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VEGETABLE OIL FOR LUBRICATING CHAIN SAWS

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INTRODUCTION

To work properly, chain-saw chains and bars must be lubricated. In the past, most operators have used petroleum-based oils. When a chain saw is used, virtually all of the lubricant ends up in the environment. Every year, thousands of gallons of chain-and-bar oil are carried into the forests and none returns.

The demand for environmentally acceptable products is growing rapidly. There is increased concern about the influence of petroleum-based oils on the environment. Also, exposure to petroleum-based oils can have adverse health effects on users. One potential alternative is the use of "environmentally compatible" or "eviro-friendly" oils that are produced from vegetables. To achieve this classification, an oil must be nontoxic and must biodegrade rapidly if spilled. Rapeseed-based (usually called canola) oil is currently the most common environmentally compatible chain-and-bar lubricant.

BACKGROUND

Vegetable-based oils are triglycerides or natural esters that come from agricultural crops. These oils are natural products and therefore their chemical composition varies somewhat from one crop to another.They have some undesirable characteristics. Their cold-temperature properties and oxidation stability are their main disadvantages compared to petroleum-based oil, and additives are needed to overcome these problems. Vegetable oils have many good natural properties including good lubricity, good resistance to shear, high flash point, and high viscosity index. Vegetable oils vary in price but, in general, are about twice as expensive as petroleum-based oils.

Modern vegetable-based lubricants first appeared in the marketplace in Europe in the mid-1980s. The acceptance and use of these products, particularly in the European forest industry, is widespread and growing. The two main reasons for this are concerns about workers' occupational safety and health and environmental protection.

Petroleum-based oils are known carcinogens and medical records show that they cause discomforting eczema and oil acne. In addition, prolonged exposure to petroleum-based-oil mist can cause irritation of the respiratory tract. Environmental damage caused by petroleum-based oil spills has had extensive attention from the media.

The benefits of using vegetable oils are well known in Germany, where there are about 80 brands available, and in the Scandinavian countries. In Austria, all petroleum-based chain saw oils have been banned. The Coordinating European Council (CEC) has established a test methodology for biodegradability. This test standard (CEC-L-33-T-82) measures the amount of oil that biodegrades over a 21 day period. (Cautionary Note: Some products show CEC on their product labels and all this means is that it contains some portion of biodegradable material but may contain mineral oils or mineral-based additives. It is best to find out what percentage of the total product will biodegrade in 21 days.)

Readily biodegradable, petroleum-free lubricants based on canola oil—including hydraulic fluids, greases, motor oils, concrete release oils, two-cycle oils, and chain-saw oils—are now available commercially in North America. Canola oil is a renewable, sustainable farm product. Manufacturers claim that these products are rapidly biodegradable, nontoxic to the environment, and safe for operators and mechanics.

Canola-based chain-and-bar oil has been extensively tested in Europe. It has excellent lubricating properties and some studies have shown up to 40 percent reduction in consumption without sacrificing bar and chain life. Most high quality or "professional" chain saws have sophisticated chain oilers that are more

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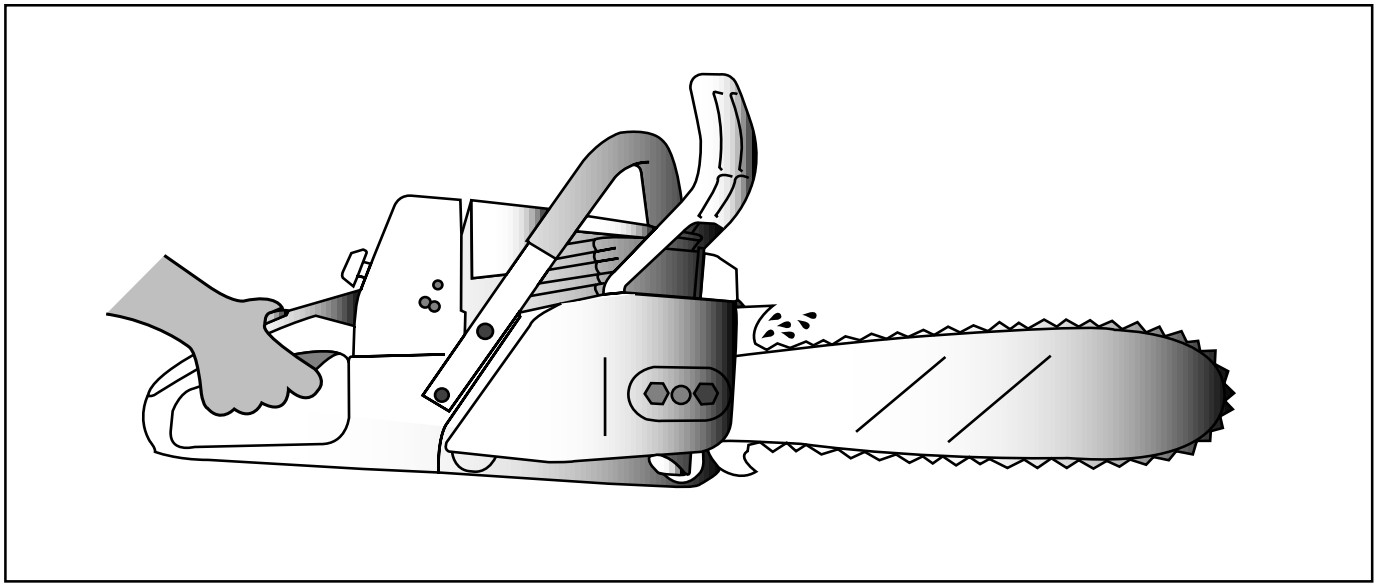

Figure 1.—Chain-saw chains and bars must be lubricated. Virtually all of the lubricant ends up in the environment

efficient and have the capability of controlling the amount of oil being used, see figure 1. Manufacturers and some users claim that there is a potential for extended bar and chain life when using canola-based products because it lubricates and adheres to metal better than petroleum-based oils.

Canola-based chain oils have low vapor pressure, which reduces inhalation of fumes by users. Its composition is similar to human skin oil and this can reduce skin irritation and eczema for operators and mechanics. Tests have shown that canola-based chain oils provide good performance down to -25 degrees C but storage can affect the pour point temperature (they may not pour easily after standing for several days at -30 degrees C). Generally, vegetable-based oils have higher flash points than petroleum-based products.

FERIC STUDY

The Forest Engineering Research Institute of Canada (FERIC) tested and reported on field trials of a vegetable-based oil for lubricating chain saws. (See FERIC General Field Note Number 35.) They conducted two trials, one with chain saws on a conventional manual falling operation and the other with chain saws on Rottne single- and double-grip harvesters on a shortwood mechanical harvesting operation. The climatic conditions on the two tests were different as the hand falling took place in a wet, temperate Coastal rain forest while the mechanical harvesting experienced sub-zero temperatures. Both trials used an oil called Binol that is produced in Sweden by Karlshamns AB. This chain oil is canola-based with additives and the manufacturer claims that the product (oil and additives) is nontoxic and biodegradable (degrading 97 percent in 21 days.)

The overall results were positive. Users reported that the vegetable-based oil was easier to clean from clothes and equipment, and that they experienced less skin irritation. Rottne harvester operators noticed a significant reduction in the oil mist that collects on the machines' windows due to the cleanliness of the Binol compared to petroleum-based oil and due to the reduced consumption of oil.The operators claimed a 60 percent reduction in consumption, however, the manufacturer does not recommend this large of a reduction. They also claimed that Binol increased the life of the bar and chain but the hand fallers reported no noticeable change. The coldest temperature during the trial was -22 degrees C and there were no lubrication-related failures.

The vegetable-based oil performed satisfactorily in both trials. FERIC reported that Binol costs about twice as much as mineral oil, but when taking into account the manufacturer's recommended 40 percent reduction in consumption, the cost increase over mineral oil is around 20 percent. They noted that the potential for extended bar-and-chain life may offset this cost. The report concluded that even with the increased cost,

the benefits for workers and the environment make vegetable-based oils an attractive alternative.

FOREST SERVICE FIELD TRIAL

A limited field trial of three vegetable-based chain oils was conducted by Winston Rall on the Wind River Ranger District of the Gifford Pinchot National Forest. Rall has a great deal of interest in and experience with chain saws and is the lead instructor for chain-saw training and certification in Region 6, see figure 2. He tried vegetable-based products from Greenland Corporation, Green Oil Company, and Stihl.

Figure 2.—Forest Service employee operating chain saw.

All of the vegetable-based oils performed adequately in these limited field trials. While these trials were by no means scientific studies, some opinions from an experienced sawyer are worth noting. Starting with new bar and chain, Rall could see no difference in the amount of wear shown on these components (and after using one of the vegetable-based oils, he felt that the bar showed more wear than expected.) He noted that the oil was difficult to see—good for aesthetics and the environment, but somewhat disconcertingforthe operator. Rall would not recommend using these products in a fire situation such as bucking burning logs because it appeared that the oil comes off or evaporates in extremely hot conditions. (Petroleum-based oils also have problems with these conditions.) Rall was pleased that he saw no oil sheen "rainbows" in puddles or rainy weather and that the oil was less noticeable following cutting operations. Rall recommends using these products, particularly when environmental protection is important, in work such as streamside restoration, and in areas where aesthetics are a concern, such as public recreation sites and hiking trails. Please bear in mind that these observations and opinions are based on very limited field trials.

CONCLUSION

The information contained in this publication is based on background investigations, literature searches, and consultations with technical specialists. Based on this and limited field observations, vegetable-based chain-and-bar oils are an attractive alternative to petroleum-based oils. The cleanliness and non-toxic characteristics of the vegetable-based oils make them worth trying. Chain-saw users that are conscious of their impact on the environment should use these environmentally-compatible oils instead of conventional petroleum-based chain-and-bar oil.

INFORMATION

The information in this publication is for the use and convenience of Forest Service employees and does not constitute an endorsement by the Technology and Development Center or the U.S. Government of any product to the exclusion of others that may be suitable.

Additional information on vegetable-based chain oils may be obtained from the following suppliers (this list is by no means complete):

Mike Dowd
Greenland Corporation
Tel: 406-682-5237
Toll free: 888-682-6040

Ira Pierce
Green Oil Company
Tel: 215-542-8584
Toll free: 888-542-8584

Mark Hilliard
Stihl Incorporated
Tel: 757-486-9100

For further information on the Forest Service field trials, contact Winston Rall at 509-427-5646.