A photograph of a combine harvester and a tractor in a field at sunset. The combine harvester is in the foreground, and the tractor is to its right. The sky is a mix of orange and blue, and the field is golden-brown. The text is overlaid on the image.

# U.S. Biodiesel Update— Industry Outlook & Policy Update

**Larry Schafer**

USDA Ag Outlook

February 21-22, 2008

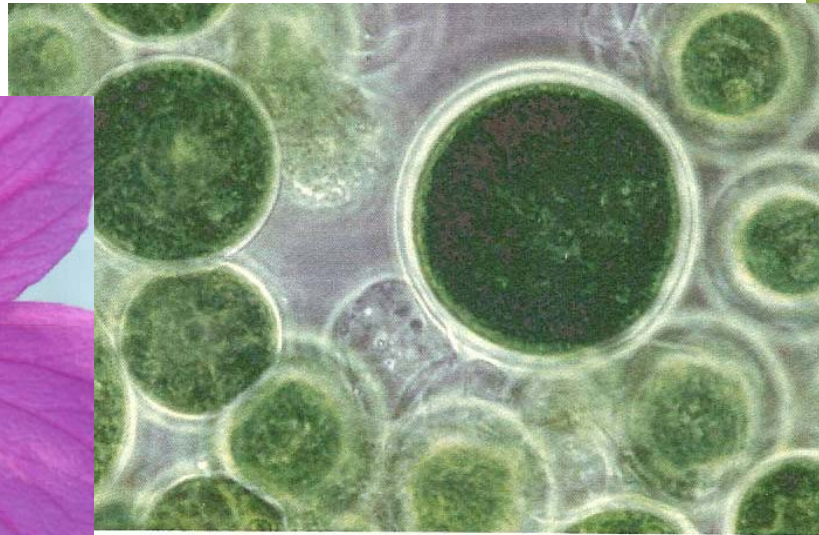
# Raw Materials for Biodiesel Production



# Potential Sources



Seashore Mallow



Algae



Brassica Juncea

Brown Grease  
Chinese Tallow  
Etc.



National Biodiesel Board  
Jatropha



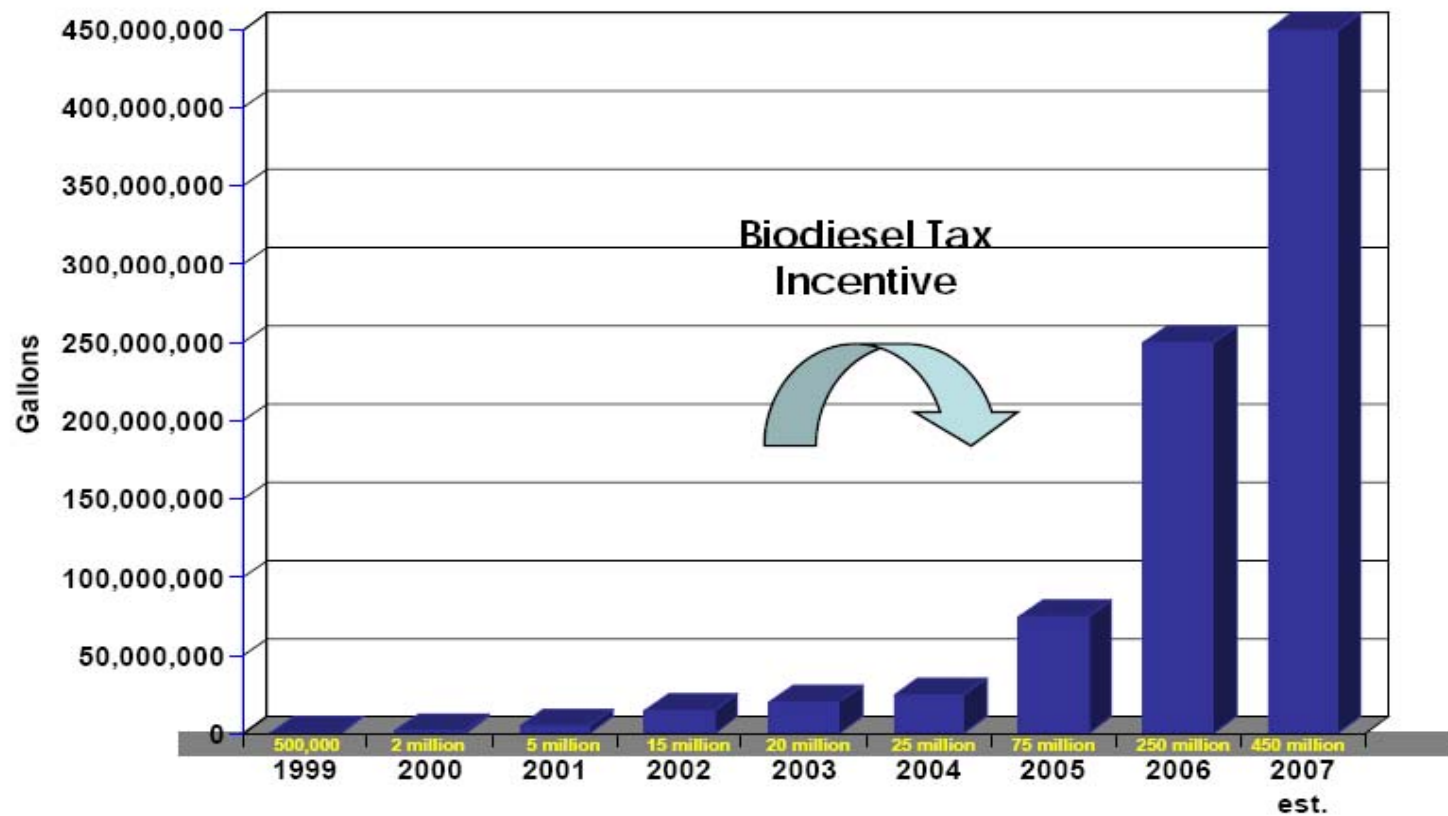
Low Ricin Castor

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# Capacity Trends

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# US Biodiesel Demand

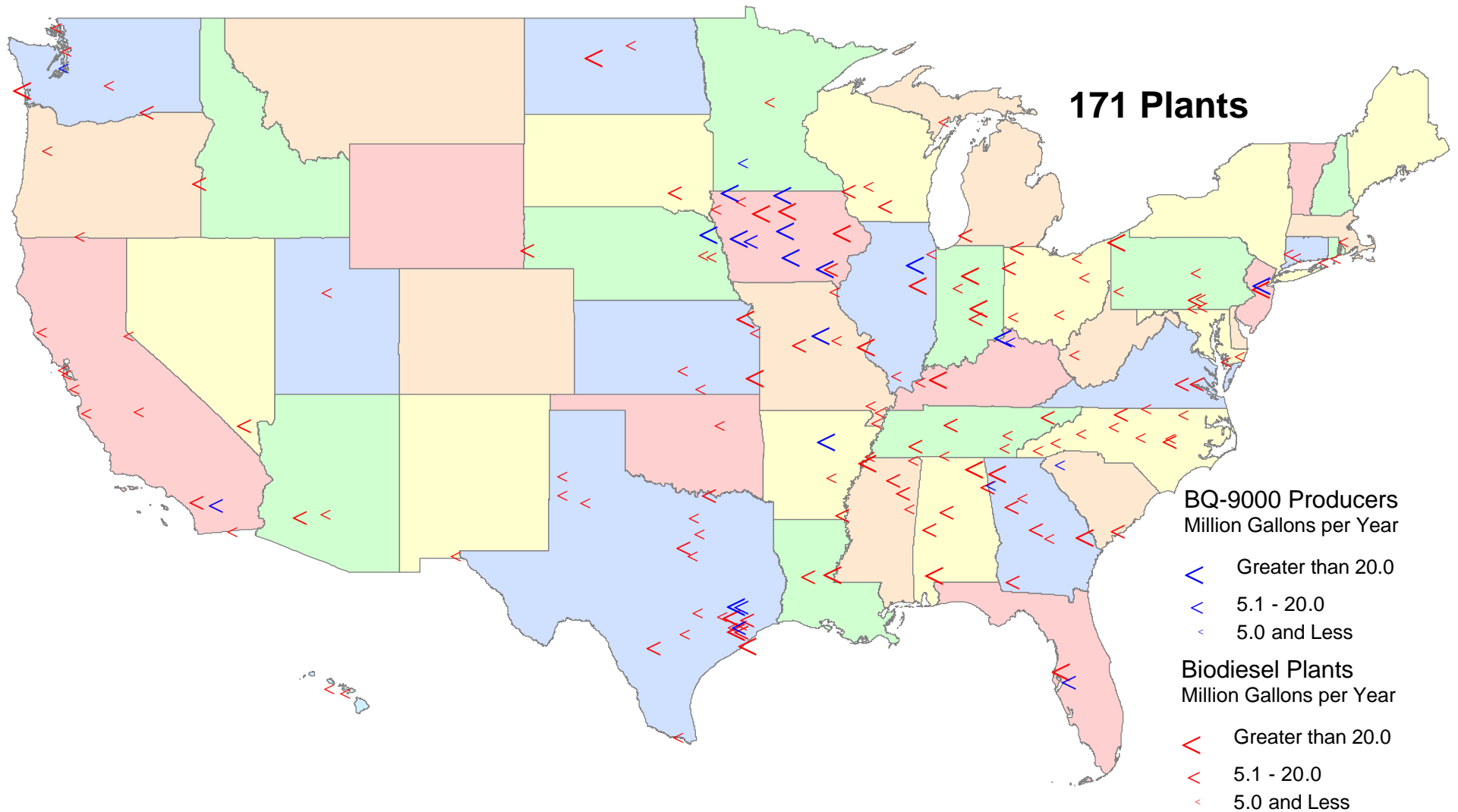


# US Production Capacity History

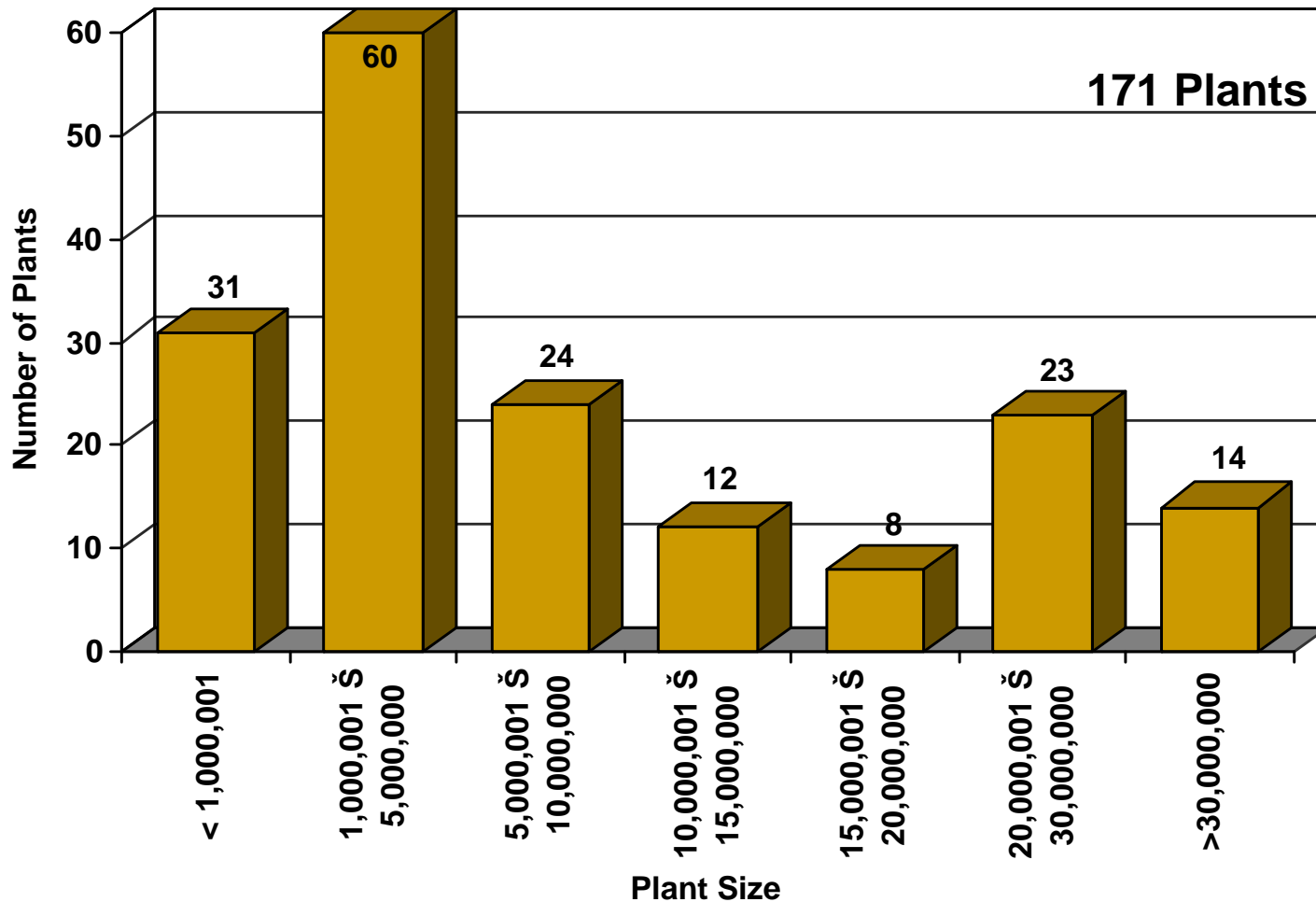
	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>
<b>Plants</b>	9	11	16	22	45	86	165	171
<b>Capacity (millions)</b>	50	54	85	157	290	580	1,850	2,243

- Capacity Information was based on information available in or around the month of September for each year.
- However, the 2008 information is based on data available on 1/25/08

# Production Locations (1/25/08)



# Industry Plant Size

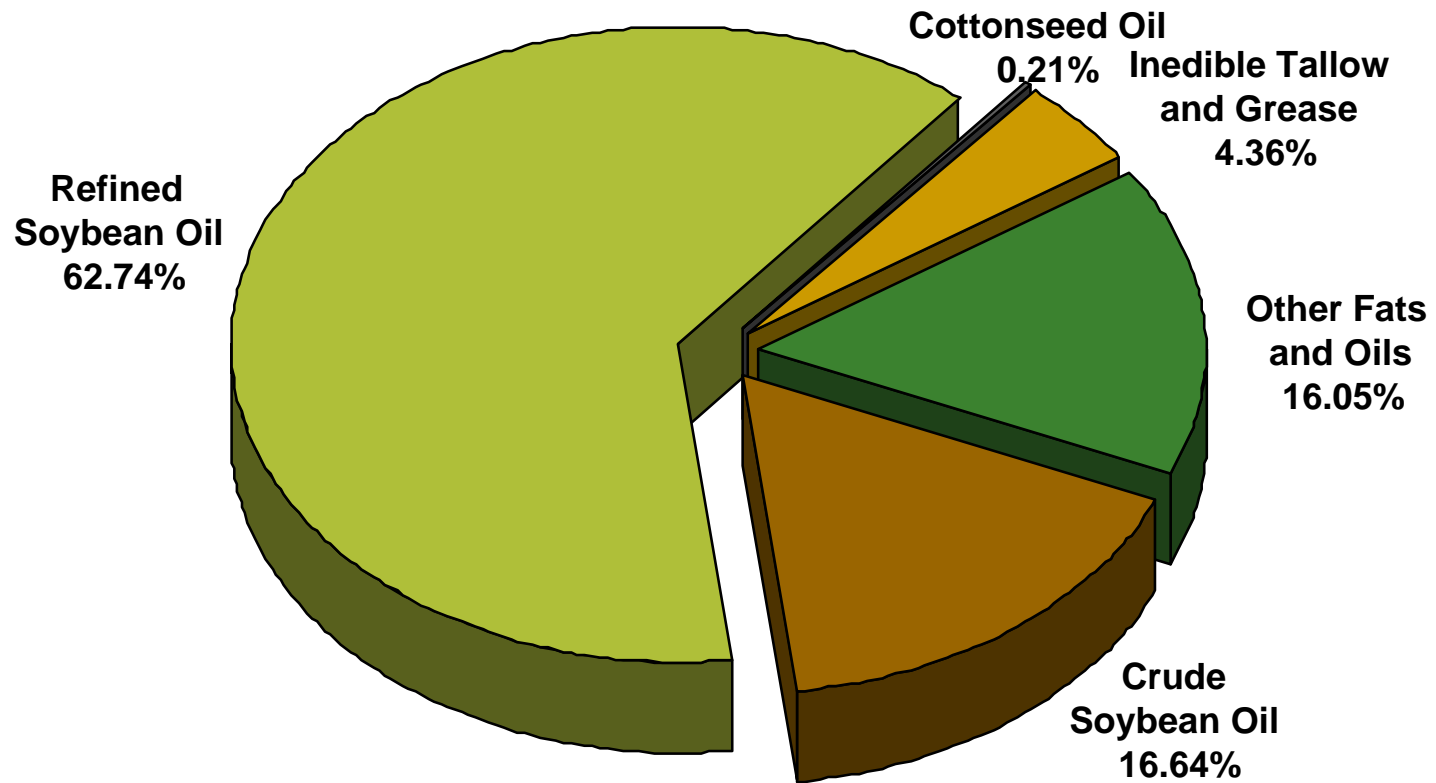


Production Capacity 2.24 billion gallons per year  
Average Plant Size 13.1 million gallons per year

National Bioethanol Board



# Raw Material Use (2007)



# Raw Material Availability

- To date, soybean oil has been the predominant feedstock.
- Supply Response will happen...
  - Grow more beans
  - Raise the means
  - Change the genes
- Additional Sources
  - Ethanol plants
  - High percentage oilseeds such as canola
  - Imports
  - Reduction of exports
  - Mustard
  - Camelina
  - Algae

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# Near Term Potential - Oilseeds

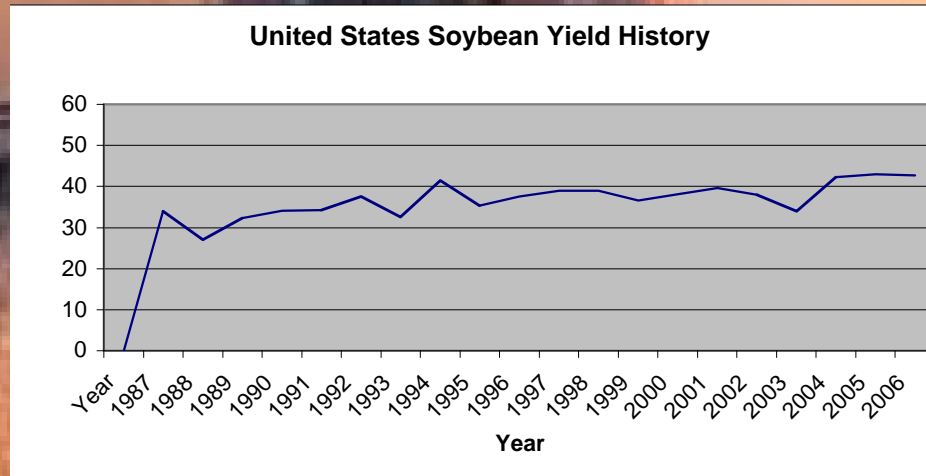
- Soybeans
  - Camelina
  - Canola
-

# Expansion of Soybean Oil Supplies

- In 2007, approximately 80% of U.S. produced biodiesel was from soybean oil.
- Future Expansion of Supplies....
  - Acreage
    - In 2007, U.S. soybean acreage decreased by more than 11 million acres (more than 700 million gallons worth of biodiesel)
    - USDA expect 8-10 million acres to be replanted in 2008
  - Yield
    - Can we significantly increase?
    - Increasing yields by 10% on 60 million acres potentially equates to more than 250 million additional bushels of soybeans (the equivalent of nearly 400 million gallons of biodiesel).
  - Oil Content

# Soybean Yields

- Technology exists for stepwise change in yields
  - Monsanto and Pioneer/Dupont set to introduce new varieties
    - 10% yield increases
    - Full introduction in 2010



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# Increasing Vegetable Oil Content of Oilseeds - “Changing the Genes”

- Previous breeding efforts to increase oil content in vegetable oils has been at the expense of protein quality.
- Leveraging federal funds, the biodiesel industry is funding a program at the Danforth Center to address this issue.
  - Initial work with soybeans, but applicable to all oilseeds.

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# Camelina

- Relatively low input crop
- Relatively high in linolenic acid (38%)
  - 30 to 40% oil
  - Will existing processing techniques be adequate?
- Increasing acreage in Montana
  - Acres under contract in 2007
  - At least two companies contracting acres in 2008
    - Seeking to contract 2 million acres

# Winter Canola

- Opportunity to increase acres as a raw material for biodiesel
- Pacific NW
- Midwest
- Price premium of canola vs. soybean oil



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# Longer Term

- Corn Oil

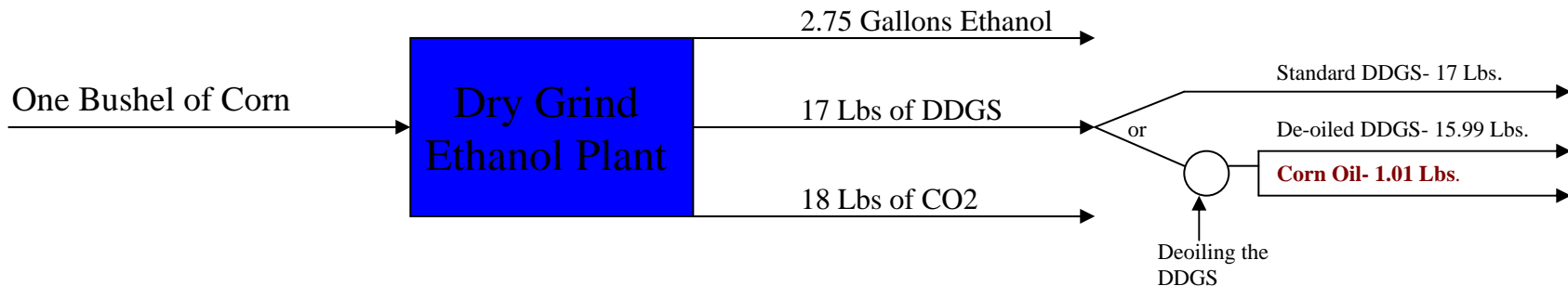
- Other Sources

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# Dry Grind

## Co-Product Descriptions

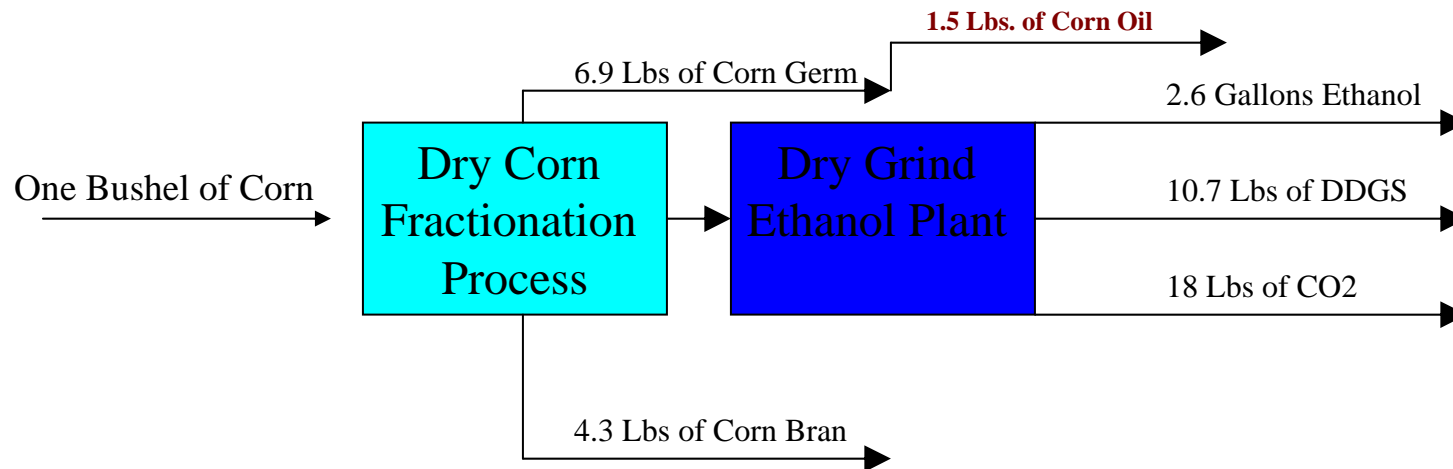
- **DDGS**
  - **Standard**- 29% protein, 7% fiber, and 11% fat
  - **Deoiled**- 35% protein, 9% fiber, and 4% fat
- **Corn Oil**- Non edible oil
- **Ethanol**
- **CO2**



# Corn Fractionation

## Co-Product Descriptions

- **Corn Oil**- Food grade oil or feed ingredient for poultry, dairy, and swine
- **Fractionated DDGS**- 43% protein, 10% fiber, and 5% fat
- **Ethanol**
- **CO2**
- **Corn Bran**- Can be used as a fuel source if the plant is capable to burn it or it also can be sold as a feed ingredient
- **Corn Germ**- Can be sold as an oil feedstock to a crusher or used as a feed ingredient



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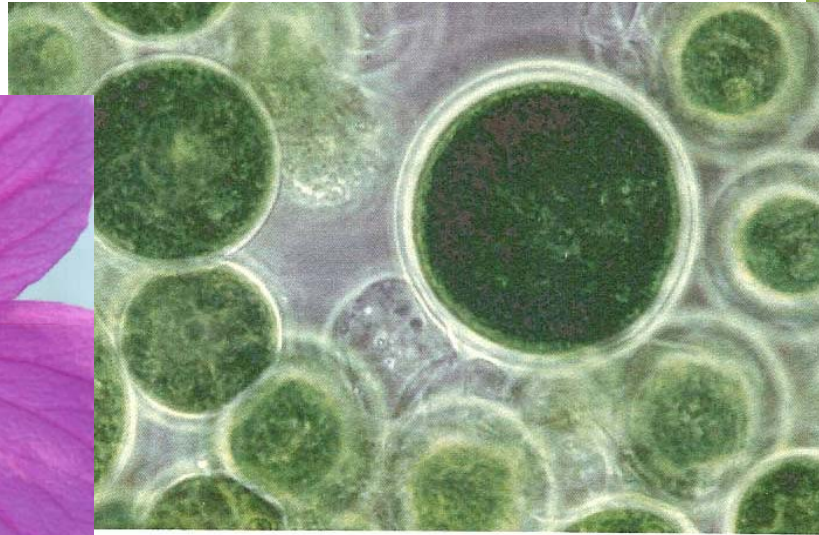
# Oil from Ethanol Plants

- Market Impact
  - Achieving a 15 billion gallon per year corn based ethanol industry would result in a potential of 5 to 7.5 billion pounds (that is, up to 1 billion gallons worth of biodiesel) if all ethanol dry grinds plants employed either fractionation or DDGS oil recovery technologies.
  - Questions
    - Will corn oil from fractionation be utilized for biodiesel production?
    - Oil quality from de-oiled DDGS?
    - Adoption rates by ethanol plants?
- What role could high oil corn play for the biodiesel industry?

# Potential Sources



Seashore Mallow



Algae



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