Biodiesel and Straight Vegetable Oil (SVO)

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Outline

- Overview of Biodiesel and SVO – Why this matters.
- Biodiesel vs. SVO
- Making biodiesel
- Using SVO
- Using biodiesel
- What is B5, B20 and B100? And what should I use in my tractor?
- Equipment (engine) considerations when using biodiesel
- The safety considerations involved in making and using biodiesel
- Crops for SVO or biodiesel
- Basic agronomics and economics biodiesel crops
- Related equipment needed to process the crops to oil and meal.
- Examples

Benefits of SVO and Biodiesel

Financial – cost of fuel
Planning – stable of cost of fuel
Efficiency – “energy return on investment”
Environmental – net carbon reduction

“A hundred years ago we all grew our own fuel.”

John Williamson
State Line Farm Biofuels, Shaftsbury, VT

The Biodiesel Process

Lots of places to “hop on” or “hop off”

Oil for use as SVO or for making biodiesel can be collected from restaurants...

... or can be grown and pressed on-farm.
### Biodiesel Blends

- **“B5,” “B20,” and “B100”**
  - Simple ways of referring to the concentration of biodiesel in a fuel blend
  - When 5% biodiesel is mixed into petroleum diesel it is called B5

### Biodiesel Overview

- Generally B20 is recommended
  - Some OEMs have fully embraced B100 and their design process focuses on this
  - B100 has been successfully used in tractors in the Northeast through winter
  - Farm-based production; i.e., from sunflower and canola oil

### What Should I Use in My Tractor?

#### Straight Vegetable Oil (SVO) vs. Biodiesel

- **SVO**
  - Mono, di, or triglycerides
  - a.k.a. vegetable oil, fry oil, “grease”
  - Filtered and de-watered
  - Usually requires secondary tank and heaters for use in diesel vehicle.
- **Biodiesel**
  - Mono alkyl esters, methyl esters
  - Refined oil, converted to “methylesters”
  - Lower viscosity, flows and sprays easier leading to better combustion
  - Lower gel and cloud point, better for winter use

### What Should I Use in My Tractor?

#### Biodiesel Blends

- Why is it blended?
  - Cold weather properties
  - Cost balance
  - Emissions balance
  - Material compatibility
  - Solvent properties
  - B20 is most common blend

#### What Should I Use in My Tractor?

- May require engine modifications
- Oil heated to change the viscosity
- Start engine on petro-diesel fuel
- Shut down on petro-diesel fuel

#### Straight Vegetable Oil Overview

- Vegetable oils have high viscosity which may lead to injector coking and eventual engine failure.
- Engine deposit buildups after running on straight soybean oil

#### What Should I Use in My Tractor?

- Things to watch for...
  - Engine may run more quietly
    - Biodiesel has lubrication properties
  - May have reduced power
    - Biodiesel has lower Btu content per gallon
    - Generally 2% reduction in power, 3% reduction in fuel economy (B20)
  - Filters may clog more frequently
    - Generally because biodiesel is “kicking up” sediment in tanks
    - Can also be due to off-spec biodiesel
  - Cold weather gelling and poor flow can occur
    - Depends on feedstock

Safety Guidelines

- Penn State Guide
- Small scale
- Somewhat PA specific, but extremely helpful
- Best single source for this sort of info

http://pubs.cas.psu.edu/FreePubs/pdfs/ags103.pdf

PPE: Personal Protective Equipment

- Eyes
- Ears
- Mouth and nose
- Skin

Material safety data sheets (MSDS’s) for each material or chemical will provide guidance on proper PPE. Copies of MSDS’s for each chemical in use should be on-hand and easily accessible by all personnel.

Crops for SVO or Biodiesel

What are Oilseeds?

Grains and Oilseeds:
"Grains are identified as cereals suitable as food for human beings. Oilseeds are those grains that are also valuable for the oil content they produce."

Soybeans
Canola
Sunflower
Camelina
Crambe
Flax
Mustard
Pennycress
Rapeseed
Safflower

Crop Production

- Recently published handbook for Northeast oilseed production

Oilseed Pressing Costs

Vermont On-Farm Biodiesel—Cost of Production and Breakeven

Economics and Breakeven of On-Farm Biodiesel Enterprises

- 2013 report explored 2 scales of farm-based production
- As with most farm operations, highly dependent on cost of crop production and yield
- Analysis is provided in step-by-step form
- Calculator is available to aid in assessing potential

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Notes: Numbers reflect estimated costs and revenues. Some operations incurred additional costs for equipment and storage. The market prices are based on local market conditions. The costs and profits are estimates for illustration.