BRIEFING

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Large Scale Commercial Oilseed Processing

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Opportunities to reduce energy related expenditures have received considerable attention in recent years because of rising and volatile prices for gasoline, diesel and other fossil fuels. One alternative to diesel that is being considered is biodiesel. Biodiesel is fuel that can be used in traditional diesel engines in many cases without modification . It is produced by combining a vegetable oil (or animal fat) with an alcohol and a catalyst. Biodiesel can be produced from the oil of a wide variety of crops. These include soybeans, canola, cotton seeds, camelina, peanuts, and safflower as well as other oilseeds. In the United States most biodiesel is produced with soybean oil. This briefing paper provides an overview of the technologies available for large scale oilseed processing and related financial and economics issues.

Oil is obtained from oilseeds by using one of two methods: mechanical extraction or solvent based extrusion. Mechanical extraction is commonly used for facilities with production capacities of less than 100 tons per day. Solvent based extrusion is generally used for facilities with production capacities of more than 75 tons per day. Additional information about small scale extraction technology can be obtained from AMPC Briefing Paper no. 88.

Seed Preparation

An oilseed's characteristics will determine the preparation required prior to processing. All oilseeds have to be cleaned prior to processing and some require additional preparation that may include de-hulling, cracking, rolling, flaking, or de-shelling. Seed cleaning is required to remove any foreign objects that may damage the processing equipment. Sunflower seeds are an example of an oilseed that requires additional preparation before processing. The additional preparation includes removing the shell. Canola is an example of an oilseed that requires little if any seed preparation beyond cleaning.

Oilseed Processing

Oilseeds with high oil content are processed somewhat differently than oilseeds with low oil content. Canola is an example of a high oil content oilseed and soybeans are an example of a low oil content oilseed.

High Oil Content Oilseeds

High oil content oilseeds (sometimes referred to as soft seeds) generally have over 30 percent oil content in the unprocessed feed stock. The relatively high oil content needs to be reduced prior to solvent application to allow the solvent to efficiently bond to the oil. Reducing the oil content of an oilseed is accomplished by flaking, heating and mechanically pre-pressing the material prior to solvent application[1]. Pre-pressing reduces the oil content of the remaining material to less than 25 percent.

[1] Not all processors will heat the material during this component of the process. The description provided here is only one example of a solvent extraction process.

Low Oil Content Oilseeds

Oilseeds with an oil content of less than 30 percent do not require prepressing. The low oil content eliminates the need to reduce the oil content before solvent application. Soybeans, with an oil content of approximately 18 percent, are an example of low oil content oilseed. The preparation process for soybeans involves de-hulling, cracking, and rolling and flaking.

Solvent Extrusion

A solvent is applied to remove the remaining oil from the prepared material. The solvent, typically hexane, bonds to the oil in the material. The oil and solvent solution is then separated from the meal. After the meal has been removed, the solvent and oil are separated. A majority of the solvent used in the process is recovered and can be recycled for future processing.

Solvent based processing commonly removes over 97 percent of an oilseed's oil. Mechanical processes are typically capable of recovering 70 percent to 80 percent of an oilseed's oil. A higher oil recover rate implies that more oil and less meal will be obtained from any given feed stock. For example, an oilseed with 40 percent oil content processed with equipment with an oil recovery rate of 97.5 percent will produce 39 percent oil and 61 percent meal (with 2 percent oil content in the meal). A similar oilseed processed with equipment that recovers 75 percent of the oil will produce 30 percent oil and 70 percent meal (with 14 percent oil content in the meal)[2]. The oil content of the meal is directly related to the oil recovery rate because any oil not recovered during processing remains in the meal. A pound of oil has a higher market value than a pound of meal. Therefore revenue generally increases as the oil recovery rate increases, although certain meal markets may offer a premium for meal with higher oil content.

Feed Stock Considerations

A commercial oilseed processing facility requires an adequate supply of feed stock to operate efficiently. Many commercial oilseed processing facilities operate 24 hours per day for 320 days each year. Table 1 indicates the tons of feed stock required annually to supply three different sizes of oilseed processing facilities.

Table 2 presents estimated annual acreage requirements for each facility discussed in Table 1. Acreage estimates for each of Montana's major oilseed crops are shown assuming the facility is operated for the entire year on a particular crop. These estimates are calculated based on average Montana yields from 1999 to 2005.

In Montana, in recent years, total acres planted to canola, safflower, flax, mustard and sunflower has averaged less than 150,000 acres. More information about historical Montana oilseed production can be found in Policy Paper no. 19 at: www.ampc.montana.edu.

Summary

Large scale commercial oilseed processing may provide an opportunity for value added enterprises in Montana, although, currently, the potential for such operations may be somewhat limited because of Montana's modest oilseed production. This briefing paper has presented an overview of large scale oilseed processing. For more information on oilseeds, oilseed processing and biodiesel refer to AMPC policy issue paper number 22 and AMPC briefing papers numbers 86 and 88 which are available at www.ampc.montana.edu.

Table 1:

	Daily Processing Capacity (Tons)	Operating Days Per Year	Tons Processed Per Year
Facility A	100	320	32,000
Facility B	250	320	80,000
Facility C	500	320	160,000

Table 2:

	Average Montana	Acres Required to Supply Feed Stock by Crop*		
	Yield (99-05)**	Facility A	Facility B	Facility C
Canola	1,113 lbs.	57,554	143,885	287,770
Flax	15 bu.	79,800	199,501	399,002
Safflower	787 lbs.	81,321	203,304	406,607
Mustard	681 lbs.	93,979	234,949	469,897
*Estimates assume each facility is supplied by one type of oilseed.				
** Averages based on National Agricultural Statistical Service data.				

[2] In a typical process approximately 3% of the material that enters the process will be lost during processing, due in large part to moisture losses. This example assumes no material is lost during processing.