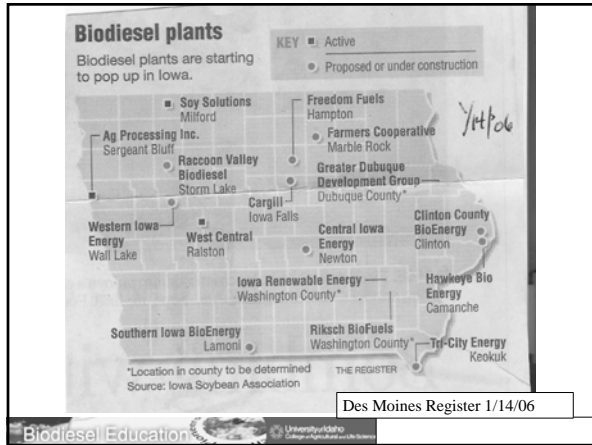
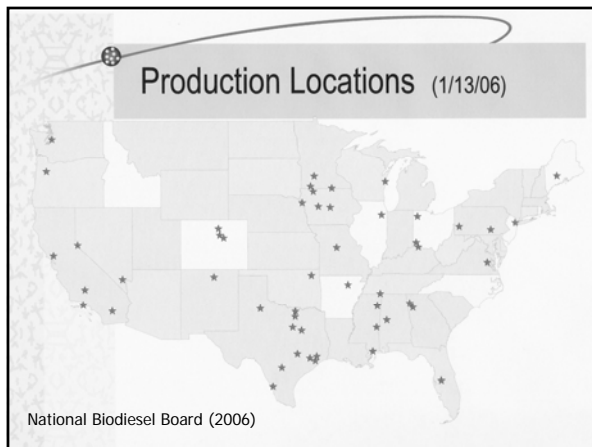


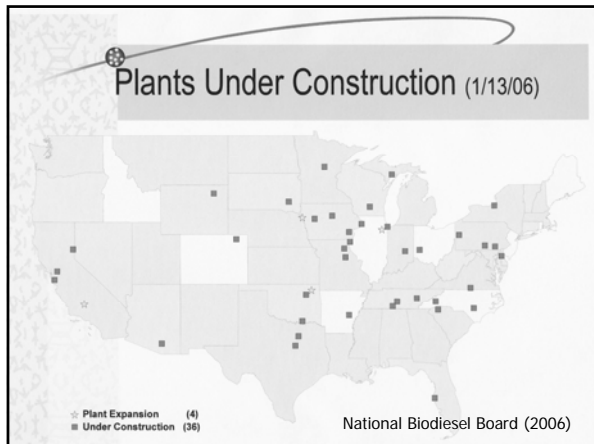
Alternative Feedstocks

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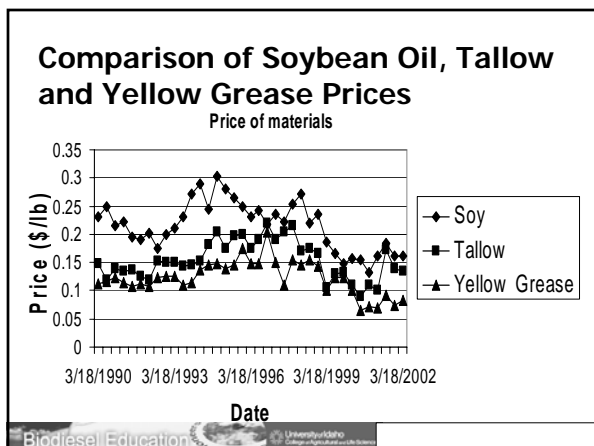








- ### Feedstock Categories
- Vegetable Oils
 - Tallows and greases
 - Waste-derived Sources
- Biodiesel Education University of Idaho



Key Physical and Chemical Characteristics for Feedstocks

- Fatty Acid Profile
- Free Fatty Acids (FFA)

Other concerns such as water and solids can be removed.

Commodity Vegetable Oil Feedstocks

- Palm Oil
- Soybean Oil
- Rapeseed Oil
- Corn Oil
- Other Oils

Fatty Acid Percentages in Commodity Vegetable Oils

Acid	Palm	Soy	Ind. Rape	Canola
16:0	32 - 45	7 - 11	1 - 3	4 - 5
18:0	2 - 7	2 - 6	0.4 - 3.5	1 - 2
18:1	38 - 52	15 - 33	12 - 24	58 - 62
18:2	5 - 11	43 - 56	12 - 16	19 - 23
18:3	-	5 - 11	7 - 10	11 - 13
22:1	-	-	40 - 55	-

**U.S. Vegetable oil Production (2005)
billion lb/yr**

- Soybean 19.55
- Peanut 0.16
- Sunflower 0.31
- Cottonseed 0.99
- Corn 2.41
- Canola 0.63
- Safflower 0.06

Total 23.66 billion lbs

Could produce 3150 million gallons of biodiesel

US Production Capacity History

	2001	2002	2003	2004	2005	2006
Plants	9	11	16	22	45	53
Capacity (millions)	50	54	85	157	290	354

- ✧ Capacity Information was based on information available in or around the month of September for each year.
- ✧ However, the 2006 information is based on data available on 1/13/06

New U.S. production

- Soy is unlikely to increase much unless price increases. Increased oil prices will be offset by depressed meal prices.
- May see an increase in corn oil recovered from ethanol plants.
- May see increased production of canola and other high-oil-content oilseeds in place of corn/soybeans in the Midwest.

World-wide

- Palm is seen as the leading contender for expansion of vegetable oil supplies.
- Palm oil is the most widely traded commodity oil world-wide.
- Roughly 10 times more yield per acre than soybean oil.
- Palm oil is solid at room temperature. It has high free fatty acids.
- Algae may be long range opportunities.



Palm oil

- 80% of palm oil comes from Malaysia and Indonesia.
- In Malaysia, 11% of total land area is in palm (62% of agricultural land).
- Palm plantations require 5-7 years to reach maturity.
- Expansion of palm plantations difficult due to need to preserve rainforests.
- Pour point is 15°C. Will need to be blended with diesel fuel or biodiesel from other oils.
- Low temperature properties can be improved by winterization (separating out the part of the oil that is most likely to solidify). This is costly and produces a stream of saturated fats that would need to be heated.

Tallow and Greases

- Originates from rendering plants that filter and dewater the fats.
- Usually semi-solid or solid
- More variability in composition and quality than vegetable oils.
- Each person produces about 9 lb/yr of restaurant waste grease.

**Animal fat production (2005)
billion lb/yr**

- Edible tallow 1.75
 - Inedible tallow 3.66
 - Grease 2.62
 - Yellow grease 1.37
 - Other grease 1.25
 - Lard 0.26
 - Poultry fat 1.02
- Total 11.93 billion lbs

**Fatty Acid Percentages in Selected
Animal Fats and Oils**

Acid	Beef	Pork	Chicken
14:0	1.4 – 6.3	0.5 – 2.5	1
16:0	20 - 37	20 - 32	25
16:1	0.7 – 8.8	1.7 - 5	8
18:0	6 - 40	5 - 24	6
18:1	26 - 50	35 - 62	41
18:2	0.5 - 5	3 - 16	18

**Grade Specifications for Tallows
and Greases**

Analysis	Yellow Grease	Brown Grease	Inedible Tallow
Min. Titer	36.0 ° C	38 ° C	40.0 ° C
Max FFA	15 %	50 %	15 %
Max Color	37	none	33
Max MIU	2 %	2 %	2 %
Sp. Gr.	-	-	0.86 – 0.87
Iodine #	-	-	35 - 48

Low Quality Sources

- Trap Grease
- Soapstock
- Spent Bleaching Clay

Low Quality Sources

- Frequently contain large amounts of contaminated water that requires disposal. Other waste products may also generated.
- High free fatty acids so need acid catalyzed pretreatment.
- Cost of pretreatment and recovery of excess alcohol can offset some of the cost savings.

Summary

- The choices for the raw materials for biodiesel production are diverse.
- The fatty acid profile is the most important performance parameter for biodiesel.
- Palm oil is one candidate for growth in oil supply but has problematic properties.

