RUNNING THE TRACTOR ON SVO AND BIODIESEL FROM OIL CROPS

Oilseed Producers Meeting
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Penn State Experiences

- Biodiesel blends and B100
- Straight vegetable oil (SVO)
Biodiesel & SVO

Animal Fat or Vegetable Oil

\[ \text{Transesterification using alcohol & catalyst} \]

Biodiesel

Straight Vegetable Oil (SVO)
In collaboration with New Holland, four new tractors ran 3 years on B100 – these have been returned to New Holland for evaluation.

2 new pieces of equipment running SVO; 1 has been returned to New Holland after using SVO for 3 years.
Manufacturers skeptical

- In 2002 biodiesel discouraged by most equipment manufacturers
- Penn State College of Ag Sciences Farm Operations began using B20
B100 tractors

- Engine crankcase oil analysis
- Observe power and performance
- Note tasks performed and operator observations
- Dismantle engines and measure internal effects
Biodiesel

- Penn State University converted diesel fuel station for all diesel fuel to B20 in 2006

New Holland endorses B100 in 2007

- NH Tier IV engines required in 2011 in over 175 HP off road equipment no longer endorsing B100 use; allowing B7
Straight Vegetable Oil (SVO) Use at Penn State Farm Operations

From the Fryer to the Fuel Tank
The Complete Guide to Using Vegetable Oil as an Alternative Fuel

Joshua Tickell
SVO Straight Vegetable Oil

- May require engine modifications
- Heated to change the viscosity
- Start engine on petro-diesel fuel
- Shut down on petro-diesel fuel
Engine deposit buildups after running on straight soybean oil
Kinematic Viscosity of Rapeseed Oil and Diesel Fuel

Rapeseed Oil
„Triglyceride“

Diesel Fuel
„Hydrocarbon Chains“

Graph showing the kinematic viscosity of rapeseed oil and diesel fuel as a function of temperature. The graph includes different processing stages: cold pressed, superdegummed, refined, and diesel fuel.
KernKraft Oilseed Press
Filter Press
Straight Vegetable Oil Fuel
Case 621E Loader  
(146 net HP)  
(109 net kW)

New Holland T7060  
(180 PTO HP)  
(134 PTO kW)
Fuel type (diesel or SVO) criteria

**Sensors**
- Engine coolant temperature sensor
- Exhaust temperature sensor

**Logic**
- Engine cold – runs on petroleum diesel
- Engine warmed up
  - Below 25% engine load – runs on petroleum diesel
  - Above 25% engine load – runs on SVO
Our challenges with the SVO systems

NH T7060
• SVO too hot from heat exchanger – engine depowering
• SVO filter clogging
• Low temperatures – mix with petroleum diesel

Case 621E
• Engine coolant not reaching operating temperature
• SVO filter clogging
• Low temperatures – mix with petroleum diesel
• Power supply – 12V vs. 24V
• Fuse location in control box
Types of vegetable oils (per Elsbett)

Canola or rapeseed..... Ok
Sunflower..... Ok if degummed
Soybean..... Not ok in direct injection engines

Reference: Mang, T. (1992), supplemented
Overall SVO vs. Petro-diesel usage at Penn State

<table>
<thead>
<tr>
<th></th>
<th>NH T7060 (1370 hours)</th>
<th>Case 621E (1118 hours)</th>
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<tbody>
<tr>
<td>% SVO used of total fuel use</td>
<td>85%</td>
<td>53%</td>
</tr>
<tr>
<td>Total SVO used</td>
<td>3428 gallons</td>
<td>796 gallons</td>
</tr>
<tr>
<td>Total diesel used</td>
<td>628 gallons</td>
<td>701 gallons</td>
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NH 7060: Power vs. RPM for Diesel and SVO
December, 2011

Rated Power – 134 kW (180 HP)