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Industrial Uses of Soyoil: A Market Analysis

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INDUSTRIAL USES OF SOYOIL:
A Market Analysis

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EXECUTIVE SUMMARY

Industry Structure

Lubricants' base oil production is virtually controlled by five, vertically integrated, multi-national companies. Their market shares are large enough to permit strong influence over the entire industry and to render competition ineffective. It will be difficult for new firms to enter the lubricant's industry and compete successfully with these entrenched firms. The lubricants market is large. The market is dominated by petroleum based, mineral oil products. Projected market growth is minimal, and worldwide supply is ample.

Growing environmental awareness and the prospect of stringent regulations regarding petroleum products use have spurred renewed interest in the manufacture of vegetable oil based lubricants. Product performance will likely be more critical to success than competitive price.

Markets that offer significant potential include those where state regulations mandate biodegradable lubricant use or in industries that seek avoid costly remedial clean ups.

Environmental Threats or Opportunities

There is no universally accepted definition for environmentally acceptable lubricants, but the American Society for Testing Materials has formed a subcommittee to establish standards.

The Environmental Protection Agency (EPA) has determined that our nation's remaining water quality problems are largely attributable to pollution from nonpoint sources. The EPA is stepping up efforts to reclassify nonpoint sources as point sources to subject former nonpoint sources to regulation liability. Public perception of ground water contaminants has been the catalyst to stimulate reclassification. Hence, in many applications a readily biodegradable and nontoxic lubricant is preferable to current options especially where the product is introduced into nature.

Lacking federal government mandated change, any firm producing an environmentally superior lubricant faces several realities. First, the product must perform as well as or better than existing lubricants. Second, success may be most easily achieved by marketing products in states that have already regulated lubricants. And finally, because the global market for environmentally friendly products is still heating up, the odds for a "green" product's success are very good.

The Drip Oil Market

If 100 percent of petroleum based drip oil was displaced by soyoil, 1.68 to 2.36 million bushels of soybeans would be consumed to produce drip oil. A more realistic forecast by one of the big five lubricant firms is sales of 2.5 million gallons for all biodegradable lubricants by 1995.

National introduction of biodegradable lubricants is feasible for one of the industry's dominant firms, but for smaller firms, niche markets and regional introduction would be more manageable and enhance the chances for success .

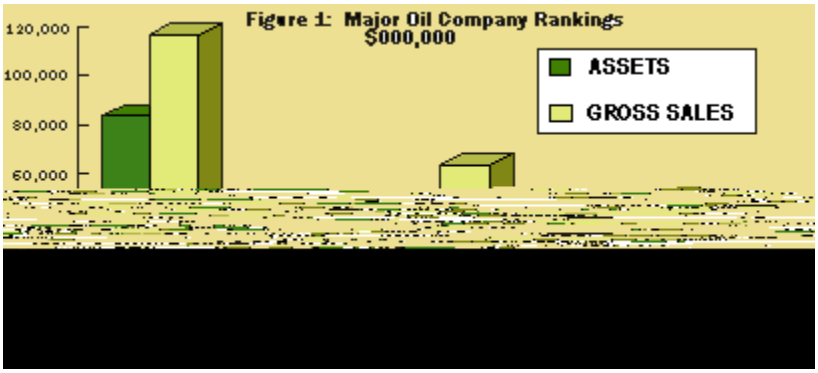
Drip oil is marketed as both a private branded drip oil and a nationally branded lubricant used for drip oil. Consumers look for anti-wear additives, lubricity and viscosity additives and quality for the price. The drip oil market is composed of more buyers who purchase small quantities of product and fewer buyers who purchase large quantities of product. Therefore, profits will *not* be garnered by "product turn" generated by high volume, low priced sales, but by offering consumers enhanced product value through distribution, packaging and product performance. Firms who can deliver the above three criteria will find consumers willing to pay a premium price for their products.

INDUSTRY STRUCTURE

Industry structure analysis quantifies the organizational characteristics of a market that help to predict competitive conduct of firms. The main feature of industry structure is each firm's market position, or "market share". Firms with less market share are under more competitive stress than those with greater market share. Concentration in the market is usually indicated by the summed shares of the top four or five largest firms. If the concentration percentage is high (over 40 percent), firms with less market share encounter severe obstacles to success .

Lubricant's Production

U.S. lubricants' base oil production is virtually controlled by five, vertically integrated, multi-national companies. Exxon, Chevron, Mobil, Shell and Star Enterprises (Texaco) account for 60 percent of U.S. lubricant base oil. This high concentration figure indicates that there is ineffective competition in this industry. Market shares are large enough to permit strong influence over the entire industry, and entry barriers are high. Figure 1 illustrates the five firm's overall size by assets and gross sales.



Leaders in finished lubricants include Burmah Castrol, Exxon, Pennzoil, Texaco, Quaker state, Valvoline, Mobil and Witco.

This high concentration of seller power indicates a strong oligopolistic industrial structure. "Competition among the few", as oligopoly is often called, is highly personalized. Each firm tends to be aware of product developments or price moves made by the other firms. Historically, entry into oligopolistic markets has been characterized as extremely difficult. Economies of scale are often the most pervasive barrier to entry, as well as complex technologies, extensive distribution networks and elaborate sales and marketing activities .

Conclusion:

It will be difficult for new firms to enter the lubricant's industry and to complete successfully with heavily promoted, branded items produced by entrenched firms with high market share and well established distribution networks.

The Lubricants Market

Estimated at over 2.4 billion gallons, the U.S. lubricant's market is valued at approximately $6 billion. (1) The market is characterized by petroleum lubricants, mineral oil based petroleum lubricants, synthetic lubricants and vegetable oil based lubricants. Additives are blended into these base fluids to impart properties that are needed and wanted by the ultimate users.

Petroleum based mineral oils dominate the market, comprising over 95 percent of total lubricant consumption. Projected annual growth of mineral oil lubricants is about 1.5 percent. Worldwide supply of these lubricants is more than adequate to meet demand for at least the next five years. Their costs, however, may be on the rise driven by the need for higher quality stocks and capital investment directed toward refinery upgrading. (2)

Synthetic lubricants account for less than two percent of the total market, but are expected to grow two to four percent over the next several years. Leading synthetic manufacturers are Mobil, E.F. Houghton, Burmah Castrol, Exxon, Royal, Amsoil, BASK and Henkel. Synthetics currently cost four to eight times more than mineral oil based lubricants. The five major chemical classes

or synthetic lubricants are: poly-alpha-olefins, polyalkylene glycols, polyol esters, diesters and phosphate esters. (3)

The higher costs of synthetic lubricants can be justified where the use of conventional lubricants is ruled out by regulatory, toxicity or environmental considerations. The general move toward more environmentally friendly products that meet these considerations is fast gaining speed says Exxon spokesman, Richard Leach.

The general order of biodegradability for common lubricants in decreasing order (from most degradable to least degradable) is presented in Table 1.

Table 1:
Lubricant Biodegradability

Vegetable Oils
Synthetic Esters
Mineral Oils
Alkylbenzenes
Polyalkylene glycols (PAGs)
Poly-alpha-olefins (PAOs)

Ester based lubricants readily degrade and lubricate better than vegetable oils. However, high costs -- about 50 percent higher than a vegetable based product-limit their use. Vegetable oils are becoming more important because they are plentiful and cost less than esters or synthetic fluids. (4) Oils from the rapeseed plant have generated new, environmentally acceptable lubricants such as Mobil's branded products, EAL 100H and 200H series oils. Mobil is currently the only dominant firm marketing a line of environmentally acceptable lubricants in the U.S. Smaller, specialty manufacturers market "friendly" hydraulic oils, and Shell and Texaco market "green" products In Europe.

The vegetable oil based lubricants are suited for practically any type of pump or valve. It must be noted that although they can be appropriate alternatives for conventional lubricants, they are not exact replacements. Superior performance can be demonstrated with different base stocks and additives, but some limitations must be recognized. They include:

1. Vegetable oils gel (solidify) at low temperatures. This may present serious implications for use and storage in cold conditions.
2. At high temperatures, vegetable oils tend to oxidize. This may shorten a lubricant's life and require monitoring of fluid condition. (If the lubricant has good dispersant and detergent characteristics, the elevated oil oxidation will not leave harmful deposits in the system.)
3. Pumps running on European, rapeseed based lubricants have worn excessively above 5000 psi. It has been theorized that such high loads break down triglycerides into acids, which attack non-ferrous metals within some pumps. Although most vegetable based lubricants have tested "compatible" with steels and copper alloys, there is insufficient data to draw conclusions on their compatibility with nonferrous metals at high temperatures and pressures.
4. Vegetable based lubricants darken if exposed to light. Photosensitive lipids, fatty materials contained in oil, absorb UV light and change color (much like human skin "tans"). Although this may not change the lubricant's physical characteristics or performance, regular sampling and testing of the fluid may be necessary.
5. Water and /or bacteria may enter the system and degrade the vegetable oil based lubricant. Given the right conditions, bacterial growth may cause color change, odor problems and loss of performance.

6. If high- detergent, high dispersancy diesel engine oils have been used for lubrication, systems may have to be thoroughly flushed with conventional turbine-type or low - additive hydraulic oils before converting to vegetable based lubricants.
7. Vegetable oil based lubricants may be two to three times more costly than petroleum based lubricants.

Conclusions:

Growing environmental awareness and the prospect of more stringent regulations regarding petroleum products use have spurred renewed interest in the manufacture of vegetable oil lubricants. Product performance will likely be more critical to success than competitive price, especially in areas where regulations mandate their use or in industries that seek to avoid costly remedial clean ups. Markets that offer significant potential include:

1. Lubricants for use in agricultural, forestry or off highway equipment, submersible or vertical line shaft pumps and elevators.
2. Lubricants for two and four stroke engines used in motor boats, jet skis, wave riders, etc.

LUBRICANTS ENVIRONMENTAL THREATS OR OPPORTUNITIES

There is no universally accepted definition for environmentally acceptable lubricants. (5) However, the American Society for Testing Materials (ASTM) has formed a subcommittee to establish standards for environmentally safe lubricants. Both petroleum and non-petroleum based lubricants will be included in the standards. The subcommittee first met December 5-10, 1993 in Dallas, Texas. Information regarding the progress on the standards can be obtained from the Industrial Agricultural Products Center at the University of Nebraska-Lincoln. (6)

Mobil Oil Corp. has coined the phrase Environmental Awareness Lubricants (EAL trademark) to identify its lubricant products (produced by Calgene, Inc., Skokie, Illinois) that reduce damage to environment. In lieu of ASTM standards, Mobil's EAL trademark products meet and pass the aquatic toxicity and biodegradability standards established by both the Environmental Protection Agency (EPA) and the European agency, the Organization for Economic Cooperation and Development (OECD).

Mobil measures biodegradability by following the procedures in EPA 560/6-82-003 and OECD 301. These tests monitor the conversion of the test material carbon to carbon dioxide. To pass, at the product must biodegrade in 28 days. (7)

Mobil assesses aquatic toxicity by following the procedures in EPA 560/6-82-002. This test measures the number of trout fingerlings who survive a minimum 100-ppm injection of oil for 96 hours in their tank. To pass, at least 50 percent of trout fingerlings must survive, and the product is considered nontoxic. Whether the ASTM will follow Mobil's lead and adopt similar standards is unknown.

Most synthetic and mineral oils are inherently biodegradable. This means that they eventually degrade and do not persist in the environment. However, they are generally toxic, and their

biodegradation time may be quite lengthy. For instance, mineral oils can persist in the environment up to three years. Consequently, the search for more easily biodegradable lubricants is important, and opportunities for more environmentally friendly products do exist especially as the EPA has stepped up its efforts to address nonpoint source pollutants.

By 1986, the EPA had determined that our nation's remaining water quality problems were largely attributable to pollution from nonpoint source. The EPA's definition of source pollution states:

Nonpoint source(NPS) pollution is caused by diffuse sources that are not regulated as point sources and normally is associated with agricultural, silvicultural and urban runoff, runoff from construction activities, etc. Such pollution results in the human-made or human-induced alteration of the chemical, physical, biological and radiological integrity of water. In practical terms, nonpoint source pollution does not result from a discharge at a specific, single location (such as a single pipe) but generally results from land runoff, precipitation, atmospheric deposition or percolation. Pollution from nonpoint sources occurs when the rate at which pollutant materials entering water bodies or ground water exceeds natural levels. (8)

Because of the difficulty in regulating NPS pollution, the EPA's Office of Water is stepping up efforts to reclassify concentrated, nonpoint sources (such as feedlots) as point sources. Reclassification subjects these former nonpoint sources to regulation and liability. Public perception of ground water contaminants has been the catalyst to stimulate reclassification. (9)

For instance, public opinion polls conducted by the by the Conservation Foundation found that the majority of respondents felt contaminated drinking water is a serious problem and that standards for its protection are not strict enough. (10) Proactive states that respond quickly to public attitude, such as Vermont and Wisconsin, have published advisories about the risks of submersible pumps that contain oil with polyaromatic hydrocarbons (classified as carcinogens by the World Health Organization).

Hence, in many applications a readily biodegradable and nontoxic lubricant *is* preferable to current options, especially where the product is introduced into nature used on or near navigable waterways or used near potable water systems. Although a few states have investigated the issues regarding lubricants and ground water, according to Mr. Jimmie Powell, a professional staff member of the Senate's Environment and Public Works Commission, it is a non-issue at the federal level at this time.

The U.S. government is directing regulations and financial resources toward regions where degraded soils and polluted water are severe. Salinization, compaction and loss of biological diversity are high on the federal environmental agenda, according to Dr. S.S. Batie , chairman of the National Research Council's Board on Agriculture.

The board is calling for new national policies and new approaches to farming to address the soil and water problems caused by agriculture. The board has concluded that increased attention should be given to prevention of surface and groundwater pollution through more effective use

of fertilizers, pesticides and irrigation. Dr. Batie suggests that, "The nation should look to new agricultural practices that will both protect the environment and help farm productivity." (11)

This bodes well for stricter federal environmental mandates that may eventually embrace the broader issues such as toxic lubricants and biodegradable lubricants. However, it is quite likely that the dominant firms in the lubricant industry will continue to delay introduction of such products. Instead, they are letting smaller firms shoulder the risks (and, perhaps reap the rewards) of innovation and will enter the market as fast second when the market heats up.

Examples of the smaller firms who are trying to benefit from innovation and early entry include Husqvarna, International Lubricants, Inc. and Renewable Lubricants, Corp. Synopses of their stories follow:

- News of Austria's ban on non-biodegradable chainsaw lubricants spurred Husqvarna, a manufacturer of chain saws and other forest equipment based in Charlotte, NC, to introduce a new, sunflower-oil based lubricant called ProForest. Spectrum, an oil blender in Hornsby, TN, formulates and packages the lubricant for Husqvarna. Husqvarna will distribute and sell the product through its dealerships. It is packaged in cartons containing six, one-gallon plastic bottles. The suggested retail price for a one-gallon container is $8.99 (12).
- International Lubricants, Inc. of Seattle, WA, has ten patents on rapeseed and crambe oil based compounds used for gear fluids , hydraulic fluids, cutting oils, etc. Their product's distinctive advantages include superior performance from linear liquid wax compounding and a lack of hydrocarbon additives (which make disposal difficult). International Lubricants Inc. blends the raw materials and packages the products in 2.5 gallon bottles, 55 gallon drums and tank trucks for distribution by oil marketers around the U.S. (13)
- Renewable Lubricants Corp. in Hartville, OH, is formulating hydraulic fluids, motor oils and diesel conditioners from canola (rapeseed) and sunflower oils. Clark Oil and Chemical in Cleveland, OH, mixes and packages the formulations which can include additives from six different additive manufacturers. Renewable Lubricants Corp. is formulating products for the Japan External Trade Association and the National Corn Growers Association's funny car racer, Mark Thomas. Since the October 1993 low sulfur diesel fuel regulations, Renewable cannot keep up with demand for their diesel fuel conditioner which adds lubricity, provides uniform spray patterns and enhances start-up. Renewable has worked closely with Lubrizol and Pennsylvania State University to test their product's performance before commercialization. Renewable currently packages products in 55 gallons drums (14).

Dominant firms do innovate, of course, as Mobil has with EAL (trademark), but empirically this is the exception rather than the rule. Generally, dominant firms in a tight oligopoly either purchase the smaller, innovative firms to enter the market or have a similar product waiting in the wings that will be launched with extensive price and promotional support to quickly supplant the smaller innovators (15).

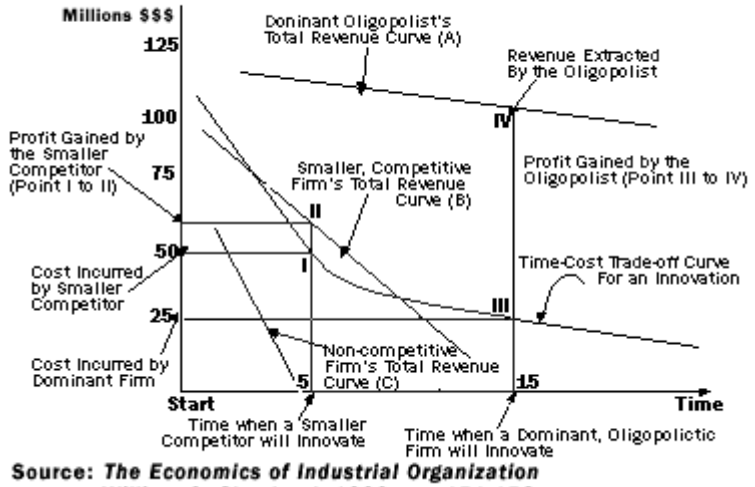
Conclusions:

The relatively large number of small innovators who are entering this market reinforces economic theories of oligopolistic industries and, subsequent, slower innovation or fast second behavior. This poses risk for early, smaller entrants who are trying to exploit technological opportunity with a product that may be easily copied. The risk is magnified by Mobil's commercialization of biodegradable products. Since innovations involve both time and cost, a time cost analysis can illustrate the smaller firm's risks and benefit limitations.

Time-cost trade-off curves vary for each specific innovation, but economists assume that its general shape is likely to be as shown in Figure 2. Innovation can be done quickly with an enormously expensive research and development program. It can be done at any speed in between along the smooth, trade-off curve.

The figure depicts two alternative innovators, a dominant, oligopolistic firm and a competitor with small market share. The total revenue curves have been drawn to illustrate the most likely general conditions. they may differ in location, slope and shape from innovation to innovation, but generally a dominant firm will have a higher, flatter curve than any small rivals. (The numbers are derived from a complex example of the time-cost trade-off presented by F. M. Scherer in the 1967 Quarterly Journal of Economics. They are assumed to be given and are strictly illustrative.)

Figure 2: An Illustration of Time, Costs and Benefits for an Innovation (A Dominant Firm Compared with a Small Competitor)



Source: *The Economics of Industrial Organization*
William G. Shepherd, 1990, pp. 151-152

The figure shows that a dominant firm is able to gain the benefits of an innovation over a long future period. The total revenue curve labeled (A) illustrates the revenues that this firm can obtain from an innovation. The curve is high to reflect the large size of revenues, and its slope is slight because the dominant firm has little fear that larger rivals will pursue the innovation and capture its future revenues. Therefore, the dominant firm can reap most of the revenues even if it:

1. innovates more slowly,
2. becomes a "fast second," or
3. interferes with innovation to protect the value of its existing technology.

This is not the case for the smaller competitor. It obtains smaller benefits because it starts out as a smaller firm and faces the risk that other manufacturers may imitate quickly and capture revenues. Therefore, the smaller firm's revenue curve (B) is lower and more steeply sloped. It is barely above the time-cost trade-off curve for a few years. (An even smaller firm might have the total revenue curve (C) which is entirely below the time-cost curve. A firm in this situation cannot probably make this innovation and is non-competitive.)

Each firm will maximize its profits where the marginal cost and revenue values are equal. This occurs where the slopes of the time-cost and total revenue curves are equal. At those points, the net profits (the vertical difference between the curves) are maximized. For the dominant, oligopolistic firm, this time is shown as fifteen years. For the smaller, competitive firm the time is much shorter, shown as five years, and the cost is that of the dominant firm ($50 million, as opposed to $25 million). The smaller firm charges its customers $60 million and garners a meager $10 million profit, compared to the dominant firm's $75 million. The dominant firm is able to reap a larger revenue ($100 million) because it enjoys a high degree of market control (16). The smaller firm faces a smaller window of opportunity and substantial risk.

Lacking federal government mandated change, any firm producing an environmentally superior product (such as biodegradable, vegetable oil based lubricants) faces several realities.

First, it is imperative that the products perform as well as or better than existing lubricants. This implies knowledge of the ultimate consumers' wants and needs and product performance that exceeds their expectations.

Second, early success may be most easily achieved by marketing the products:

1. in those states that have already moved to lubricants, e.g., in Florida, where hydraulic elevator oil has been classified as a pollutant and hazardous material, or
2. to a niche market that would perceive personal benefit (elimination of potential carcinogens), e.g., drinking water wells.

Third, the global trend toward environmentally friendly products is still heating up, and the odds for a "green" product's success are very good. The "green" products that may not be economically viable now, may be tomorrow's profit maximizers.

IRRIGATION PUMP LUBRICANTS- THE DRIP OIL MARKET

The U.S. Department of Agriculture's Cooperative State Research Service and the Department of Defense have initiated a cooperative program called "Advanced Materials from Renewable Resources." The program seeks to develop domestically produced industrial products for both national defense and the commercial marketplace made from renewable resources supplied by American agriculture.

The program has funded research on lubricants based on rapeseed (canola), crambe, castor, lesquerella and jojoba oils for use as gear oils, cutting oils, transformer oils, hydraulic fluids and oil dispersants. The Alternative Agricultural Research and Commercialization Center estimates

that the value added do these products is three to five times the cost of material. The center has no data on irrigation pump drip oil.

Since 1992, the Industrial Agricultural Products Center at the University of Nebraska-Lincoln has been investigating the use of a soyoil based lubricant to displace the use of petroleum based drip oils for irrigation pumps. Lubricant sales and consumption figures splitting out drip oil statistics are not available, but the January/February 1993 Irrigation Journal reports that there were approximately one-half million vertical line shaft pumps irrigating and sprinkling 83 million U.S acres in 1993(17).

If each of those pumps used five to seven gallons of drip oil per season, national consumption figures would range from 2.25 million to 3.15 million gallons of drip oil per year. If 100 percent of petroleum drip oil was displaced by soyoil, 1.68 to 2.36 million bushels of soybeans would be consumed to produce the product.

(The conversion formula is presented in Table 2.)

Table 2: Statistical Conversion

Bushel of Soybeans	=	10.7 lbs of crude soyoil
10.7 lbs of crude soyoil	=	171.2 ozs of crude soyoil
171.2 ozs of crude soyoil	=	1.3375 gals of crude soyoil

Realistically, Mobil oil has forecast a U.S. market or 2.5 million gallons for all biodegradable lubricants by 1995 (18).

National introduction of biodegradable lubricants is feasible for a dominant firm, like Mobil. For smaller firms, niche segments--such as irrigation pump drip oil consumers--and regional introduction into areas that have a high concentration of vertical line shaft well pumps would be more manageable and enhance the chances for success. Table 3 lists the states that meet these criteria in alphabetical order.

Table 3:

STATE	#IRRIGATION WELLS	% VERTICAL LINE SHAFT	AVERAGE DEPTH
Arizona	4,000	100	800'
Arkansas	36,300	70	120'
California	140,000	N/A	200'
Colorado	23,000	N/A	240'
Florida	58,300	N/A	100'
Georgia	7,300	80	300'
Idaho	7,500	100	275'
Iowa	2,400	92	160'
Kansas	23,091	99	245'
Louisiana	6,100	90	125'
Minnesota	3,900	80	110'
Missouri	4,300	93	650'
Nebraska	75,329	97	190'
New Mexico	7,800	85	180'
North Dakota	1,050	90	150'
Oklahoma	6,000	N/A	285'
South Dakota	N/A	96	120'
Texas	101,000	75	250'
Utah	1,844	97	272'
Wyoming	2,530	95	150'

Notice that some of the regions post enticingly large numbers of wells. But, it's important to remember that consumer needs are not uniform across states. Therefore, the numbers represent various market segments of differing extent. Diverse weather conditions and dissimilar farm sizes account for the biggest differences.

For instance, in western Nebraska wider temperature variances, less rain and larger farms call for different product performance ranges, packaging and distribution channels. Here, many drip oil dealers are petroleum jobbers who deal in 1000 gallon tank bulk shipments. Although all commercialized lubricants used for drip oils contain anti-wear additives, lubricants bound for use in colder or hotter temperatures may require additional additives to maintain optimal viscosity. For instance, Phillips 66 jobbers have found that Magnus 22 trademark turbine oils run too fast when the weather is hot, but Magnus 32 trademark works just fine.

Because the demands of the market segments are so different, an overview of the entire drip oil market structure becomes muddled and complex. Therefore, profiles of Nebraska drip oil retailers and jobbers are more illustrative of the challenges that my face potential manufacturers of biodegradable lubricants considering market entry. Synopses of interviews with Wheelers and Farmland retailers, a Whitehead Oil jobber and an Amoco/Mobil wholesaler follow:

- Wheelers are moderately large, self-serve agricultural supply stores. They are part of the Con-Agra conglomerate. They are generally located in rural communities, and their merchandise varies from clothing to pet supplies to lubricants to farm implements. Wheelers in Lincoln, NE, sells one grade of private branded drip oil to the low-volume user packaged in 2.5 gallon bottles for $12.20 ($4.88/gallon). When asked what Wheelers' customers most wanted in a drip oil, the manger did not know.
- Farmland retailers are located on or near the co-operative grain elevator sites in rural communities. They pump massive amounts of diesel fuel, sell tires and service the automotive and farm machinery needs of agriculture.

  Farmland sells two grades of private branded drip oil, regular and economy. Regular, ISO 32, is the best seller. Farmland in Waverly, NE, sells only the regular grade, packaged in a 5 gallon "case"-two, 2.5 gallon bottles wrapped together-for $19.36 ($3.87/gallon). Farmland in Aurora, NE. sells both grades, but mostly in bulk. To encourage bulk sales, this Co-op sells the 5 gallon cases for $4.86/gallon (regular) and $4.34/gallon (economy); over 30 gallons for $3.45/gallon(regular) and $2.30/gallon (economy).

  When asked what their customers most look for in a drip oil, the Waverly store manager said. " Some drip oils just don't flow for (expletive deleted)! Farmland's does a good job."

- Whitehead Oil jobber, Mr. Dennis Kirby, of Phillips 66 in David City, NE, sells the nationally branded, Phillips Magnus 32 (trademark) turbine oil for drip oil. He said that the farmers want a "good price". Mr. Kirby sells 5 gallon buckets of Magnus 32 (trademark) for $23.80 ($4.79/gallon) and 55 gallon drums for $194.70 ($3.54/gallon).
- Salem Oil in Lincoln, NE, is an Amoco/Mobil wholesaler. Salem sells biodegradable Mobil EAL (trademark) lubricants and Amoco American petroleum based lubricants.

Salem Oil has received only one drum of EAL 224 H (trademark) hydraulic oil, and there have been no orders for the lubricant. The lubricant costs Salem $7.44/gallon in a 55 gallon drum. Salem would sell it to a jobber for $7.69/gallon, and the ultimate user would pay approximately $8.19/gallon for the product. Mr. Chuck Salem commented that "some (people in the industry) have said that this (biodegradable lubricants) wasn't a good idea for Mobil."

Salem's biggest selling drip oil is Amoco branded, American #32 (trademark) Amoco American #32 (trademark) does not contain zinc, which may be particularly harmful to the environment. sales sells American #32tm to jobbers and retailers for $2.50/gallon. The ultimate consumer usually pays between $3.25 to $4.00/gallon depending on the quantity discount. Mr. Salem mentioned that quantities of 1000 gallons delivered in tanks is not uncommon in western Nebraska, compared to 1000-3000 gallon deliveries in Texas.

Salem said that their customers are looking for a quality product with anti-wear and lubricity additives. Salem Oil's move to offer the anti-zinc blend was not generated by their customers, but from the firm's internal concern for improving the environment.

Drip Oil Lubricants--Product, Price, Place and Packaging

PRODUCT--Drip oil is marketed as both a private branded drip oil and a nationally branded lubricant used for drip oil. Some manufacturers offer different grades of drip oil, but a product comparable to an ISO 32 lubricant is the most common. Consumers look for anti-wear additives, lubricity and viscosity additives and quality for the price.

PRICE--Prices across Nebraska obtained in the aforementioned interviews ranged from a low of $2.30/gallon for an economy oil to a high of $8.19/gallon for a biodegradable lubricant. Table 4 lists the price variances by product across Nebraska. Price variances are broadest at the low end because there are few sellers and little demand. The meager spread of $1.58 from highest to lowest retail price for the most popular product suggests that customers "price shop" the product and that sellers must be aware of, and close to, competitors' prices to garner sales.

Table 4: Drip Oil Price Variances By Product

PRODUCT	LOW PRICE	HIGH PRICE	VARIANCE
Economy	$2.30/gal	$4.34/gal	$2.04/gal
Regular	$3.30/gal	$4.88/gal	$1.58/gal
Biodegradable	$7.44/gal	$8.19/gal	$0.75/gal

(NOTE: Do *not* compare this variance to the differences in prices of a gallon of diesel fuel or gasoline. This variance is more comparable to the spread between the prices of a quart of Quaker State or Pennzoil motor oil where the comparable difference would be approximately $0.39/quart.)

PLACE-Drip oil is distributed by

1. large conglomerates, such as Con-Agra, for self-serve sale in retail stores;

2. by huge farm co-operatives, such as Farmland, for self-serve sale and delivered sale from retail petroleum product outlets, and
3. by conventional petroleum product wholesalers who sell the drip oil to jobbers who may be retailers or who sell to other retailers.

PACKAGING--As previously noted, drip oil comes packaged in 2.5 gallon bottles, 5 gallon buckets, 55 gallon drums and bulk tankers. the 2.5 gallon bottles are the most appropriate for self-serve in retail outlets. The 55 gallon drums are frequently refilled at a petroleum products outlet, but caution must be taken to ensure that the drums are scrupulously clean. Price and suppliers for the packaging containers are myriad. Prices from the House of cans (sic), Inc. in Lincolnwood, IL, follow in Table 5. They are a representative example of packaging costs.

Table 5:

Product	Qty. Per Case	Price Per Case	Price Per Unit	DOT Specification
2.5 Gallons Plastic Container	15	$ 46.50	$ 3.10	DOT 2U
5 Gal. Plastic Can	12	46.68	3.89	Not Given
5 Gal. Plastic Jug	36	223.56	6.21	DOT 34
5 Gal. Plastic Pail	36	158.04	4.39	Not Given
5 Gal. Closed Head Pail	36	223.56	6.21	DOT 34
55 Gal. Plastic Drum	16	768.00	48.00	DOT 21C

It is noteworthy that food grade soyoil is generally packaged "by the pound," as opposed to "by the gallon." For example, Pegler-Sysco Food services based in Houston, TX, sells food grade oil in 35 pound or 50 pound plastic jugs. Ed Miniat, Inc., a vegetable oil broker in Chicago, IL, sells 50 pound boxes of soyoil for $ 17.00. The corrugated box surrounds an approximately 6.25 gallon soft sides bottle for ease of pouring. Miniat also sells 40 pound boxes of soyoil(approximately 5 gallons) for $14.24.

Besides conventional packaging, distinctive product differentiation can be created through innovative design. For instance, Magnum Manufacturing in Holyoke, CO, is marketing an 11 gallon capacity drip oil reservoir that could be prepackaged with lubricant. The reservoir is constructed of UV resistant polyethylene and is equipped with brass fittings and adjustable tripod legs. It was designed by two farmers who sought to resolve drip oil lubrication problems. The problems that their drip oil reservoir system overcome are:

1. Currently farmers have to deal with a one gallon drip oil reservoir that has to be filled two to three times per week. The 11 gallon reservoir is enough oil to keep most pumps lubricated though a season.
2. To keep a steady drip oil measurement on the pump bearing, a control on the needle value has been added.
3. To allow contaminants to settle below the draw tube, a one gallon, cone-shaped sump on the bottom allows contaminants, water and foreign material to collect. A three-eighths inch plug in the bottom of the cone eases draining.
4. The larger capacity reservoir facilitates dripper operation in colder temperatures. (The larger the volume of oil, the less viscosity is affected by colder weather.)

5. The dripper has a six-inch diameter cap with an extra number of large threads that prevents contaminants from entering the reservoir, but allows enough air to enter to eliminate a vent hole. The vent hole invites dust, bugs and water to enter the oil reservoir.
6. The six-inch opening facilitates easy cleaning and easy refilling of the reservoir (19).

Distinctive product differentiation for a commodity-like product such as drip oil may allow a firm to command a premium price, sell more of a product at the going price or gain equivalent benefits such as greater buyer loyalty during cyclical or seasonal downturns or towards the purchase of other products (20).

Unique packaging itself does not lead to differentiation unless it is valuable to the buyer. If "environmental friendliness: is not particularly valuable to a drip oil buyer--but the elimination of costly repair to a pump because of poor bearing lubrication is --then the wise (and successful) drip oil manufacturer will raise its product performance through differentiation. It is important to remember that differentiation encompasses quality , but it is a much broader notion. Quality encompasses the physical product. Differentiation creates value for the consumer beyond the physical product (21).

Conclusions:

The drip oil is composed of more buyers who purchase small quantities of product and fewer buyers who purchase large quantities of product. Therefore, profits will not be garnered by high volume, low priced sales, but by offering consumers enhanced product value through distribution, packaging and product performance. Firms who are able to deliver the above three criteria have found that consumers are willing to pay premium prices for products when the consumer's overall costs in terms of personal time, maintenance time, repair time, etc., are lowered.

Every firm is a collection of activities that are performed to design, produce, market, deliver and support its product. Performance, in relation to the competition, is at the core of every firm's success or failure. The fundamental basis of a successful performance is sustainable competitive advantage.

The notion of competitive advantage requires a firm to make a choice based on the industrial structure and environment. The choice is simple--can the firm sustain cost leadership in this industry, or can it sustain product differentiation? Ultimately, the choice is to each individual firm. Does the collective strength of the dominant firms in the lubricant's industry narrow the choice to differentiation? Yes, unless a new entrant can sustain lower costs at their same level of service, distribution, performance and promotion.

FOOTNOTES

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