

## Sunflower oil runs diesel tractors

MINNEAPOLIS, Mn. — A third of a typical farmer's acreage used to be hay and oats to feed old Tag and Bess, the team that provided the power for fieldwork.

But now, say some researchers, you can logically begin to think about devoting as little as 10 percent of your cropland to growing sunflower; then squeeze the oil out of the seed produced and run your diesel tractor on it.

The dynamic new energy source is sunflower oil — also called sunoil or sunfuel. Research in North Dakota and other states is running full speed ahead on how-to-do-it details.

Known as far as that sunoil will work in a diesel tractor — you can actually substitute it 100 percent for diesel fuel and do your fieldwork. What isn't known, and toward which research at North Dakota State University and on North Dakota farms is being directed, is how long an engine will last running on sunoil.

Most researchers suspect pure sunoil won't work for very long, that what's best is to blend sunoil and diesel, plus perhaps make engine design modifications to accommodate sunoil.

"This new source of fuel — sunflower — will grow successfully just about anywhere, though they're now grown primarily in the Dakotas, Minnesota, and Texas," says Dick Schulte, Northrup King Co. sunflower product manager. "We're seeing an increasing interest in sunflower as a doublecrop alternative. Just think of growing one food crop... following it with a sunfuel crop... then using sunfuel to plant another food crop."

As a part of its recently launched "Keep Farming Profitable" program, Northrup King is promoting further exploration into the use of sunoil as an alternative fuel. As the petroleum-based diesel fuel gets more scarce and therefore higher priced, sunoil will look that much more attractive, according to Schulte.

Comparing sunflower oil with ethanol, it looks like the work involved in getting energy out of sunflower seed pays off more favorably. Just one unit of energy input produces up to five units of energy. And currently, sunflower produces more gallons of fuel oil per acre than other popular oilseeds. (Peanuts are an exception; however, production costs are nearly five times as great as raising sunflower.)

An acre of sunflower at average seed yield can produce over 50 gallons of sunoil: 1,350 pounds of seed; extract three-fourths of the 40 percent oil content, or 405 pounds of oil. Sunoil weighs 7.7 pounds/gallon, so you've produced 53 gallons of sunfuel. And researchers say that sunoil contains 94 percent as much energy as diesel fuel.

To boot, there'd be sunflower oil meal residue enough to provide the high protein supplement for a dairy or beef cow herd. Because of the high oil content, however, the

meal must be fed quickly before it turns rancid. Researchers recommend feeding under three pounds per animal per day.

An early attempt at burning sunflower oil in a farm tractor was made in the spring of 1980 by a North Dakota farmer. Farming 1,800 acres, the sunflower, corn and wheat grower bought a 55-gallon drum of sunoil and burned 35 or so gallons in an old John Deere he's used for years as a chore tractor.

"It ran well," he says "Some mornings the temperature was down to zero outside, but the engine started and ran fine I'd say I was running on 90 percent sunoil, because there was a little diesel in the fuel tank when I put the oil in."

He used the tractor for about three weeks on the sunoil, grinding feed and generally doing a lot of stopping and starting. He also burned about 18 gallons of the sunoil in his diesel-powered automobile, however with less success.

"About half the time it didn't want to start. After it did start, and got warmed up, it ran OK. I was probably burning about 50-50 sunoil and diesel fuel."

He's had no complications with either engine. He does point out these were only short-term tests. Problems may show up in long-term tests.

After conducting a year of research running sunoil in test engines and through diesel engine fuel pumps, Ken Kaufman, research ag engineer at North Dakota State University, Fargo, said he feels strongly that a sunflower oil/diesel fuel combination shows the most promise on a sustained basis in present-day diesel engines.

Says Kaufman, "You get a carbon buildup on injectors in the cylinder that can eventually bring about a change in the atomization of the fuel. Eventually the sunflower oil can get down into the crankcase oil and solidify it so that it doesn't lubricate well."

Kaufman points out that research work in the country of South Africa has contributed greatly to what is known about burning vegetable oils such as sunflower oil in diesel engines.

Research also is being conducted at Ohio State University, the University of Idaho, the University of Missouri, the University of Illinois, and the University of California-Davis.

Kaufman indicates the tests using a 50-50 sunoil and diesel blend look promising.

"There is no doubt you can burn sunflower oil in a diesel engine," he says. "We just don't know for how long, and what mixture ratios are best. We'll have a lot more answers after another year to year and one-half of work."

The engineer points out that sunoil is not yet as economical to burn as diesel fuel. On a gallon-for-gallon basis, No. 2 diesel fuel is selling (late April) for \$1.10/gallon, while crude sun-



Ken Tweten, Grand Forks, ND, farmer and president of Flower Power, Inc., a non-profit corporation testing sunfuel in actual on-farm situations, fills his test tractor from a tank with

the words "Sunflower Oil" posted on the meter. Actually, the fuel's a 50-50 blend of sunoil and diesel fuel.

flower oil's price is \$2.08. Two hundred proof ethanol, he adds, is selling for \$1.80/gallon.

Looked at on an energy output per gallon basis, diesel fuel at \$1.10/gallon is far the cheapest fuel. Kaufman calculates that 100,000 BTU's of energy as diesel fuel costs \$0.80; as sunflower oil \$1.59; and as ethanol \$2.14.

Sunil produced by a small on-farm oil expeller worth \$4,000 to \$8,000, according to figures prepared by the Department of Ag Economics at NDSU, would cost \$2.20 to \$4.01/gallon, depending on how the farmer figured costs.

In an attempt to answer the question on what ratio of sunoil and diesel fuel is best, an extensive on-farm test is under way in North Dakota under the cooperative effort of a non-profit organization called Flower Power, Inc., and NDSU.

According to Ken Tweten, Grand Forks farmer and president of Flower Power, Inc., the organization is testing 12 tractors in actual on-farm situations this crop season. By late April, 10 of the 12 tractors were actually in use on 10 different North Dakota farms, burning either 25 percent or 50 percent sunoil along with diesel fuel.

Tweten himself, farming 1,850 acres, of which 200 will be sunflower this year, is operating a model 2390 Case 160-horsepower row crop tractor, new at the start of the season. He's burning 50-50 sunoil and diesel, and comments, "I can tell no differences yet — no misfiring, no hesitation, good power. We haven't cleaned the fuel filter yet (25 hours)."

It is expected that each of the 12 tractors on test, varying in size, will be operated about 600 hours each. Then, engines will be torn down and carefully studied. Engineer John Walter at NDSU is heading up the university's effort to support the 12-tractor experiment, considered complementary to on-campus lab research.

Tweten is optimistic about the future of sunoil as tractor fuel. "I believe it will be useful as an emergency fuel, if the Arabs cut us off completely. Also, sunoil as fuel might increase the price of sunflower seed in a depressed market situation."

Tweten doesn't foresee himself making sunflower oil on his own farm with a small expeller. "Eventually," he says, "a medium-sized commercial production plant might be the most economical way to produce sunoil."

Ag economist LeRoy Schaffner at NSDU currently is evaluating the economic feasibility of a community-sized sunoil production

plant. Processing 25 or more tons of seed a day, such a plant could be owned cooperatively, he says, and investment for machinery alone would be approximately \$200,000 to \$250,000.

Daily production from such a plant could be 2,600 gallons of sunoil. The average North Dakota farmer, according to Schaffner, uses 3,600 gallons of diesel fuel a year, so operated 240 days a year, the small community plant could serve 175 or more farms, depending on the ratio of sunfuel and diesel used.

Such a plant would still not yet produce sunfuel competitively to diesel fuel at present-day prices.

Sunflower breeding research by companies may eventually help bring down the cost of sunoil.

According to Northrup King Company's sunflower research director Steven Shein, the outlook

is good for new hybrids that will increase sunoil production per acre via increased seed production and increased oil content percentage in the seed.

"While seeds from present-day hybrids contain 40 to 45 percent oil, some of our experimental hybrids have oil content levels in the low 50's," he says. "And oil content is not the only characteristic we're working with. We also must have high yield potential, resistance to diseases, and tolerance to insects."

The seed researcher feels there is good potential for improving oil output per acre, and feels that the development of hybrid sunflower "is about where hybrid corn was in the early 1940's."

"The genetic potential of sunflower is largely untapped," he says.

## Students present prize-winning papers

NEWARK, Dela. — Two University of Delaware graduate students took both "best paper" awards in stiff competition against other entries at a recent meeting of the Potomac Division of the American Phytopathological Society in College Park, Maryland.

Papers by Steve Leath and Mary Lou Casadevall-Keller were among 26 presented by plant pathology graduate students, most of them from the Mid-Atlantic area.

Leath and Casadevall-Keller are both candidates for master's degrees this spring.

It is very unusual for the same institution to get both awards, says Dr. Charles R. Curtis, head of Delaware's department of plant science and past president of the Society's Potomac Division.

Papers were judged for purpose, research rationale, procedures and approach, experimental design, quality and quantity of data, and conclusions, as well as organization and visual presentation.

Leath's paper described a new technique he developed with his advisor, Dr. Robert B. Carroll, for screening soybeans for resistance to Fusarium wilt disease.

Casadevall-Keller reported on her study of the genetics of virulence and toxin production in two bacteria harmful to plants. The advisor for her project was another Delaware plant pathologist, Dr. Myrolyn Sasser.

Leath, who spent two months this winter showing vegetable farmers in Panama how to identify and control potato diseases under an international agriculture Title XII exchange grant, plans to continue his studies at the University of Illinois at Champaign-Urbana next year, working towards a Ph.D. in plant pathology and international agriculture.

After she receives her master's degree, Casadevall-Keller plans to work for industry on bacterial genetic research—possibly in the areas of crop protection or human medicine.



Farm produced sun meal's high fiber and low lysine content make it best suited for ruminant animals. Protein content, with hulls, runs about 28 percent. Due to sun meal's high oil content, researchers suggest limiting animals to less than three pounds per day.

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