegetable oil (SVO) fuel in an internal combustion engine.

## *Press Settings*

Manufacturers produce presses that have characteristics that can be changed to accommodate different sizes, shapes or types of seeds or nuts. Not all manufacturers accommodate all of the following setting changes, but most allow at least some of the settings. Remember that the press should be shut off and the power disconnected before changing the settings.

For screw type presses:

- distance between end cap (press head) and screw end
- speed of press
- tip size (diameter of hole through

which meal is expelled)
- type of screw (distance between and depth of auger flights)

Considering each of these characteristics in more detail provides the effects of each setting. Because each setting can have an impact on other settings it takes time, record keeping and patience to find the acceptable setting for each type of seed, or even each batch within a type of seed. It is for this reason that operating a press is more of an art than a science. Changes in moisture content or other characteristics may also require changes to press settings for acceptable oil recovery.

**Fig. 4: Example of a press head.**

### *Distance Between Press Head and Screw End*

The clearance between the end of the screw and the press head itself (Fig. 4) is one common adjustment, though not an adjustment available on all presses. As this clearance is made smaller, the force needed to push the seeds through the press increases, creating a greater pressure overall on the oil/meal mixture. Too much pressure, though, and the press will no longer allow the meal to pass through effectively blocking the meal flow and stopping the flow of material through the press. Too large a distance and the meal will pass through easily, leaving a large amount of oil in the meal. Finding the correct setting is a balance between the meal passing reliably through the press and extracting the maximum amount of oil while doing so.

On a Kern Kraft press, this setting is changed by turning the pressing head in or out. As the head is turned, the threading either increases or decreases the clearance between the end of the screw and the press head. Even a small adjustment (1/16 of a turn) can change the press from being productive to being plugged. Once an adjustment is made it can usually be left for the duration of the pressing of that seed. It is not a setting that needs to be altered continuously.

Turning the press head out to increase clearance looks like an easy process, and usually it is. If the machine has been run for a long period of time, or the heating element has been used on the barrel and head while pressing then turning the press head may be difficult. Turning the press head in can be a trying proposition because meal is already packed into the space between the end of the screw and the presshead. Reducing this clearance means squeezing this material tighter, and that's not always easy to do. Removing the press head and clearing the material may be the only way to relieve this pressure enough to be able to turn the press head in.

### *Speed of Press*

Many presses have a variable speed drive. This may be an electronically variable speed drive, a variable pitch drive, or another type of drive that allows the pressing screw(s) to be driven at different speeds.

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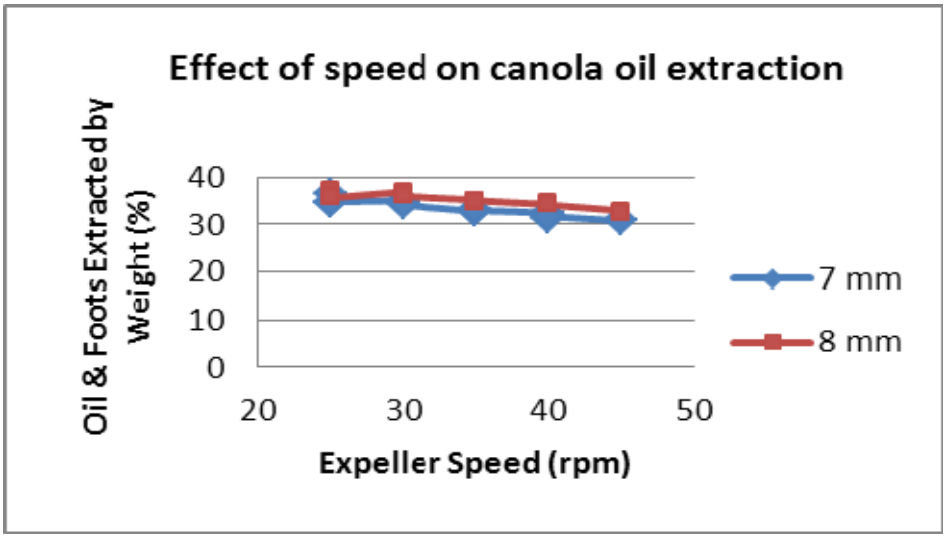


**Fig. 5: Effect of speed on oil production**

Turning the screw(s) faster will put more feedstock through the press in a set amount of time and increase the oil production rate (gallon or liters per hour). This sounds like a great idea, but there are downsides to running the machine faster (Fig. 5). As the screws turn faster, more material is moving through the press and this provides less time for the oil to migrate out and be separated from the meal. As a result, the slower the press is run the higher the extraction rate for oil; the less oil is left in the meal. If cold pressing of the oil is a requirement, then a slower speed is often necessary because as screw speed increases, the temperature of the oil and meal moving through the machine also increases. Temperature and efficiency of oil extraction need to be balanced against overall oil production to decide on a screw speed.

## *Tip Diameter*

Tips are available in varying diameters for each press. Many presses come with a range of tip diameters to allow pressing of different feedstocks. Typically tips are available from ~ 5 mm to ~ 15 mm diameter. Press tip diameter is one factor that greatly influences the amount of "back pressure" on the meal/oil moving through the press. Too large a diameter tip and the feedstock is not held back adequately and flows freely from the press with little oil extraction. Too small a tip and the tip plugs, effectively ending that pressing session. On smaller presses, tip diameter may be the only variable present to change the oil extraction rate, as there may not be a way to change the press head to screw end clearance or the screw speed.

**Table 1: Successful Tip Diameters**

| Feedstock | Tip Diameter |
|---|---|
| Brazil nuts | 5 mm |
| Camelina | 7 mm |
| Canola | 5, 6, 7 mm |
| Flax | 7 mm |
| Sunflower (Hulls off) | 5, 7 mm |
| Sunflower (Hulls on) | 10 mm |

Tip diameters that have been used successfully are presented in Table 1. Remember that every batch of seed and every machine are slightly different, so these diameters are a place to start but may not be the best sizes for your feedstock and conditions. Experiment with different tip diameters until the oil extraction rate is acceptable. Also realize that as new tips become worn in, they become smoother and produce less "back pressure" on the meal passing through.

Reducing screw/cage presses use a different technique for pressing the oil than the expeller screw presses. Operational requirements are similar, but adjustments are made by tightening (reducing) the distances between the bars to increase the back pressure and increase oil extraction.

## *Type of Screw*

Manufacturers may provide screws with different pitches (distance between high points of the screw) or


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depths to better handle the variety of seed shapes and types available. For example, the Kern Kraft press provides a screw that will handle soybeans more readily than the screw that handles canola, camelina and other smaller seeds. Check with the supplier of the press before purchase to be certain you understand the possible need for additional components to handle the range of products you are considering pressing.

## *Starting the Press*

Bear in mind that every press will have slightly different requirements for starting and stopping. Steps below are for one particular type of press, but should translate well to any press with slight modification.

- Be certain the gate allowing seed to the press is shut. This allows the barrel and press head of the press to be heated without seed present.
- Be certain the desired tip diameter is in the press head and set the press head to screw end clearance if a change is needed. Different clearances can be noted by counting the number of threads showing or by measuring this distance.
- Most oilseeds that will be pressed require that the press be initially heated to a temperature of ~120 F (60 C). Typically this is done with heating bands that cover each press head of the press and a controller. Some heat band controllers thermostatically control the heat of the heat band, while other heat bands are simply on or off. Typically about 10 minutes are needed to get the press head up to the preheat temperature. This can be measured with a thermometer inserted into a hole in the press head or more simply with an infrared thermometer aimed at the press head. Some presets do not require preheating.
- Start the press and select the desired drive speed.
- Once the press head is at the correct starting temperature open the gate allowing seed to flow to the press. Oil and meal production is not immediate; it may take several seconds to over a minute to start having oil drip or flow from oil holes in the barrel. Different oilseeds contain different amounts of oil, so the oil that is produced may range from a steady drip to a steady stream.

## *Shutting Down the Press*

- Close the gate that allows feedstock to flow to the press.
- Wait until the meal flow slows considerably or stops, and oil no longer drips from the barrel.
- Shut off the screws.
- Turn off heaters if they have been used during pressing.

Manufacturers suggest removing and cleaning the barrels and screws of the presses after shutting down the press. Experience has shown that if the seed flow to the press is shut off and the press is run long enough to expel the material in the press, this may not be necessary. If the press is to be restarted soon (within a week?) then leaving the press without removing the barrel and cleaning is all right. The press will start up again with only the steps outlined above.

## ***Summary***

As the center point of the oilseed conversion process, the press can be used to extract oil from a variety of seeds. The quality of the product is determined by many factors, including the settings of the press, as well as moisture content and proper storage of the oilseed.


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## *Resources*

**Press manufacturers (not an exhaustive listing)**
Ag Oil Press (www.agoilpress.com)
Egon Keller (www.keller-kek.de)
Kern Kraft (www.oelpresse.de)
Komet (www.ibg-monforts.com)
Piteba (www.piteba.com)
Tabypressen (www.oilpress.com)
Tokul (www.tokultarim.com)

**Vegetable oil processing equipment**
Tinytech (www.tinytechindia.com)

**Northeast Oilseed Information**
University of Vermont:
www.uvm.edu/extension/cropsoil/oilseeds

*Note: This is not an exhaustive resource list nor do any of the oilseed project partners endorse any of the products or companies on this list. It is intended as a resource and starting point for those interested in small-scale oilseed processing.*

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