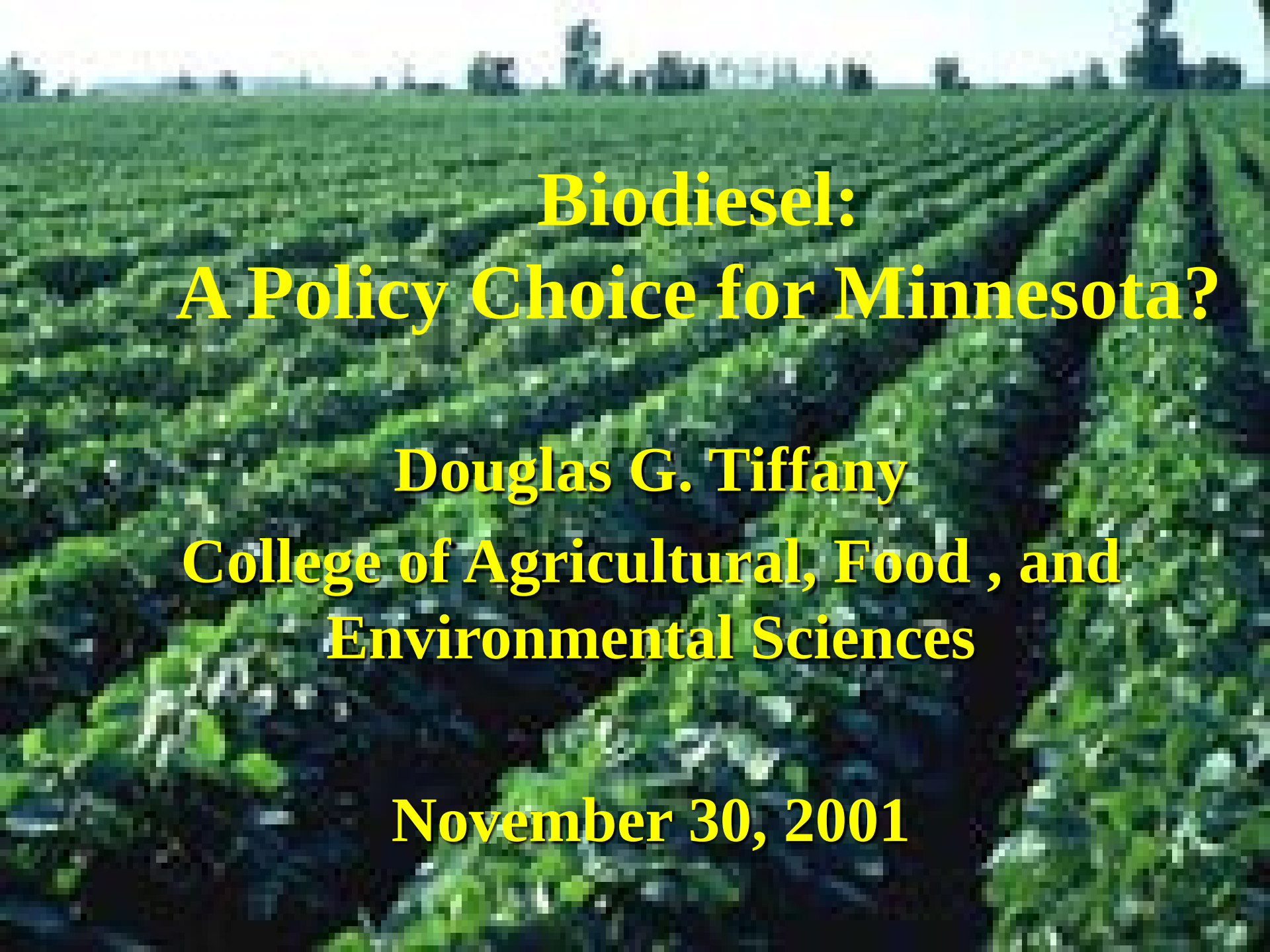

Biodiesel: A Policy Choice for Minnesota?

Douglas G. Tiffany
College of Agricultural, Food , and Environmental Sciences

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Economic Considerations for Biodiesel

- Farm Level Sustainability
- Costs to Produce Biodiesel from Soy Oil
- Retrospective Price History of Biodiesel
- Potential Economic Impacts for MN
- Incentive Programs: Current and Proposed
- Conclusions and Questions

Sustainability Issues

From the Avg. MN Soybean Acre:

- 45 bushels X 60 lb. = 2700 lb.
- Crush 2700 lb. :

  540 lb. of soyoil

  2160 lb. of soybean meal

- 540 lb. soyoil + 108 lb. of methanol = 70.13 gal.
- biodiesel/A.
- 45 bushels of soybeans produced

  = 43 lb.

  glycerine/A.

One Acre (45 bu.) of MN Soybeans

- Requires 7.4 gal. of Diesel to Produce
- Yields 70.1 gal. of Biodiesel, following other energy inputs
- Yields 2160 lb. of soybean meal
- Yields 43 lb. of glycerine

Energy Accounting

- Production of Soybeans
  - Imbedded Energy in Seed
  - Imbedded Energy in Fertilizer
  - Imbedded Energy in Chemicals
  - Explicit Fuel Energy in Tillage, Harvesting, Transportation

Energy of Processing/Distribution

- Energy in Crushing/Extracting
- Energy in Stabilizing Soyoil
  - Necessity? Non-Food Grade Oil?
- Energy to Transesterify Vegetable Oil
- Energy to Transport

Sustainability, Energy Security

- Energy Balance is Greater for Biodiesel (3.24) than Ethanol (1.25).
- Reductions in GHG and Tailpipe emissions
- Closed-Loop Cycle of Carbon Dioxide
- Home-Grown, not Subject to Terrorism or Embargoes

Costs to Produce Biodiesel

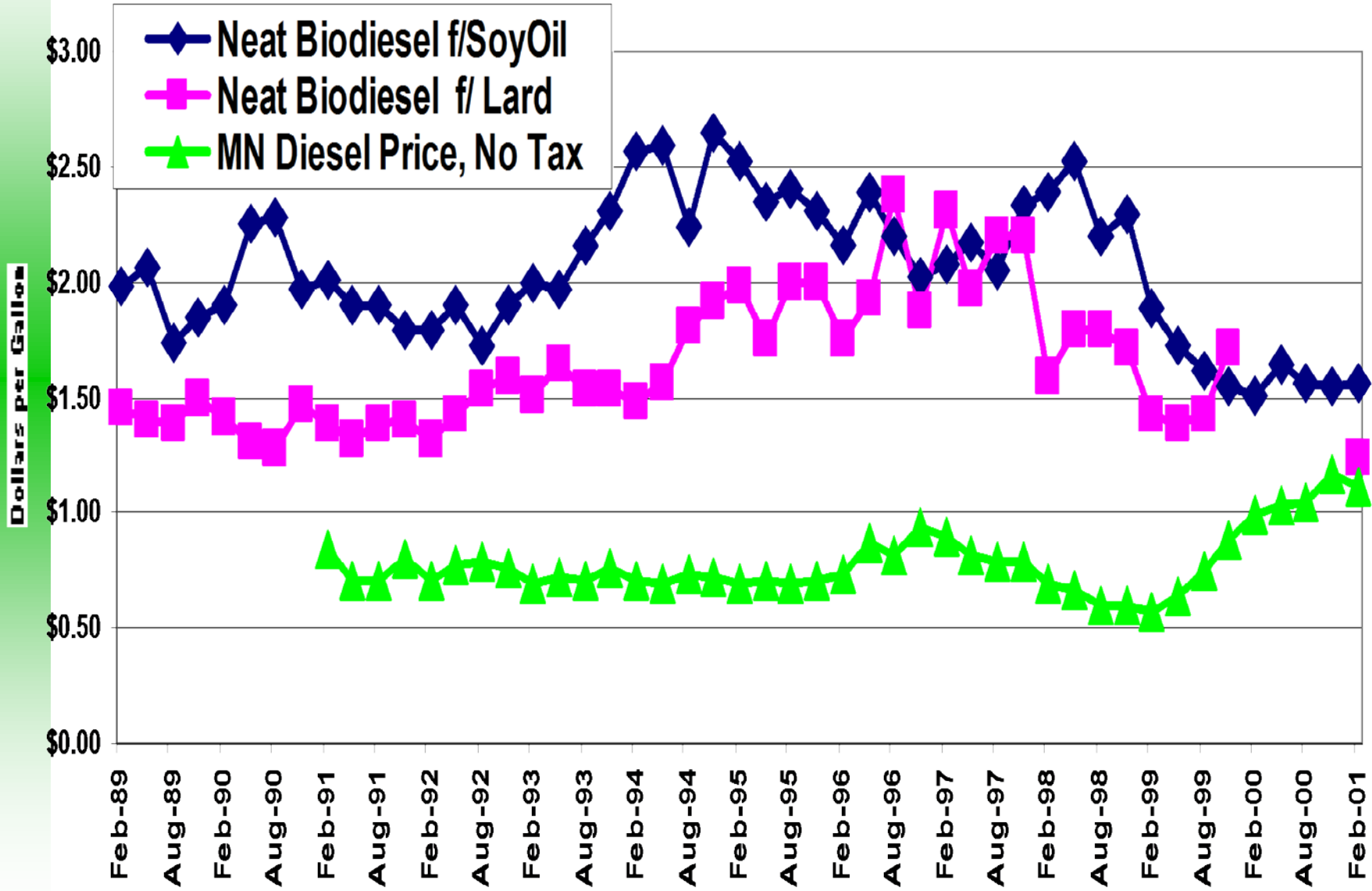
Table 1: Derived Price of Neat Biodiesel

Feedstock Oil Price Per Pound								
$0.26	2.20	2.24	2.28	2.32	2.36	2.40	2.44	2.48
$0.24	2.05	2.09	2.13	2.17	2.21	2.25	2.29	2.33
$0.22	1.89	1.93	1.97	2.01	2.05	2.09	2.13	2.17
$0.20	1.74	1.78	1.82	1.86	1.90	1.94	1.98	2.02
$0.18	1.59	1.63	1.67	1.71	1.75	1.79	1.83	1.87
$0.16	1.43	1.47	1.51	1.55	1.59	1.63	1.67	1.71
$0.14	1.28	1.32	1.36	1.40	1.44	1.48	1.52	1.56
$0.12	1.12	1.16	1.20	1.24	1.28	1.32	1.36	1.40
$0.10	0.97	1.01	1.05	1.09	1.13	1.17	1.21	1.25
	$0.20	$0.24	$0.28	$0.32	$0.36	$0.40	$0.44	$0.48
	Net Processing Charge Per Gallon							

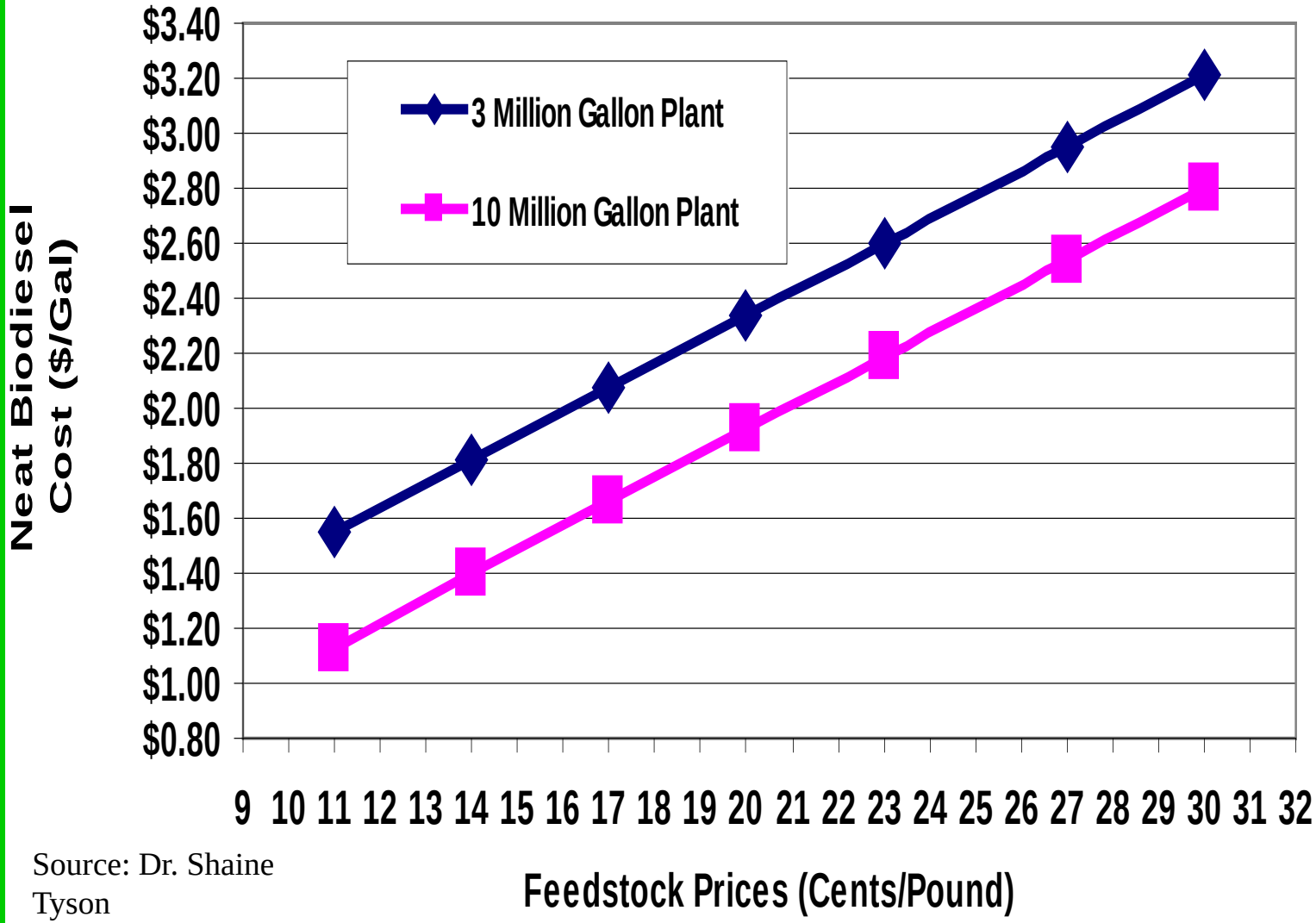
FAPRI Models Predict:

- Ten year average price of Soybean Oil at $.17 per pound.
- Translates to Biodiesel derived from soy oil around $1.66 per gallon.

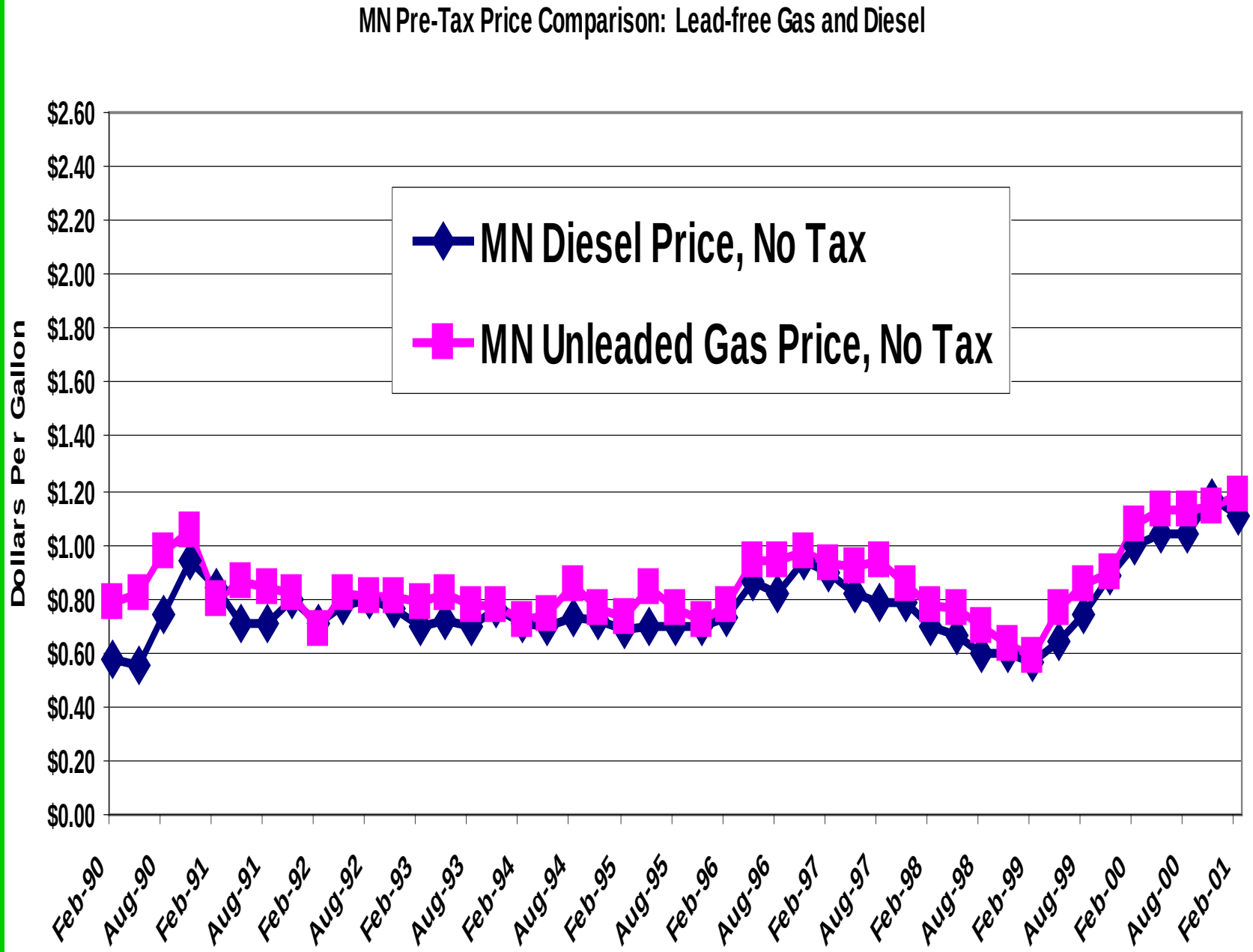
Graph 1: Retrospective Prices of #2 Diesel and Neat Biodiesel from Soyoil and Lard



Graph 1. Biodiesel Costs for Alternative Plant Sizes, Feedstock Prices & 15% ROR



Source: Dr. Shaine Tyson


MN Pre-Tax Price Comparison: Lead-free Gas and Diesel
Dollars Per Gallon
$2.60
$2.40
$2.20
$2.00
$1.80
$1.60
$1.40
$1.20
$1.00
$0.80
$0.60
$0.40
$0.20
$0.00
MN Diesel Price, No Tax
MN Unleaded Gas Price, No Tax
Feb-90
Aug-90
Feb-91
Aug-91
Feb-92
Aug-92
Feb-93
Aug-93
Feb-94
Aug-94
Feb-95
Aug-95
Feb-96
Aug-96
Feb-97
Aug-97
Feb-98
Aug-98
Feb-99
Aug-99
Feb-00
Aug-00
Feb-01

Price Affects of Biodiesel Blends

- 2%

Table 2: 2% Biodiesel Blend Prices

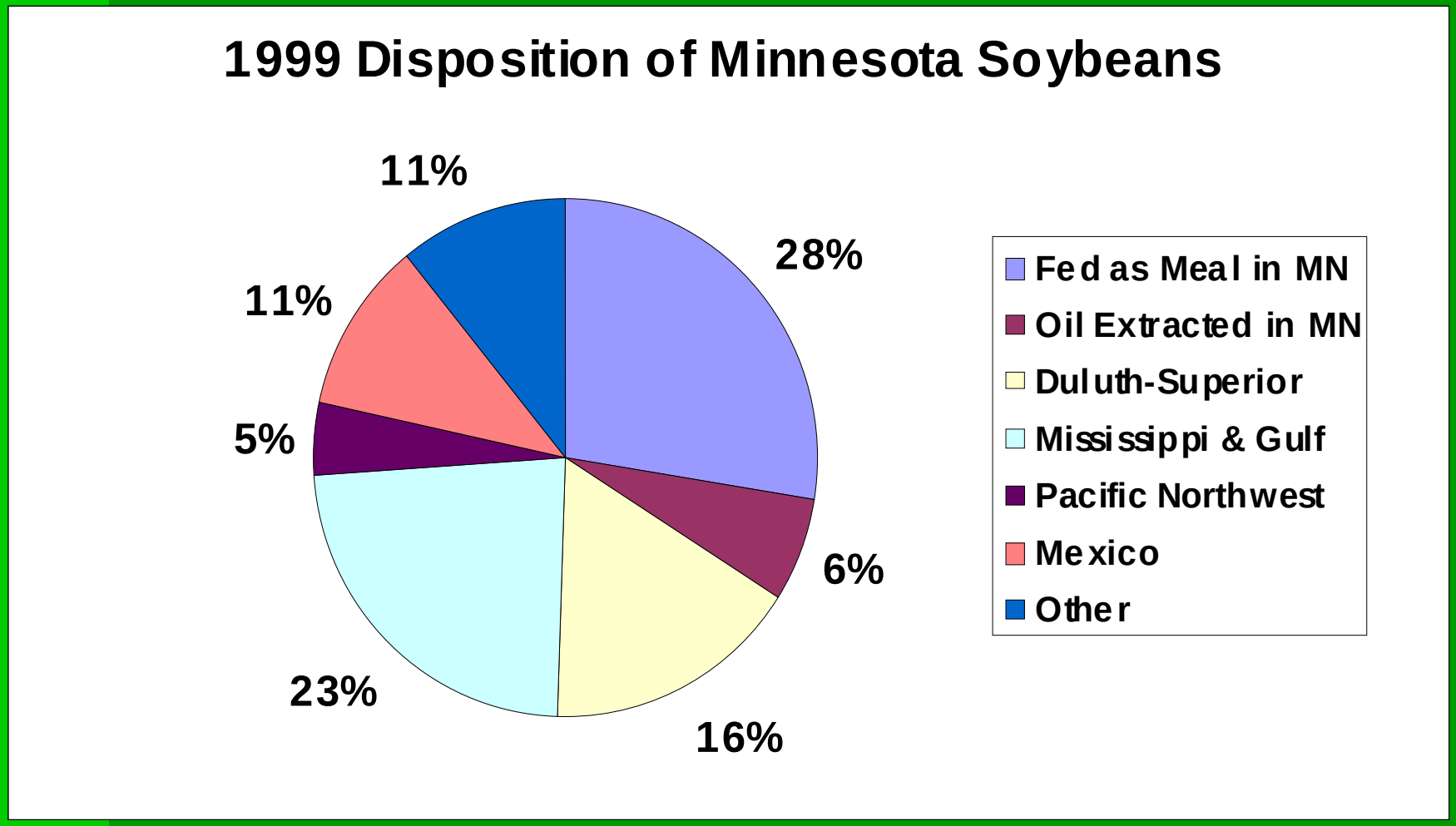
Fat & Oil Prices Per Pound	Neat Biodiesel Prices Per Gallon								
$0.266	$2.40	0.636	0.832	1.028	1.224	1.420	1.616	1.812	2.008
$0.240	$2.20	0.632	0.828	1.024	1.220	1.416	1.612	1.808	2.004
$0.214	$2.00	0.628	0.824	1.020	1.216	1.412	1.608	1.804	2.000
$0.188	$1.80	0.624	0.820	1.016	1.212	1.408	1.604	1.800	1.996
$0.162	$1.60	0.620	0.816	1.012	1.208	1.404	1.600	1.796	1.992
$0.136	$1.40	0.616	0.812	1.008	1.204	1.400	1.596	1.792	1.988
$0.110	$1.20	0.612	0.808	1.004	1.200	1.396	1.592	1.788	1.984
$0.084	$1.00	0.608	0.804	1.000	1.196	1.392	1.588	1.784	1.980
		$0.60	$0.80	$1.00	$1.20	$1.40	$1.60	$1.80	$2.00
							Diesel Prices		

Low-Sulfur Diesel and Lubricity

- In 2006 sulfur content of diesel fuel will be lowered from 500 ppm to 15 ppm
  - $.045-$.05 higher cost per gal. by EPA
  - $.078-$.106 higher cost/ gal. by Am. Petro. Inst
- In 2007 diesel engines will have catalytic convertors to burn more cleanly
  - $1200-1900 more cost/ engine by EPA
- (Sulfur would make catalytic convertors fail.)
- Diesel fuel w/o sulfur loses lubricity, hastens wear on injection pumps, however, 2% Biodiesel blends restore lubricity.

Possibilities f/ MN Soybeans

Destinations of MN Soybeans in 1999



Source: Tiffany & Fruin

MN Vegetable Oil Possibilities

- MN has “surplus” soy oil in state after crushing beans to satisfy soybean meal demand.
- MN crushed 34% of 1999 crop to feed livestock.
- MN consumers utilized 42.8% of the oil released by the crush of soybeans, BUT just 13% of oil of MN crop. (91.4# of all fats and oils per capita)
- Remainder soy oil crushed in state could make 77,890,860 gallons of biodiesel or 9.7% of MN diesel usage.
- MN would require
  - 16 million gal. biodiesel for 2% blend
  - 40 million gal. biodiesel for 5% blend

If all MN soybeans were crushed in the state, we would get------

- Soy Oil of 3.34 Billion pounds
- Minus .45 Billion pounds used in MN/cap.
- Could make 375 million gal. of biodiesel, 47% of MN annual total usage.
- MN uses 800 million gal. of diesel annually
  - 550 million gallons on-road
  - 250 million gallons off-road

Economic Impacts for MN

- National Price Increase for Soybeans (U.S.D.A.)
  - $.17 / bu. price increase of soybeans for each of ten years with increase from 24 - 377 Million Gal. of Biodiesel. (U.S. Tot. production 30 Mill.gal.)
  - Greater Increase in MN soybean prices because of higher basis levels and surplus supplies of soy oil.
  - U.S.-13,000 jobs– farm, food proc., mfg, service
- Slightly higher costs for blends if no reduction in Federal Diesel Excise Tax
  - 1.7 cents per gal. @ 2% blend
  - 4.7 cents per gal. @ 5% blend

Biodiesel Initiatives: Current & Proposed

- Bioenergy Program
  - C.C.C. payments for new capacity $.85-$1.17/gal.
- EPAct Credits for Fleet Usage
- Proposed
  - Federal Diesel Excise Tax Reduction Proposal Would Transfer Loan Deficiency Payments to Lower Diesel Excise Taxes
  - National Renewable Standard (S. 1006) includes biomass fuels and biogas

  (.8% in 2002, to 5% by 2016)
  - State Mandates, City or Regional Transit

Research Identifying Attributes and New Uses for Biodiesel

Conclusions: Regarding Biodiesel

- Biodiesel Has Excellent Performance Attributes.
  - Lubricity, Cetane, Miscibility, Stability, Emissions
- Emerging Uses by Aircraft, Microturbines
- Encouragement at Federal Level Is Crucial.
- Good Timing w/ Ultra-Low Sulfur Levels (2006)
- Air Quality, Health Concerns of Public.
- Biodiesel Development Fits MN W/ Surplus Oil.
- There Are Advantages for MN as Trend-Setter.

Questions for Doug Tiffany:

Phone: (612) 625-6715

E-mail: dtiffany@dept.agecon.umn.edu

Websites:

http://agecon.lib.umn.edu/mn/p01-04.pdf

www.biodiesel.org