



BRIEFING

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Small Scale Oilseed Processing

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Objective

Analysis

for Informed

Decision Making

Recently, increases in the prices of diesel and other petroleum based fuels have created substantial interest among agricultural producers and other entrepreneurs in local bio-fuel production opportunities. Historically, energy costs have accounted for between 10 and 20 percent of out-of-pocket farm or ranch's operational expenses. Higher energy prices therefore have important implications for farm and ranch profitability. In response to higher energy costs, some operations have decreased their expenditures on energy inputs by adopting fuel and nitrogen fertilizer conserving technologies and crop rotations. Others have responded by evaluating potential on-farm energy production opportunities. This briefing paper examines the on farm energy technologies currently available and the financial issues associated with decisions about whether these technologies should be adopted. Oilseed processing is an important step in the production of biodiesel. This bulletin provides farmers and other entrepreneurs with information they may need in order to evaluate the financial implications the opportunities presented by small scale oilseed processing.

Processing Technology

Oilseed processing equipment with a daily capacity of less than 50 tons per day typically employs a mechanical extraction process to separate the oil from an oilseed. Mechanical extraction processes apply pressure to

separate oil from the meal in an oilseed. A common method for applying mechanical pressure is through a screw press.

Mechanical extraction processes have two main elements. The first is seed preparation. Seed preparation methods vary depending on seed characteristics. For example, seed preparation for canola often is limited to seed cleaning while other oilseeds may need to be cleaned, de-hulled, cracked, rolled, and/or flaked. Additional equipment may be required to complete seed preparation. A producer should identify the oilseeds that they are likely to process in order to determine exactly what equipment will be needed.

The second element is the removal of oil from the oilseed. In a screw press operation, seed is fed from a hopper into the screw press, which uses pressure to force oil contained in an oilseed through small openings in the side of the press. Meal, that is too large to exit through the small openings is extruded through larger openings at the end of the press. Screw presses are capable of removing approximately 65 percent to 75 percent of the oil contained in an oilseed. Some mechanical presses preheat seed as it enters the press. Preheating increases oil recovery rates to 65 percent to 80 percent. Alternatively, if seed is processed at low temperatures (for example, below freezing) oil recovery rates may be less than 60 percent. Actual recovery rates will depend on press quality,

press operation, seed quality, seed type and seed temperature.

Capital Costs

Equipment retailers may include various accessories with their processing equipment. It is important to consider exactly what equipment is included when comparing offers. The following is a list of basic equipment used for oilseed processing.

- Seed Preparation Equipment
- Mechanical Extractor
- Power Source for the Extractor
- Seed Storage Bin(s)
- Meal Storage Bin(s)
- Pumps, Filters and Plumbing for Oil Storage
- Oil Storage Tank(s)

Seed preparation equipment varies, depending on the oilseed to be processed. For some oilseeds (for example, canola) very little seed preparation equipment is required. For other oilseeds, (for example, sunflower) additional equipment is required. Equipment manufacturers and retailers can assist producers in determining equipment requirements for a particular oilseed.

One of the largest capital expenditures for a small scale oilseed processor is the mechanical extraction press. These presses may be sold either with or without a power source. Sample prices at the time of this publication were as follows:

- 1 ton per day press without a power source was priced at \$995
- 5 ton per day press with a power source was priced at \$6,000
- 10 ton per day press with a power source was priced at \$10,500.

Small scale oilseed processing equipment is often sold without seed storage bins, meal collection bins, and oil storage tanks. Some buyers may utilize bins and tanks they already own to reduce their capital costs. However, some retailers offer complete systems that include a

press, tanks, bins and a power source.

Installation, delivery and set up costs should also be considered. Shipping costs can be substantial because of the size and weight of presses, bins, and tanks. Purchasing bins and tanks from a local supplier may reduce shipping costs. The oil has to be stored and filtered as part of the process, pipes, valves, tanks, pumps and filters may have to be installed for storage purposes.

Most oilseed processing equipment is electrically powered. Installation may require modifying or upgrading a buyer's current electrical system to accommodate the new equipment. Installation costs are sometimes overlooked but they can be an important consideration.

Operating Costs

Operating costs vary widely among different sizes and brands of processing equipment. Labor costs are one important source of these differences. Some presses are designed to operate without direct supervision. When direct supervision is not required, a press can be operated for hours without substantial labor requirements. Other presses require approximately 5 minutes of labor per hour for monitoring and other purposes when the press is operating. Although this may seem like a small amount of time, it requires the operator to remain relatively close to the press during its operation. Another consideration is the output per unit of labor input. For example, one supplier indicated that their 2 ton press required essentially the same labor input as their 5 ton press. This implies that on a per ton basis, labor costs for the 2 ton press would be 250 percent higher than for the 5 ton press.

Equipment Manufacturers and Suppliers

Oilseed processing equipment is available directly from manufacturers

or through distributors. Many presses are manufactured in foreign countries. Several such manufacturers have US based distributors to provide sales, service and technical support but others may not. Some distributors and manufacturers of processing equipment are as follows:

- Insta-Pro
- BioFuel Canada Ltd.
- The Dupps Company
- PlantDrive.com
- De Smet Rosedowns
- Oilpress.com

This list should not be considered a recommendation or endorsement of any company or product. The list is provided simply to give readers an overview of the various types of commercially available processing equipment.

Processor Capacity

Commercially available mechanical processors have daily processing capacities ranging from less than one ton to over 50 tons. Several important issues should be evaluated when determining the correct processing capacity for an operation. The capacity of the processor and the hours of operation determine the amount of seed that can be processed. Commercial plants often operate 24 hours per day for over 300 days each year, but smaller processors may operate for less than 12 hours per day and only a few months each year. Table 1 presents estimated annual processing volumes for three processors with different capacities, assuming that each is operated 24 hours a day for 320 days each year. Table 2 presents estimated processing volumes for the same three processors under the assumption that each is operated 12 hours per day for 120 days each year. These tables also provide estimates of the quantities of products produced by each processor.

**Table 1: Estimated Annual Plant Output:
Operating 24 hours per day, 320 days each year**

Processor Daily Capacity	2 Tons	5 Tons	30 Tons
Operating Days Per Year	320	320	320
Operating Hours Per Day	24	24	24
Oil Content of Feed Stock	35%	35%	35%
Oil Recovery Rate	75%	75%	75%
Annual Seed Requirement (Short Tons)	640	1,600	9,600
Annual Oil Production (Gallons)	44,800	112,000	672,000
Annual Meal Production (Short Tons)	427	1,068	6,408

**Table 2: Estimated Annual Plant Output:
Operating 12 hours per day, 120 days each year.**

Processor Daily Capacity	2 Tons	5 Tons	30 Tons
Operating Days Per Year	120	120	120
Operating Hours Per Day	12	12	12
Oil Content of Feed Stock	35%	35%	35%
Oil Recovery Rate	75%	75%	75%
Annual Seed Requirement (Short Tons)	120	300	1,800
Annual Oil Production (Gallons)	8,400	21,000	126,000
Annual Meal Production (Short Tons)	80	200	1,202

Availability of Feed Stock

An important issue for small scale oilseed processing operations is the required volume of feed stock. Farm based processors may be able to produce all or a significant portion of their feed stock requirements. Larger processing facilities will need to purchase most or all of their feed stock from other sources. Estimating on-farm oilseed production and the commercial availability of oilseeds in the region is a critical step in the planning process.

Farm Production

Farm based processors need to assess current crop yields and costs to determine whether or not an oilseed crop is a viable option for their crop rotations. This assessment should include the agronomic and financial implications of altering current crop rotations. Combining the estimated oilseed acreage with the expected yield from the oilseed crop provides an estimate of on-farm production.

Regional Oilseed Production

Operations that are unable to produce sufficient feed stocks for an oilseed

processing operation will have to purchase feed stocks from other producers. Montana oilseed production is relatively limited; therefore producers need to consider the quantity, availability, location, and cost of additional feed stocks. Several commercial oilseed processing facilities currently operate in Montana. Some of Montana's current oilseed production is under contract to these commercial processing facilities and is not available for purchase on the open market. Transportation costs increase with distance, limiting the area from which a processing plant can economically purchase additional feed stocks. Evaluating local markets for oilseeds is another important step in the planning process for processors who do not expect to produce sufficient feed stocks to meet their needs. Additional information on historical Montana oilseed production can be obtained from Agricultural Marketing Policy Paper no. 19 (www.ampc.montana.edu).

Product Markets

Oilseed processing produces two products, oil and meal. Oilseed meal is generally used as a feed product for

livestock. The oil has a variety of uses, including human consumption, bio-fuels, bio-lubricants, cosmetics, and many other applications.

Meal comprises over 60% of the seed processed. Identifying markets or uses for the meal before processing large amounts of feed stock may prevent storage and disposal problems. The characteristics of an oilseed meal are determined by the oilseed processed and the oil content of the meal. The characteristics of the meal produced vary. Thus, consideration of available markets for each specific meal product is important. Establishing local markets for the meal and seed reduces transportation costs. If local markets for meal are only available seasonally additional meal storage may be required.

Oil extracted from an oilseed has numerous potential uses. Human consumption markets for the oil are often niche markets that offer high prices, but only for limited quantities. The bio-fuel market usually demands higher quantities but offers lower prices. If the oil produced from an oilseed is to be used for human consumption, a producer's processing equipment must meet State of Montana health and safety standards. Information about wholesale food manufacturing standards and other related issues is available on the Montana Department of Health and Human Services Web site (www.dphhs.mt.gov/PHSD/Food-consumer/food-safe-index.shtml). Oil produced for industrial uses, such as bio-energy or bio-lubricants, is not required to meet these standards.

Additional Information

The information presented here focuses on technologies and issues related to small scale oilseed processing. Additional information on oilseed processing and biodiesel production can be found at www.ampc.montana.edu



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