Energy Price Change; Impact on Selection of Conservation Systems

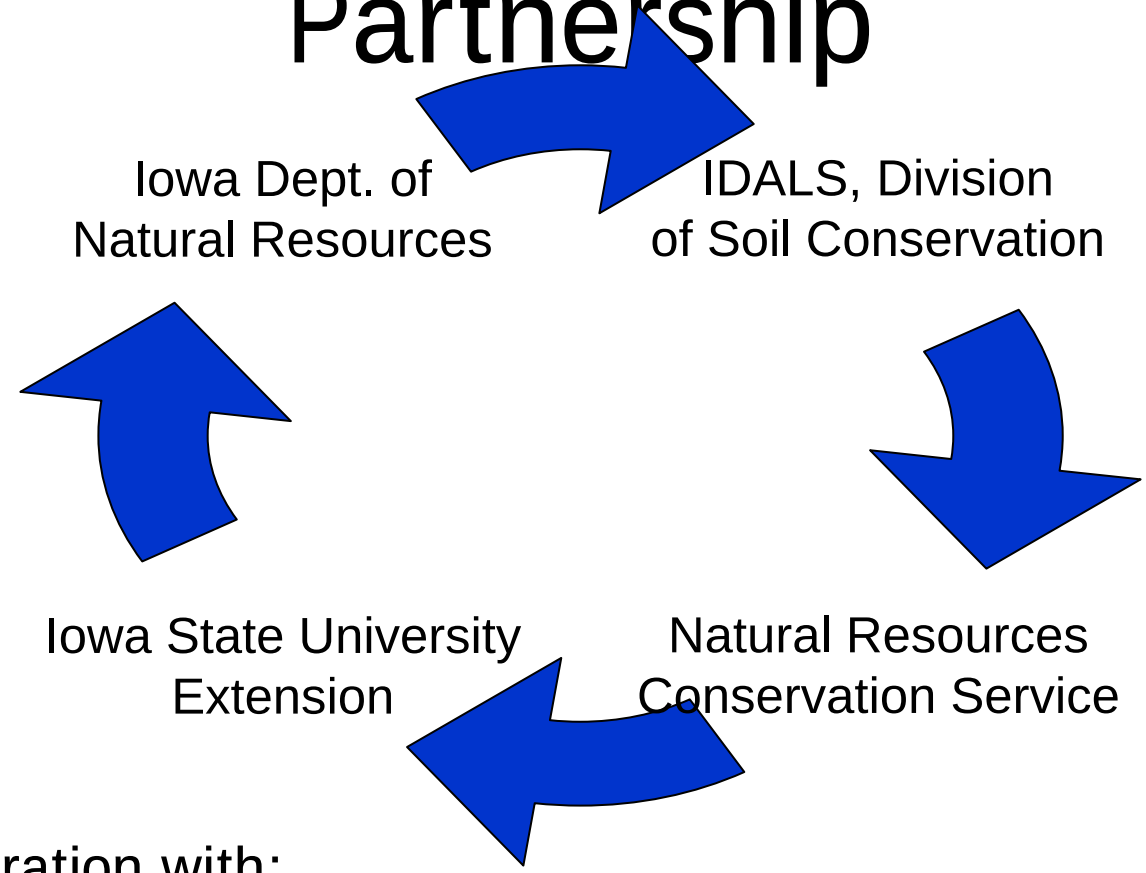
December 1, 2005

Mike Duffy

Iowa Learning Farm

- The Iowa Learning Farm strives for the development of practical solutions of production and environmental challenges through the adoption of conservation systems and exchange of ideas between framers, practitioners, and scientists.
- The primary goal of this project is the improvement of state water quality through the increased adoption of conservation systems.

Partnership

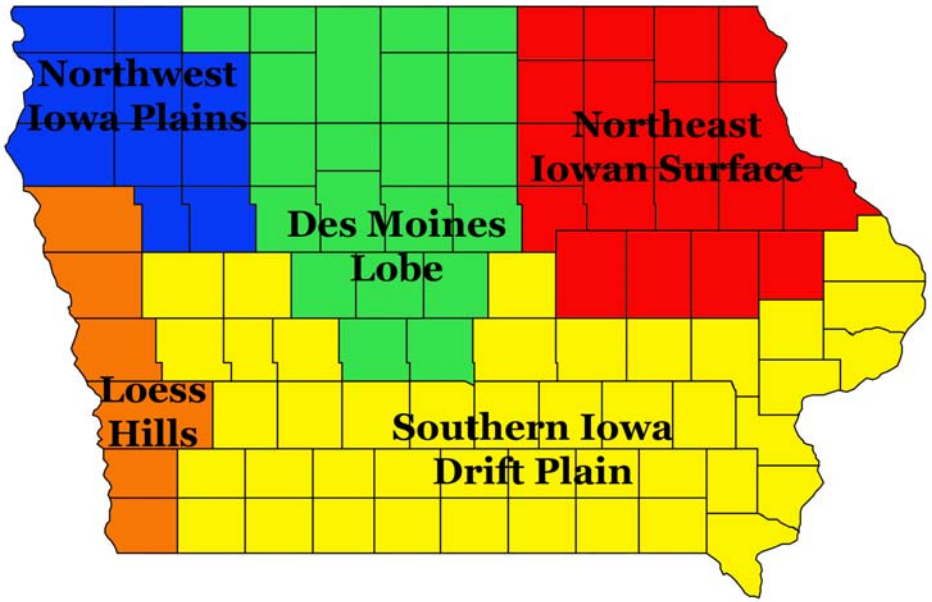


In cooperation with:

- Conservation Districts of Iowa
- Iowa Farm Bureau Federation

Approach

- Establish a regional tillage concept based on soil formation.
- Establish 5 to 10 on-farm demonstrations in each region.
- Agronomic and economic evaluation for each site and region.
- Regional evaluation for communities role in promoting conservation systems.
- Conduct an extensive regional / statewide education and outreach program.



Outline

- General comments/observations
- Iowa farm energy use and cost impacts
- Energy use by crop rotation
- Conclusions

General Calculations

- Approximately 139,000 British Thermal Units (BtU's) in a gallon of diesel fuel
- A BtU is the amount of heat needed to increase the temperature of a pint of water one degree Fahrenheit

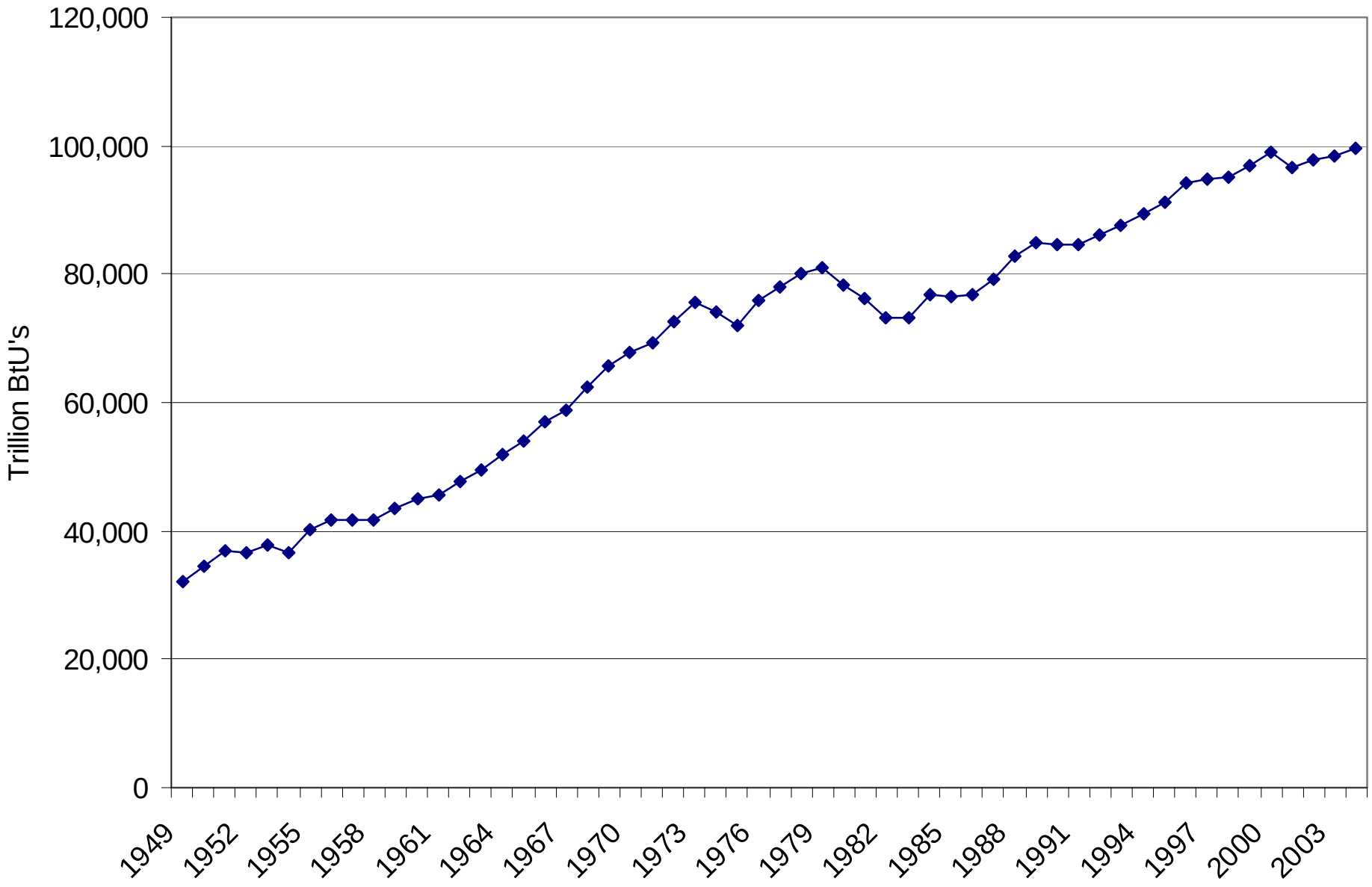
Common Units

- Gallons of diesel fuel equivalents
  - Pound of anhydrous .20
  - Pound of urea .25
  - Pound of P2O5 .05
  - Pound of K2O .04
  - Gallon of propane .65
  - Pesticides vary by formulation; approximation 1 pound a.i. 1.00

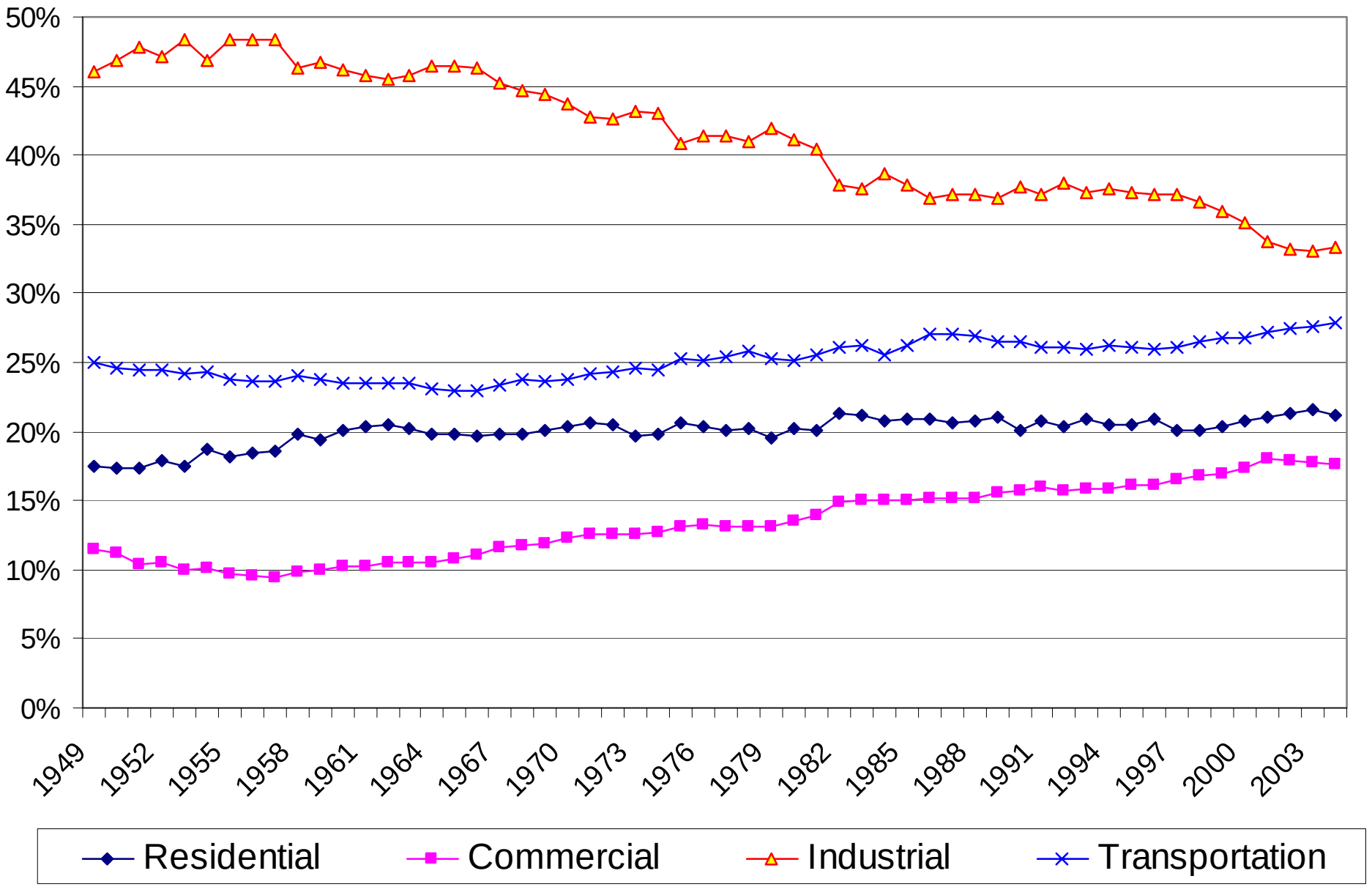
U.S. Energy Use

- Agriculture is approximately 1 percent of total U.S. energy use. What we do as far as energy savings will help us but will not have an impact on price. The exception to this would be how much ethanol, biodiesel and other bioenergy use increases.

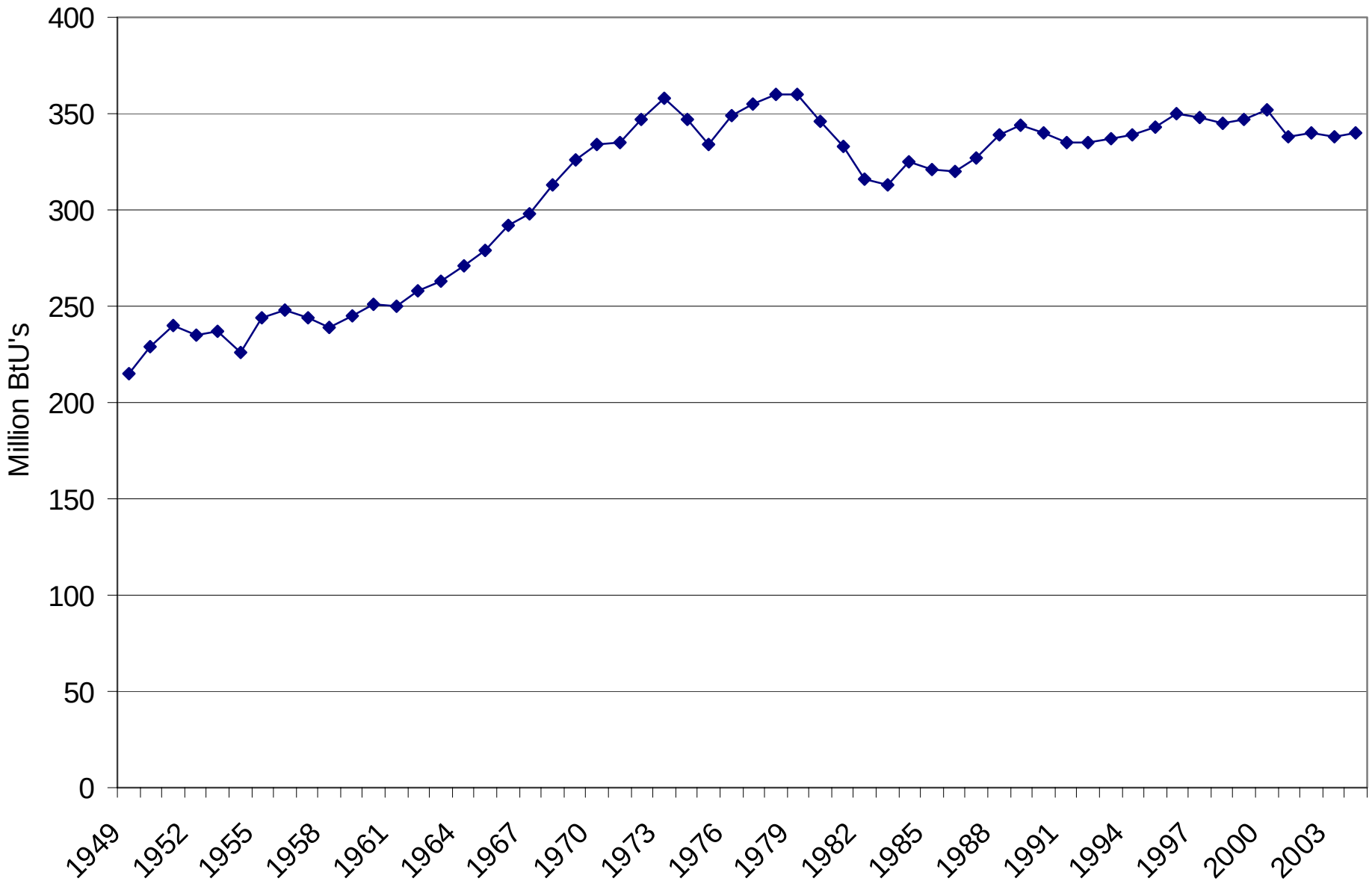
Total U.S. Energy Use



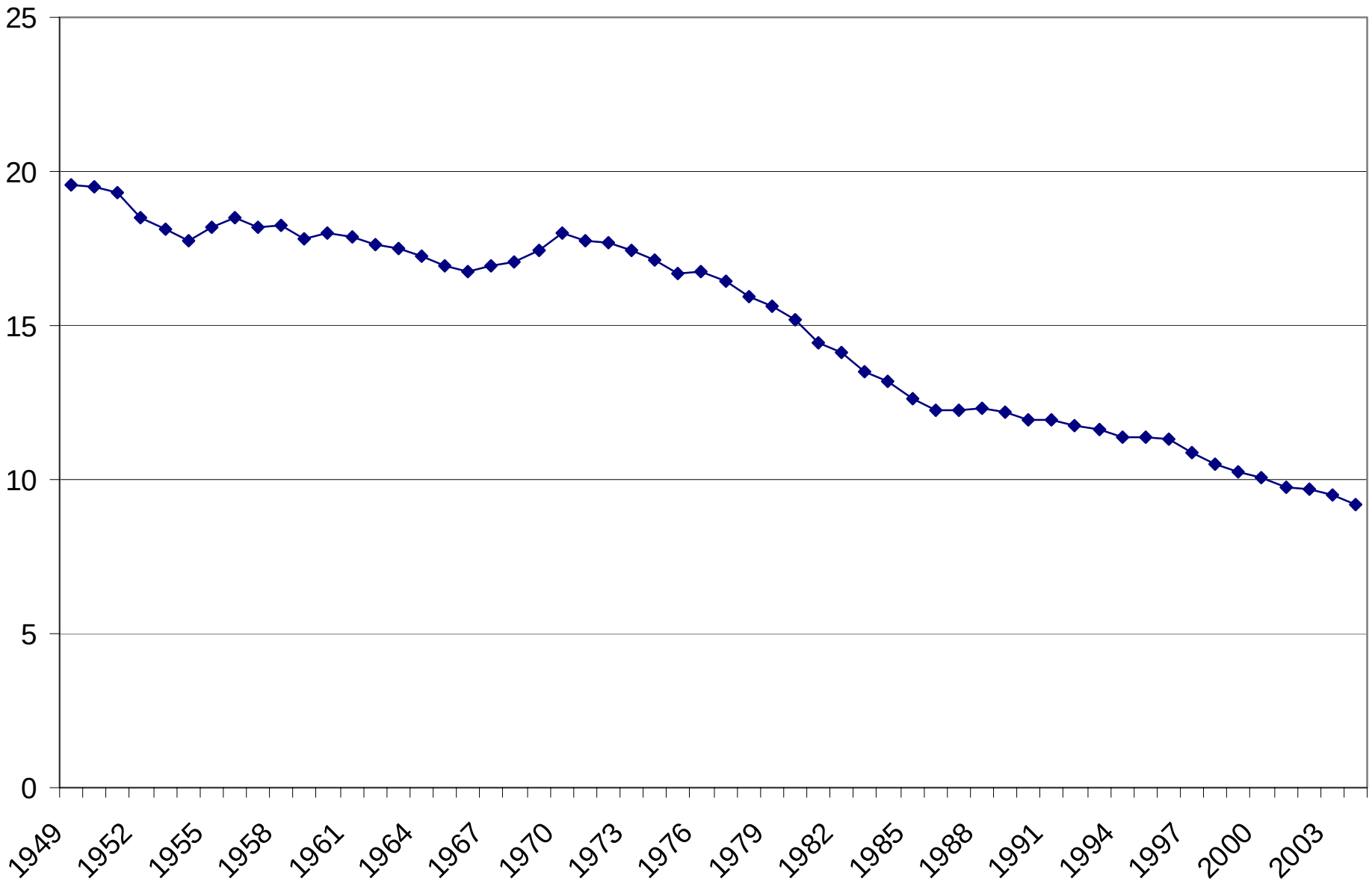
Percent of Total Energy Use in U.S. by Sector

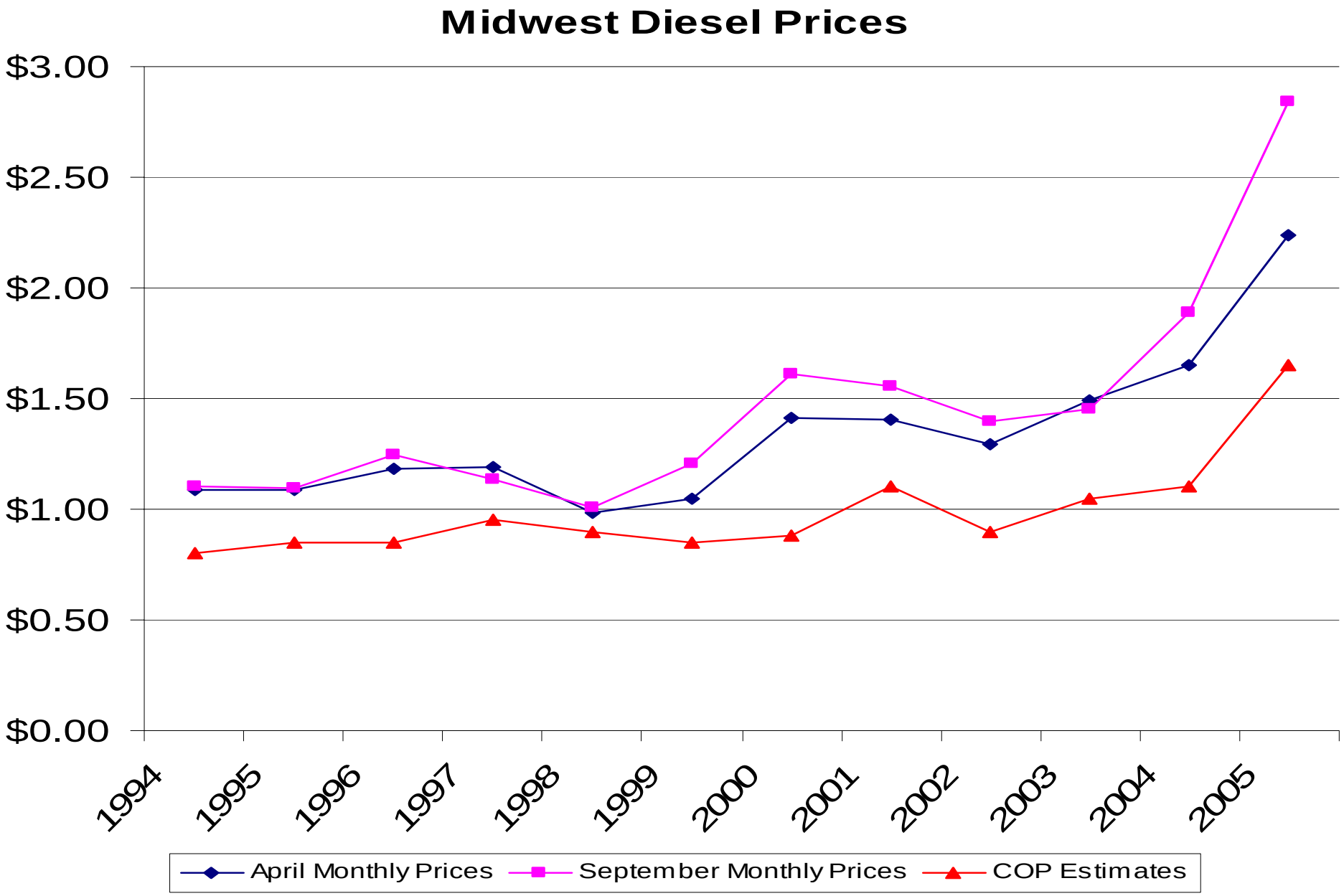


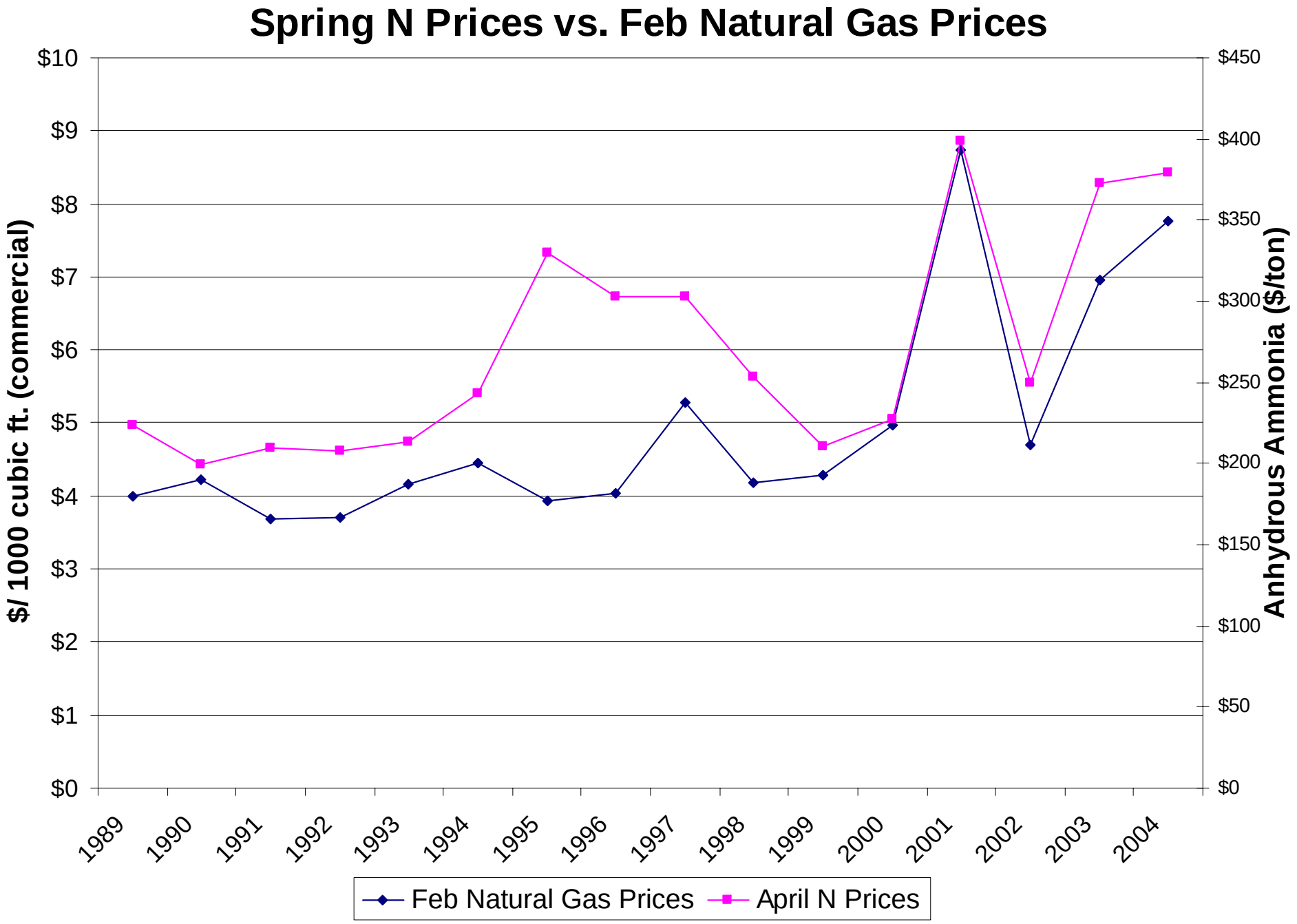
Energy Consumption per Person per Year in U.S.



Thousand BtU's per Constant Dollar GDP

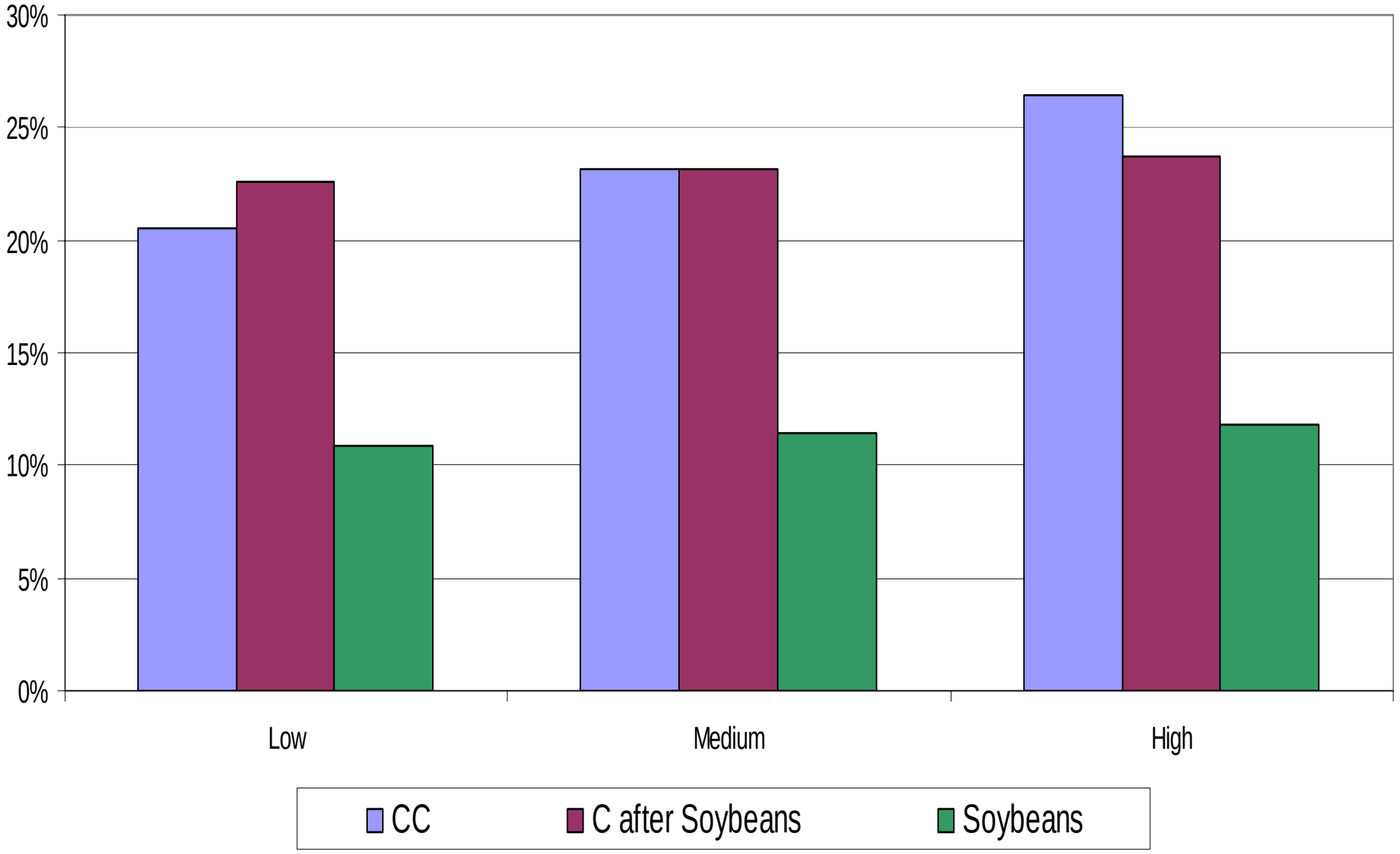



Midwest Diesel Prices
$3.00
$2.50
$2.00
$1.50
$1.00
$0.50
$0.00
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
April Monthly Prices
September Monthly Prices
COP Estimates

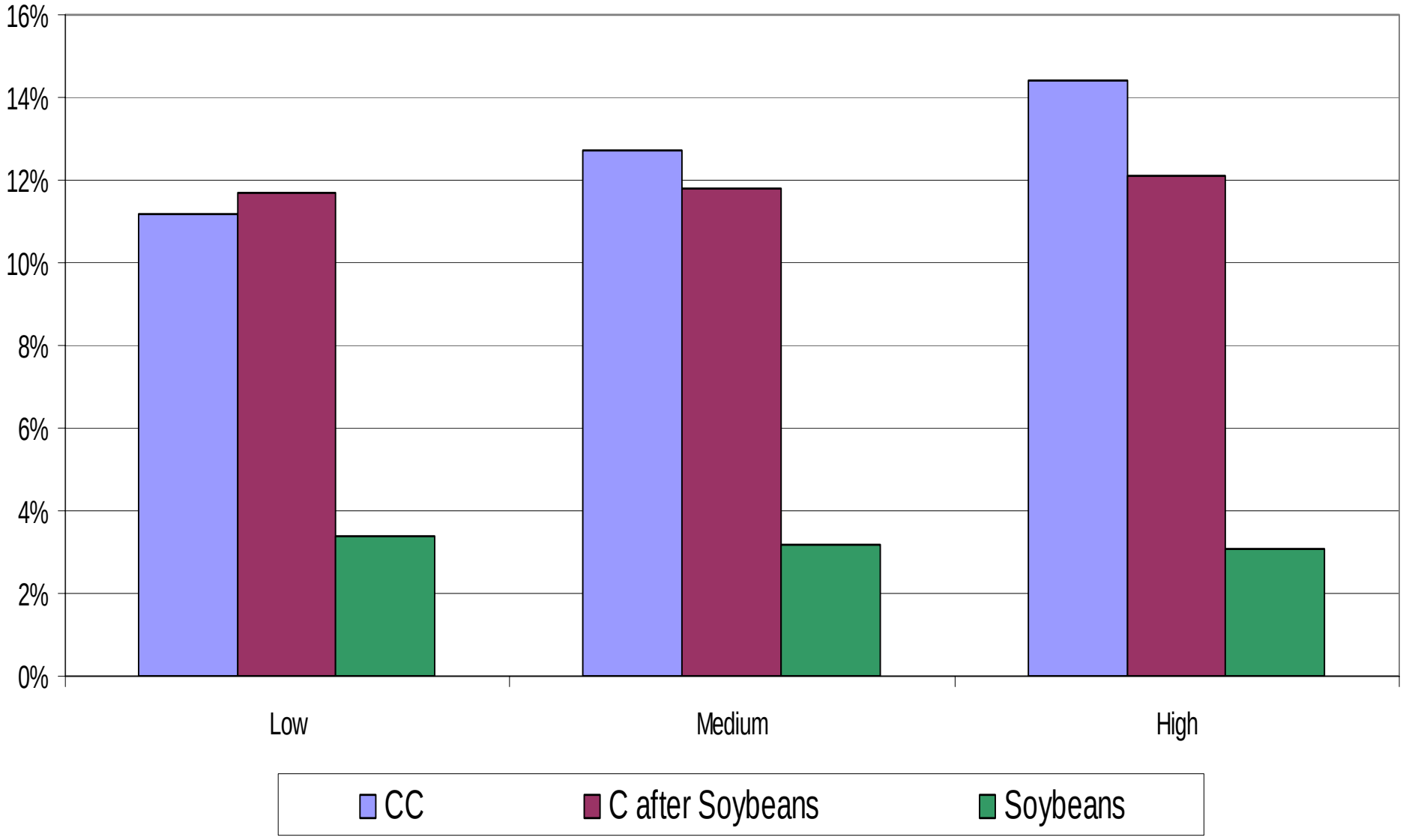

Spring N Prices vs. Feb Natural Gas Prices
$/ 1000 cubic ft. (commercial)
Anhydrous Ammonia ($/ton)
$10
$9
$8
$7
$6
$5
$4
$3
$2
$1
$0
$450
$400
$350
$300
$250
$200
$150
$100
$50
$0
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Feb Natural Gas Prices
April N Prices

Iowa Energy Use and Input Cost Impacts

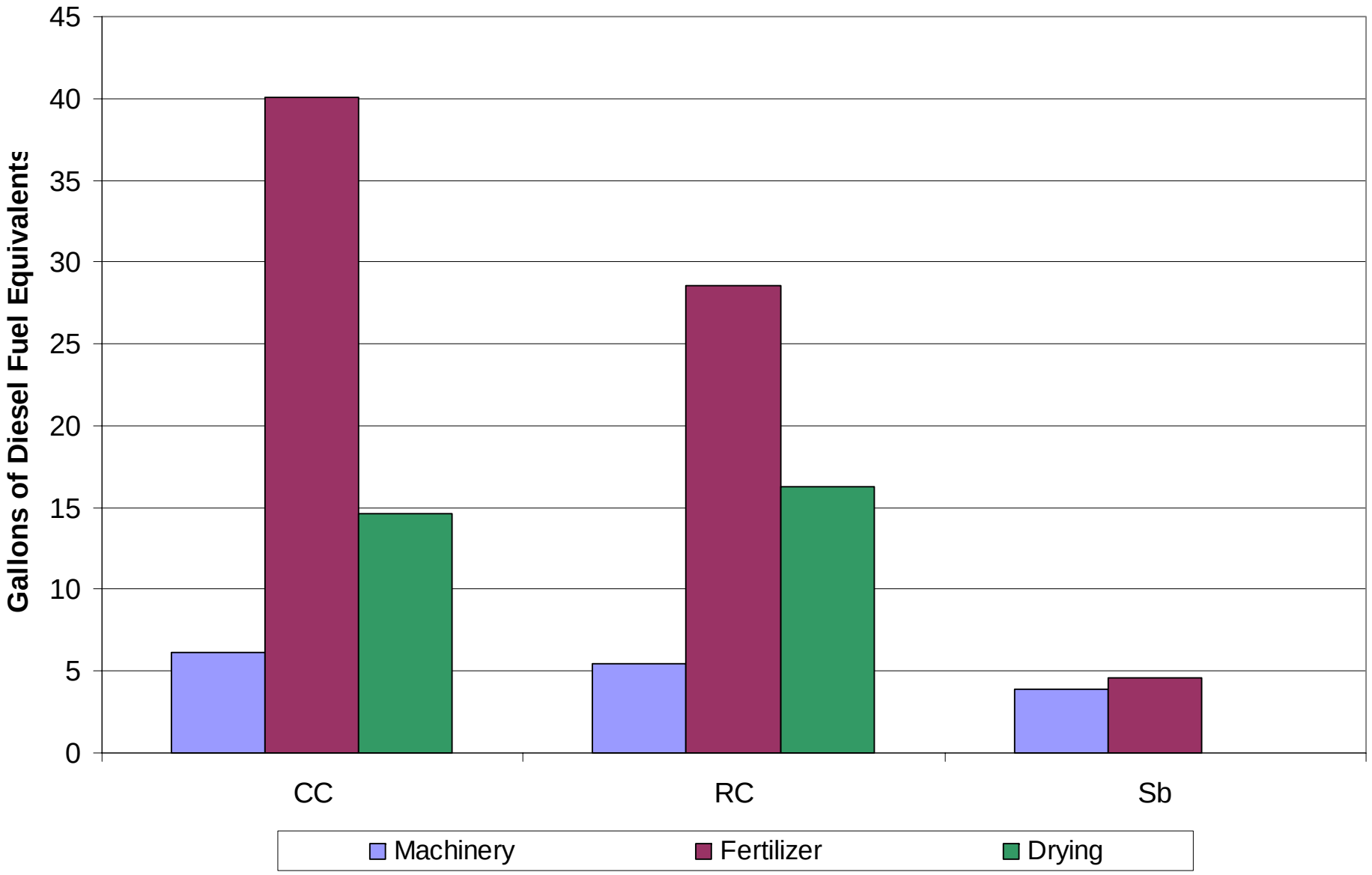
Percent Change in ISU Variable Cost Estimates by Crop and Yield Level with 75% Higher Fuel and 30% Higher Fertilizer



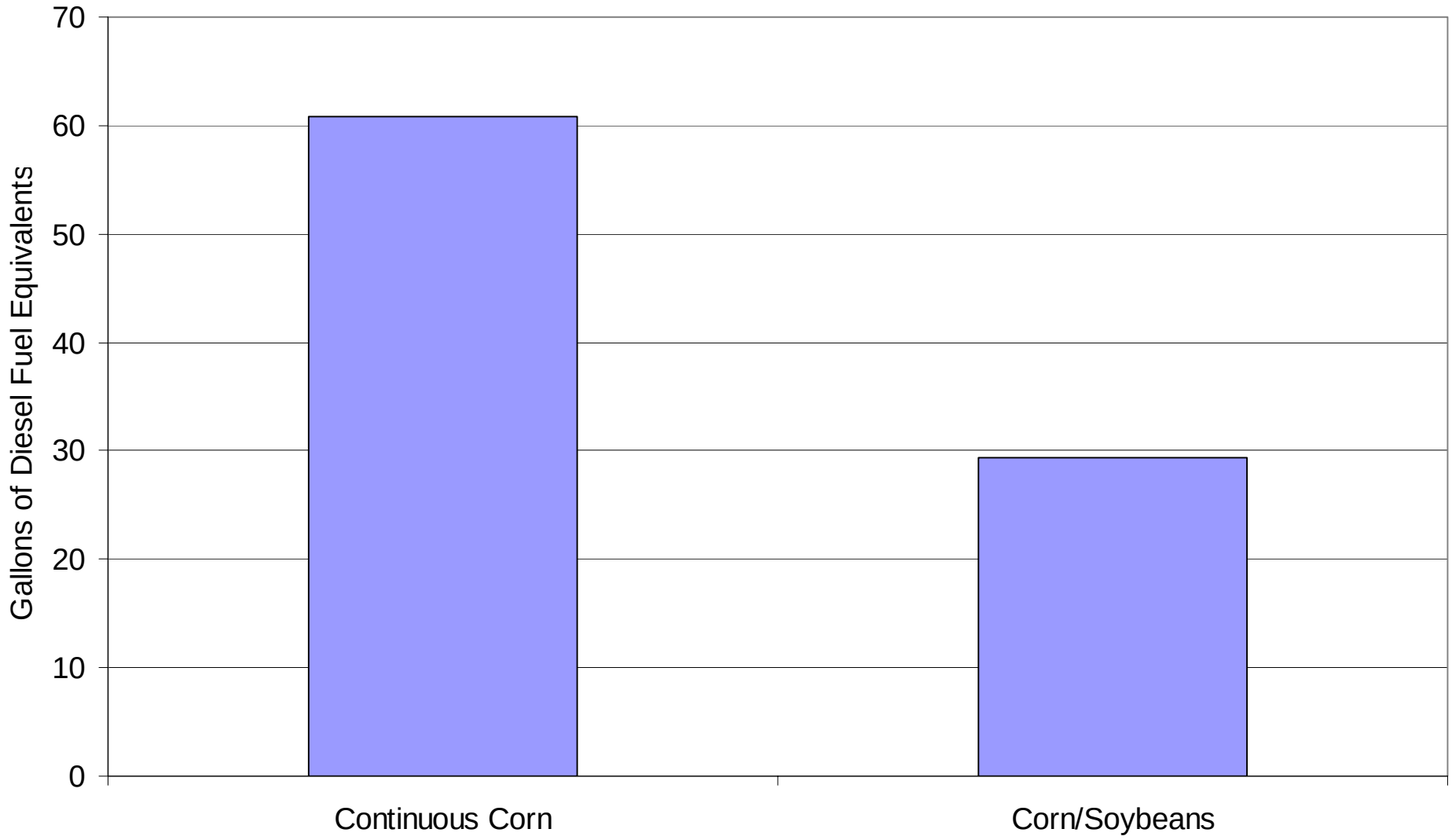
Percent Change in ISU Total Cost Estimates by Crop and Yield Level with 75% Higher Fuel and 30% Higher Fertilizer

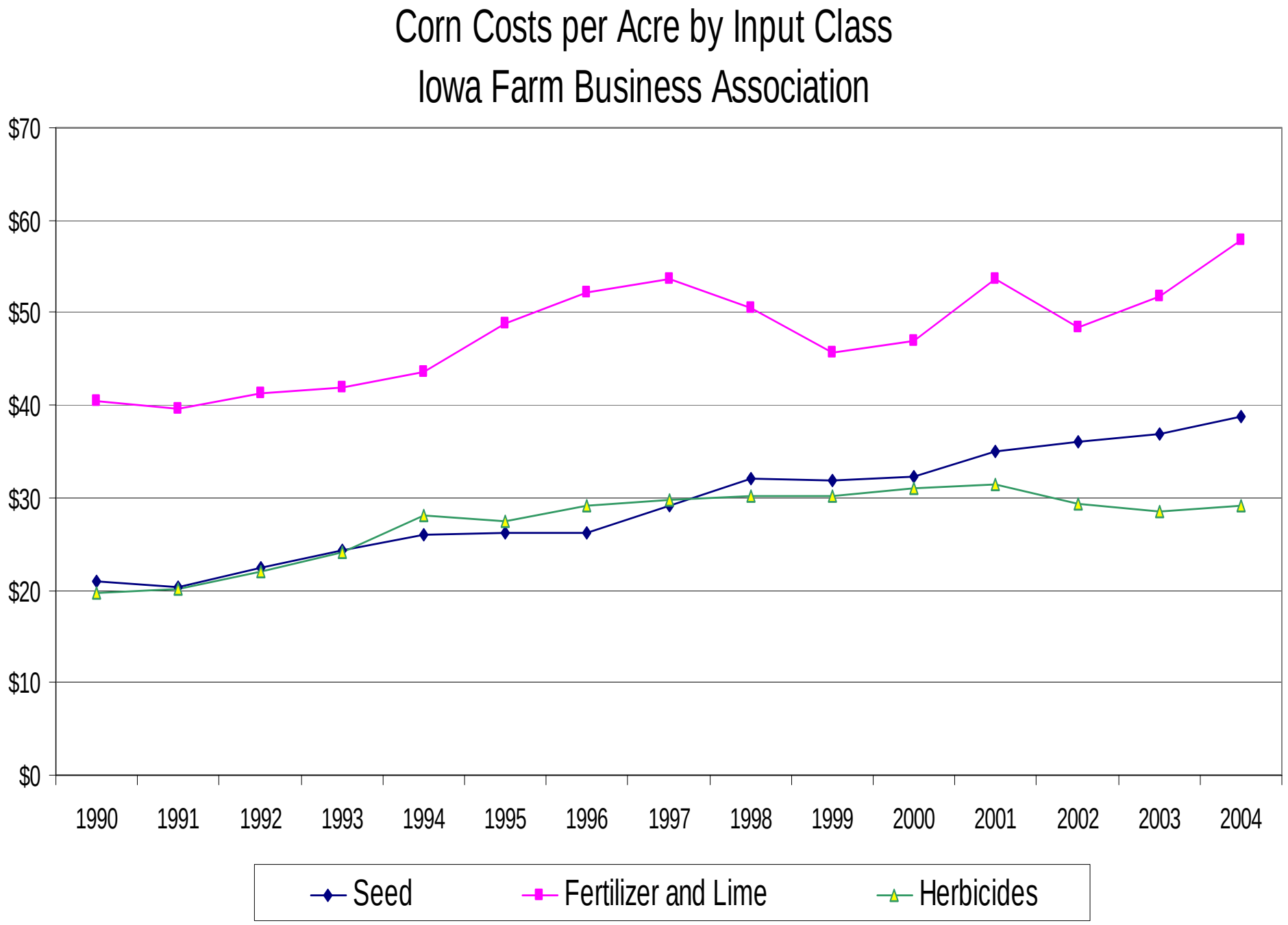


Energy Use for Selected Categories by Crop

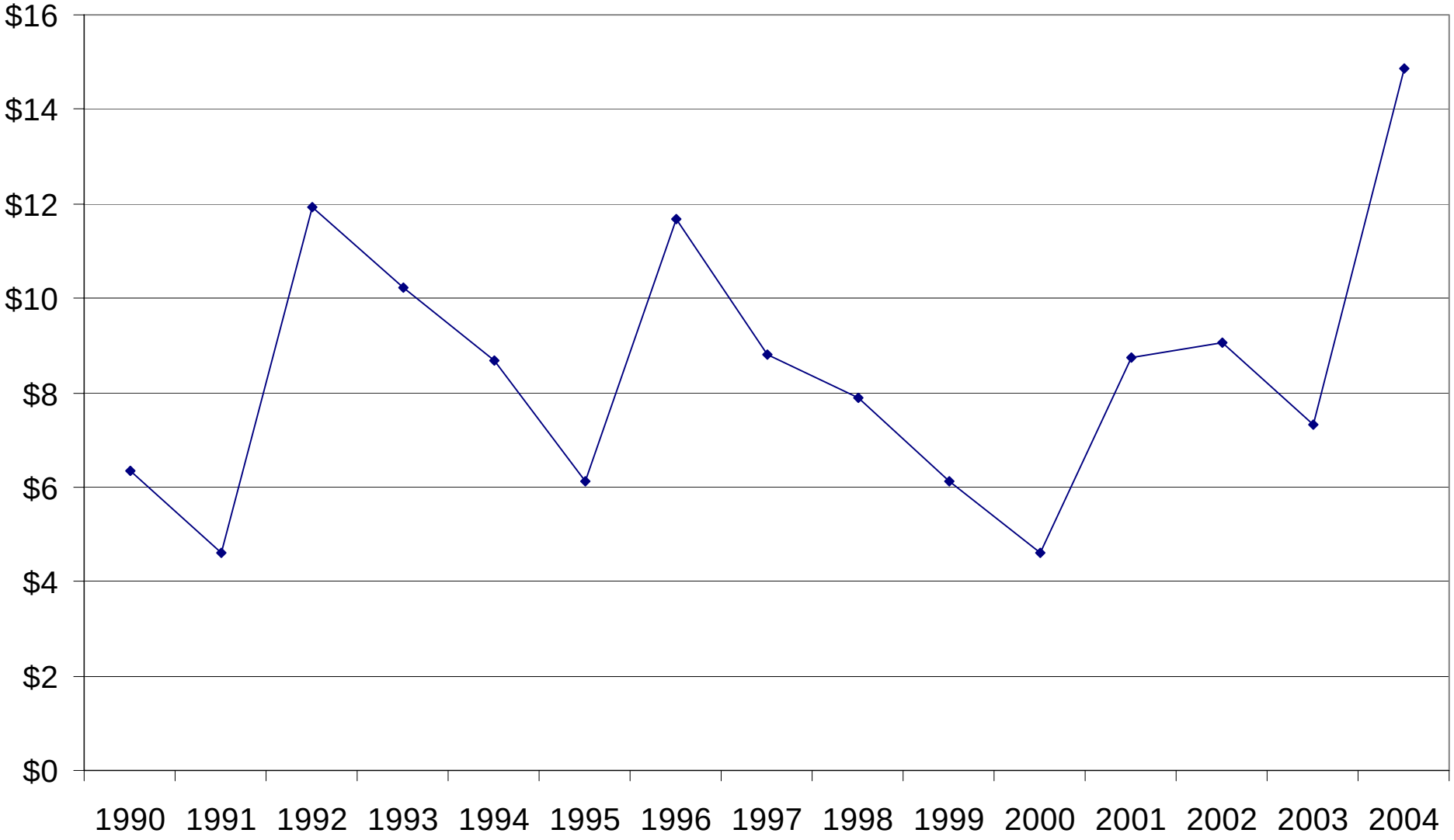


Energy Use for Machinery, Fertilizer, and Drying by Rotation

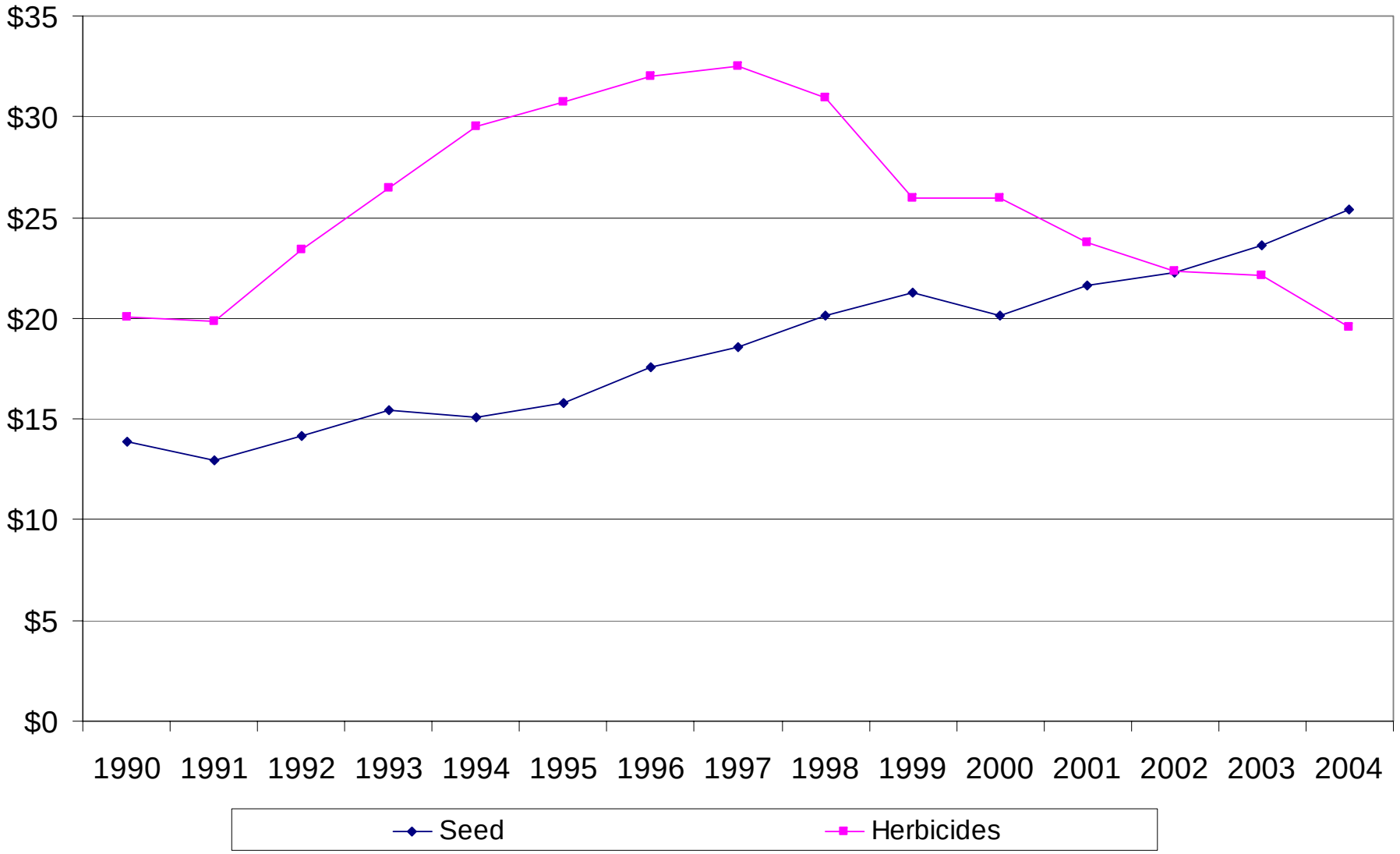



Corn Costs per Acre by Input Class
Iowa Farm Business Association
$70
$60
$50
$40
$30
$20
$10
$0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Seed
Fertilizer and Lime
Herbicides

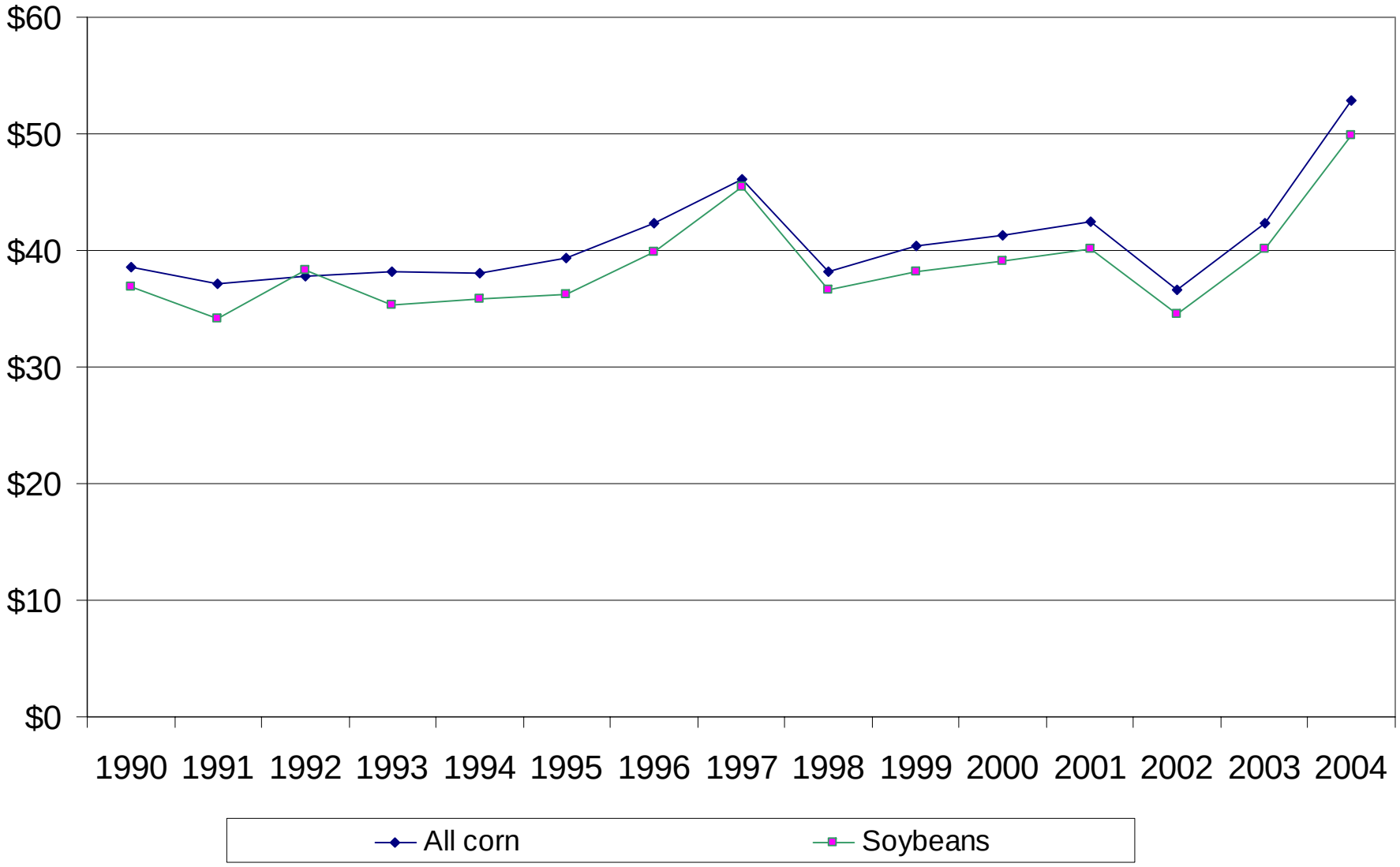
Corn Drying and Storage Costs
Iowa Farm Business Association



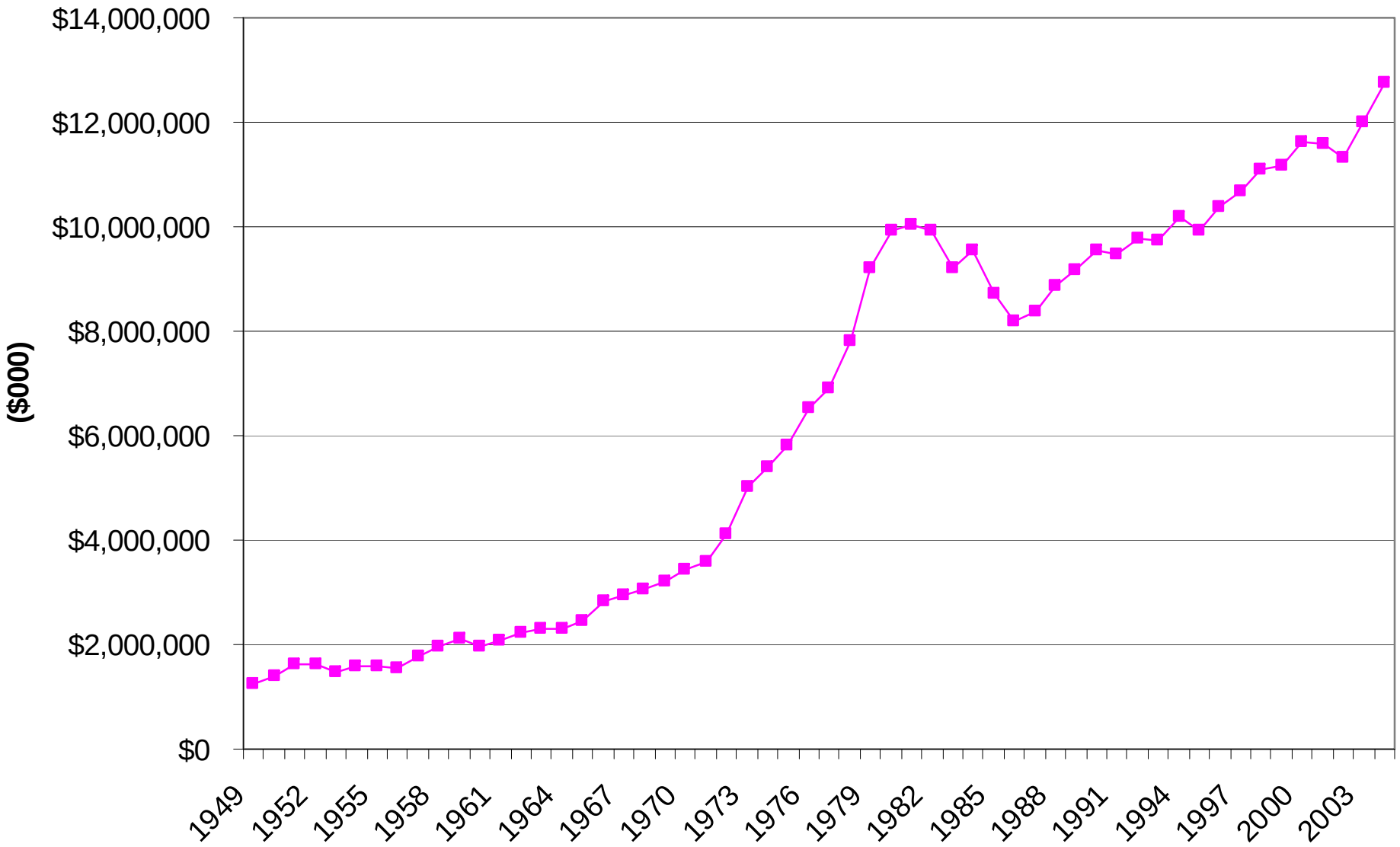
Soybean Costs per Acre by Input Class; Iowa Farm Business Association



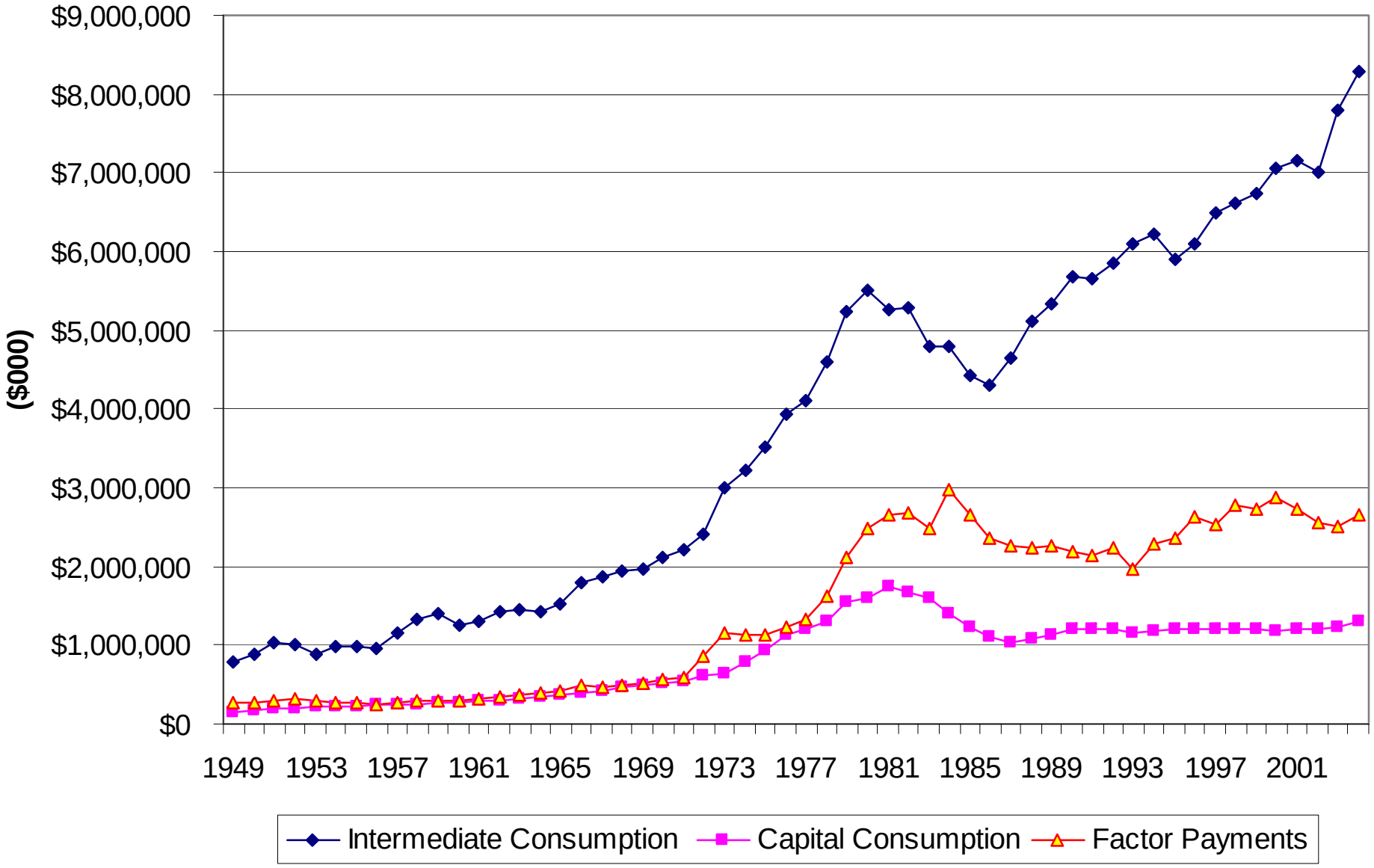
Machinery Fuel, Lube, Repairs, and Hire by Crop; Iowa Farm Business Association



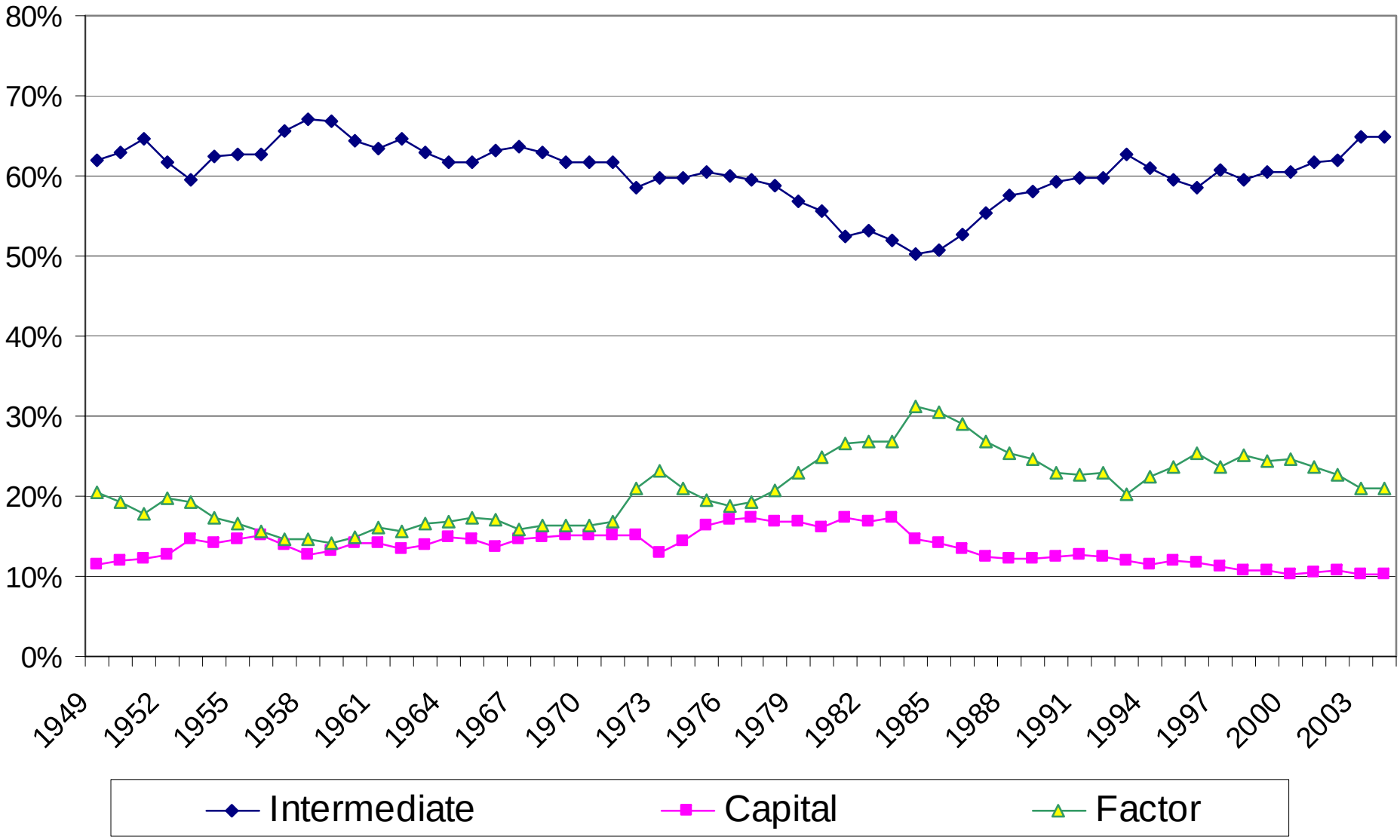
Total Farm Expenses in Iowa



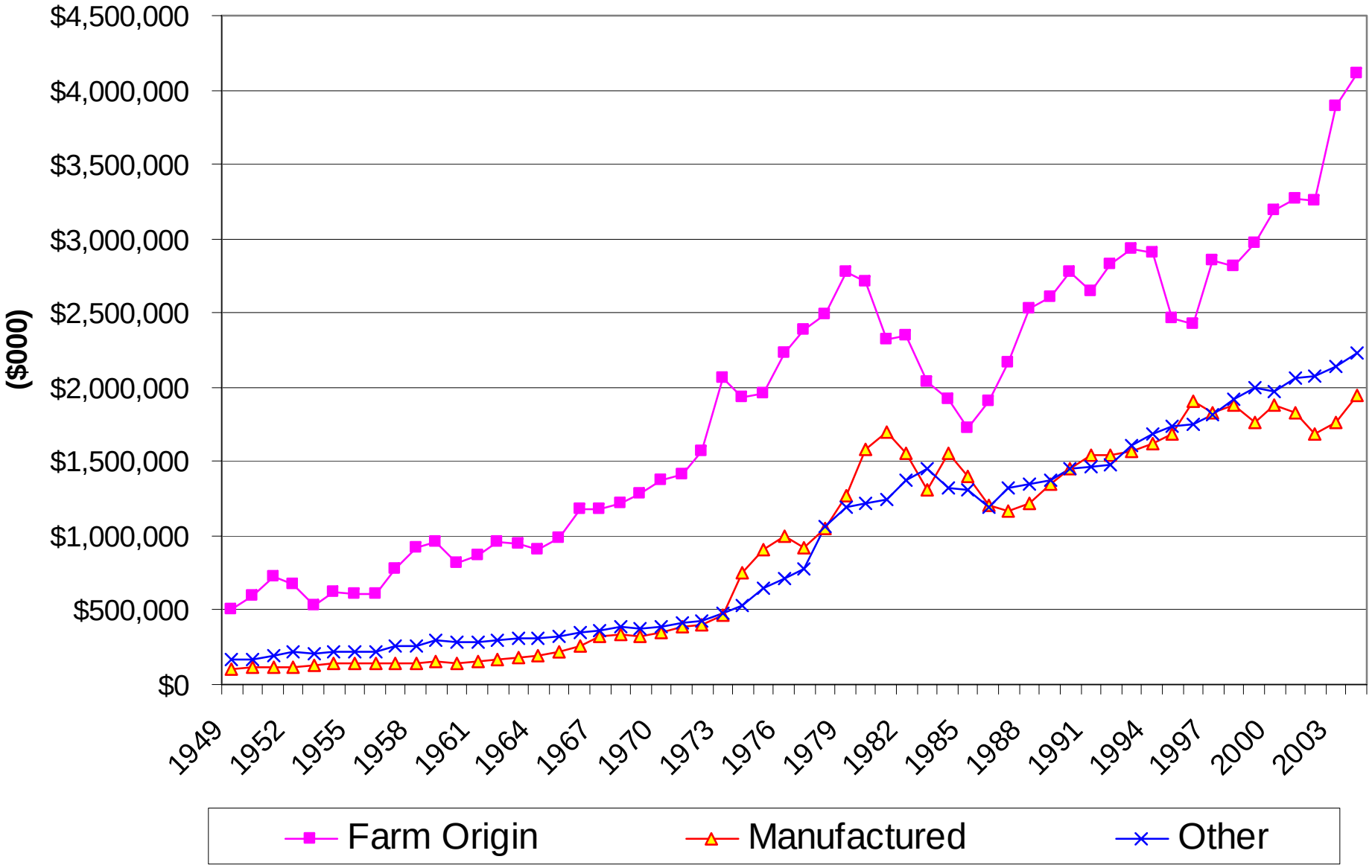
Distribution of Iowa Farm Expenses by Major Categories



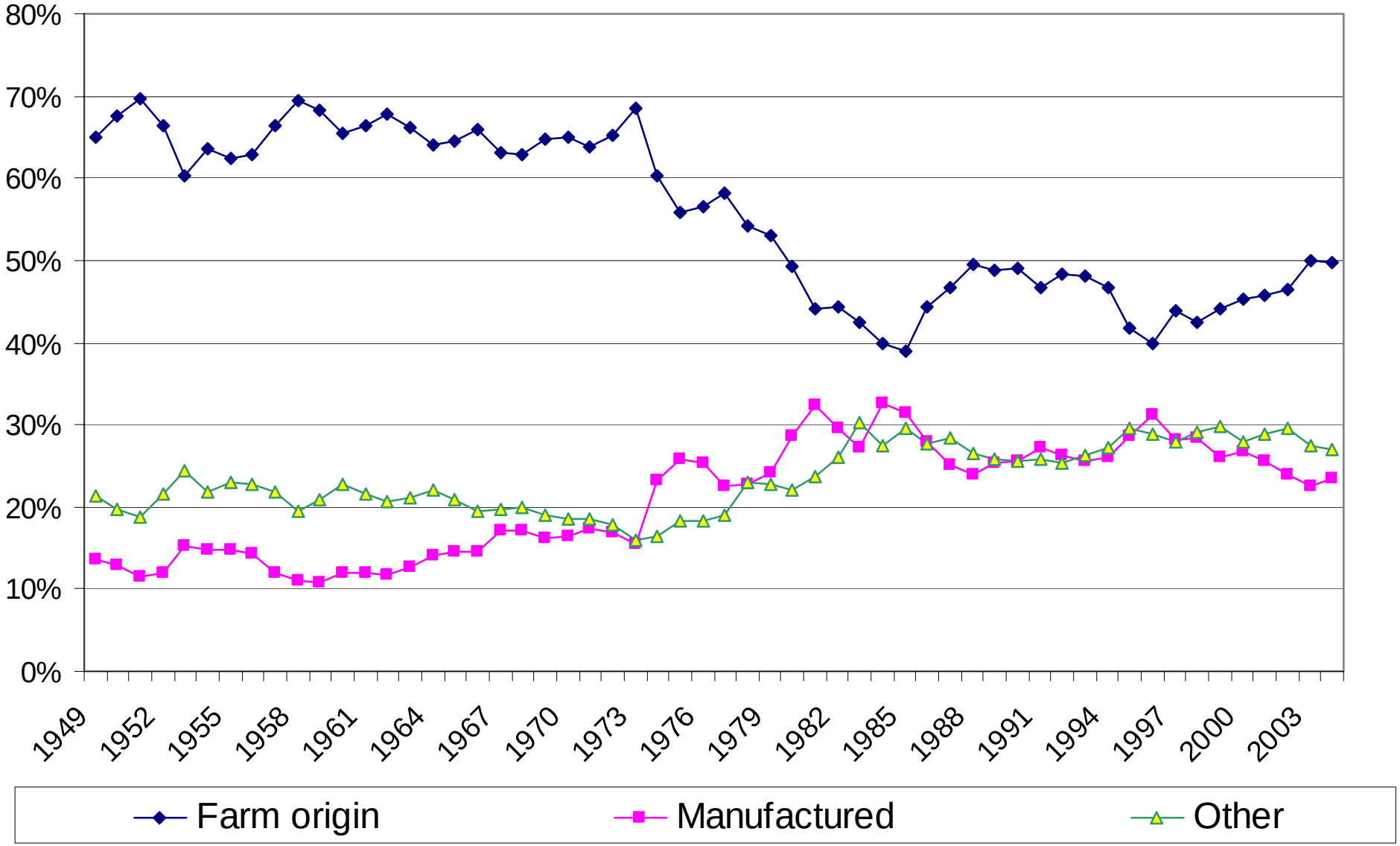
Percentage Distribution of Iowa Farm Expenses by Major Categories



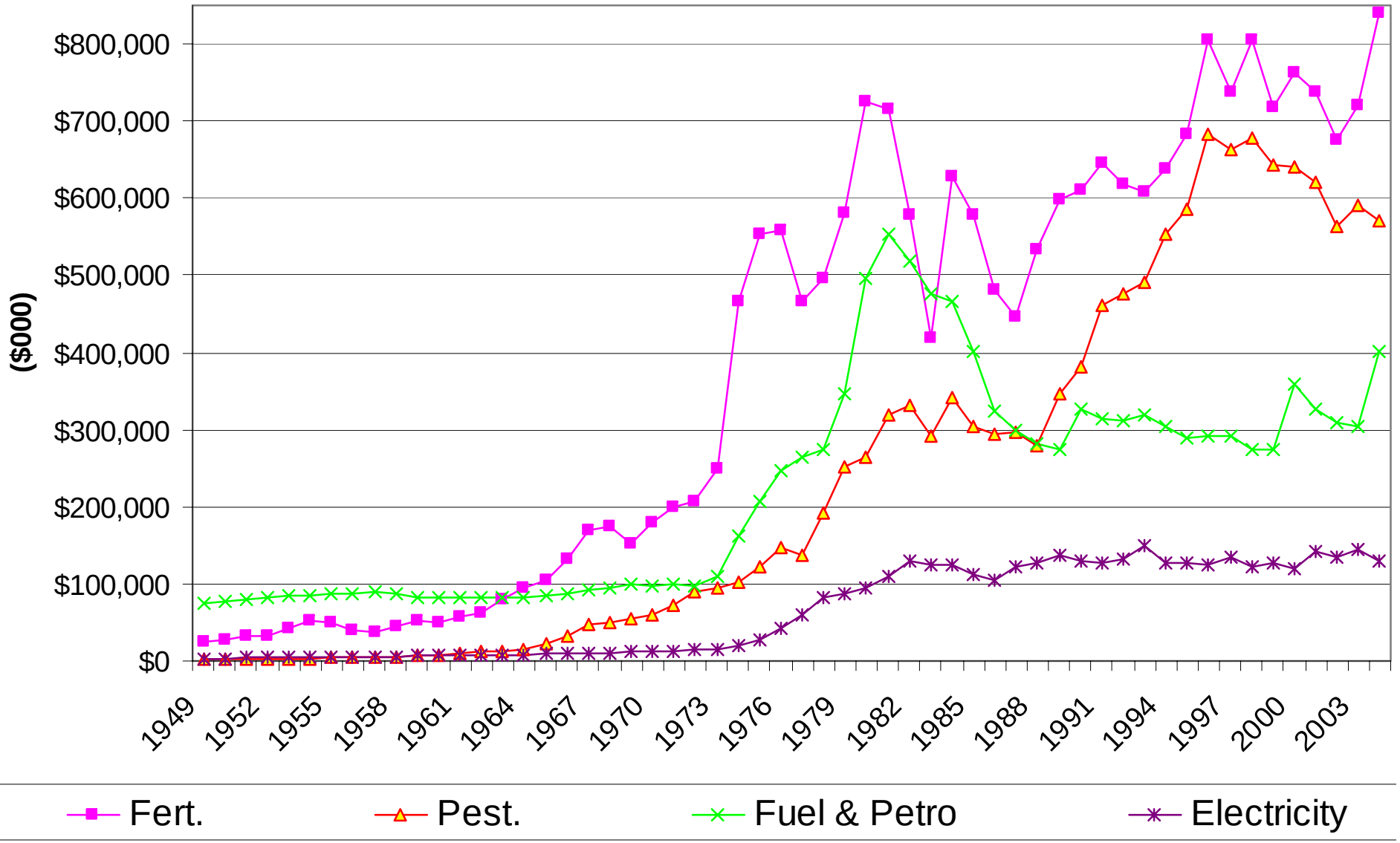
Distribution of Intermediate Expenses by Category



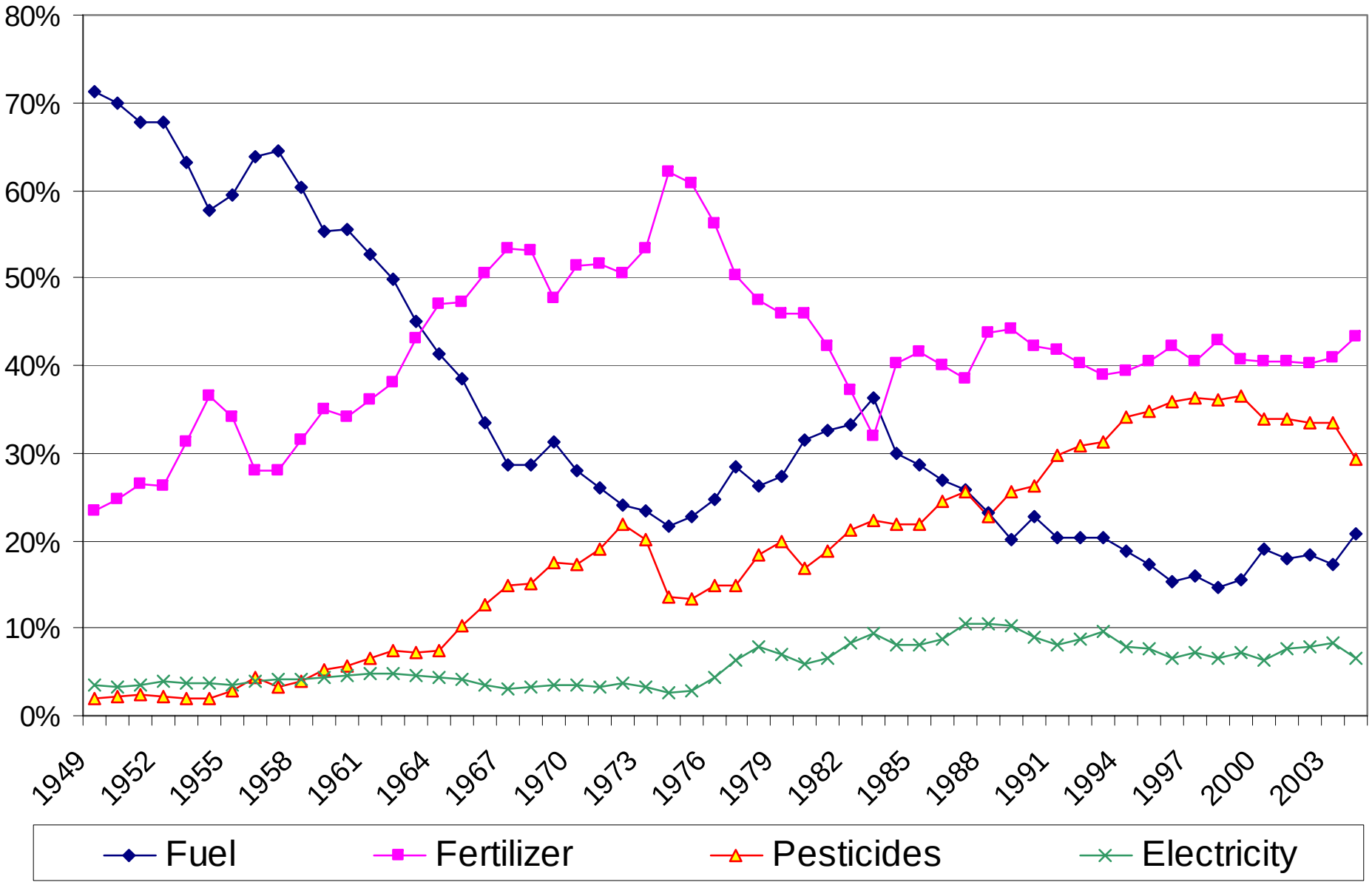
Percentage Distribution of Intermediate Expenses by Major Categories



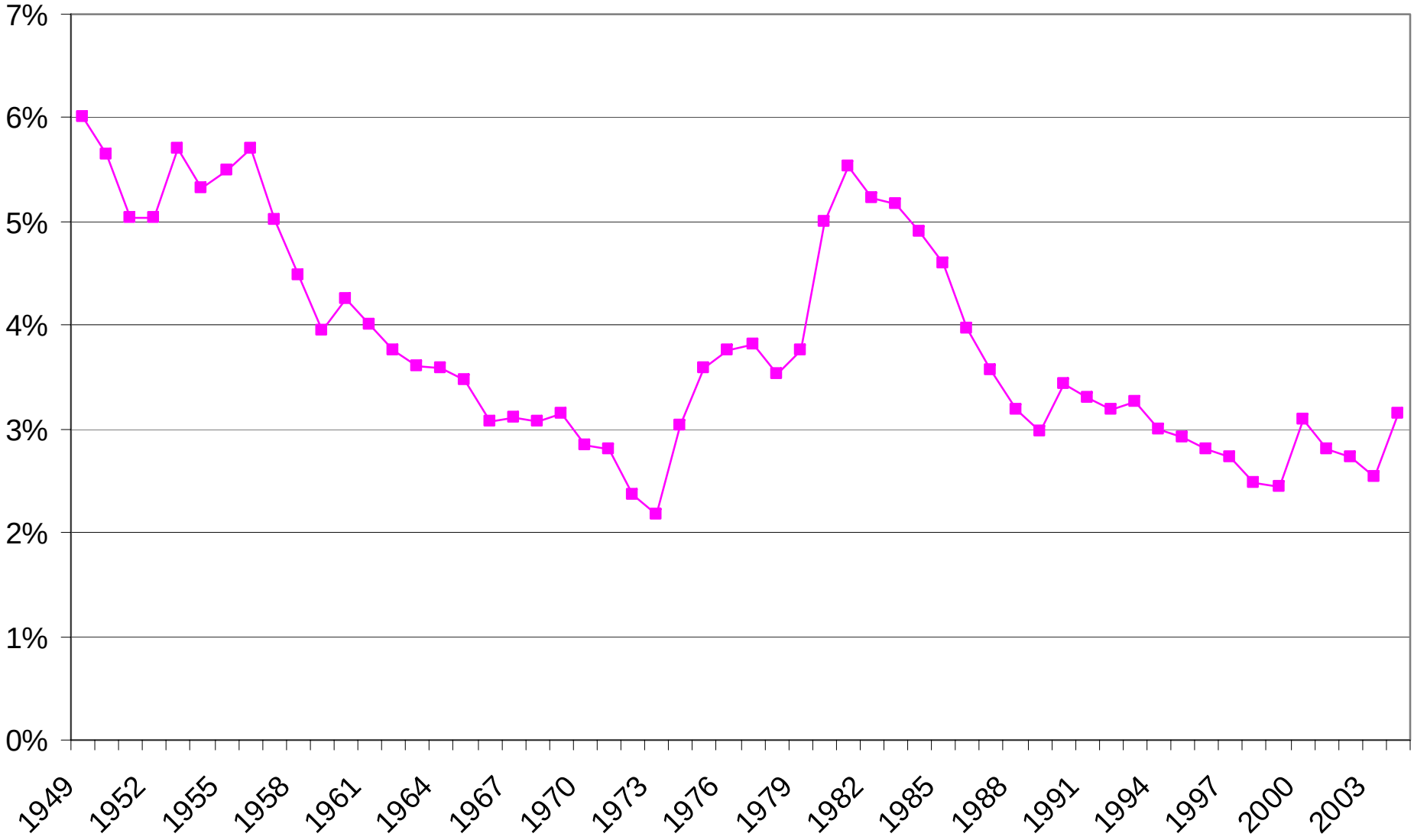
Distribution of Manufactured Input Expense



Percentage Distribution of Manufactured Input Costs



Fuel as a Percent of Total Expenses

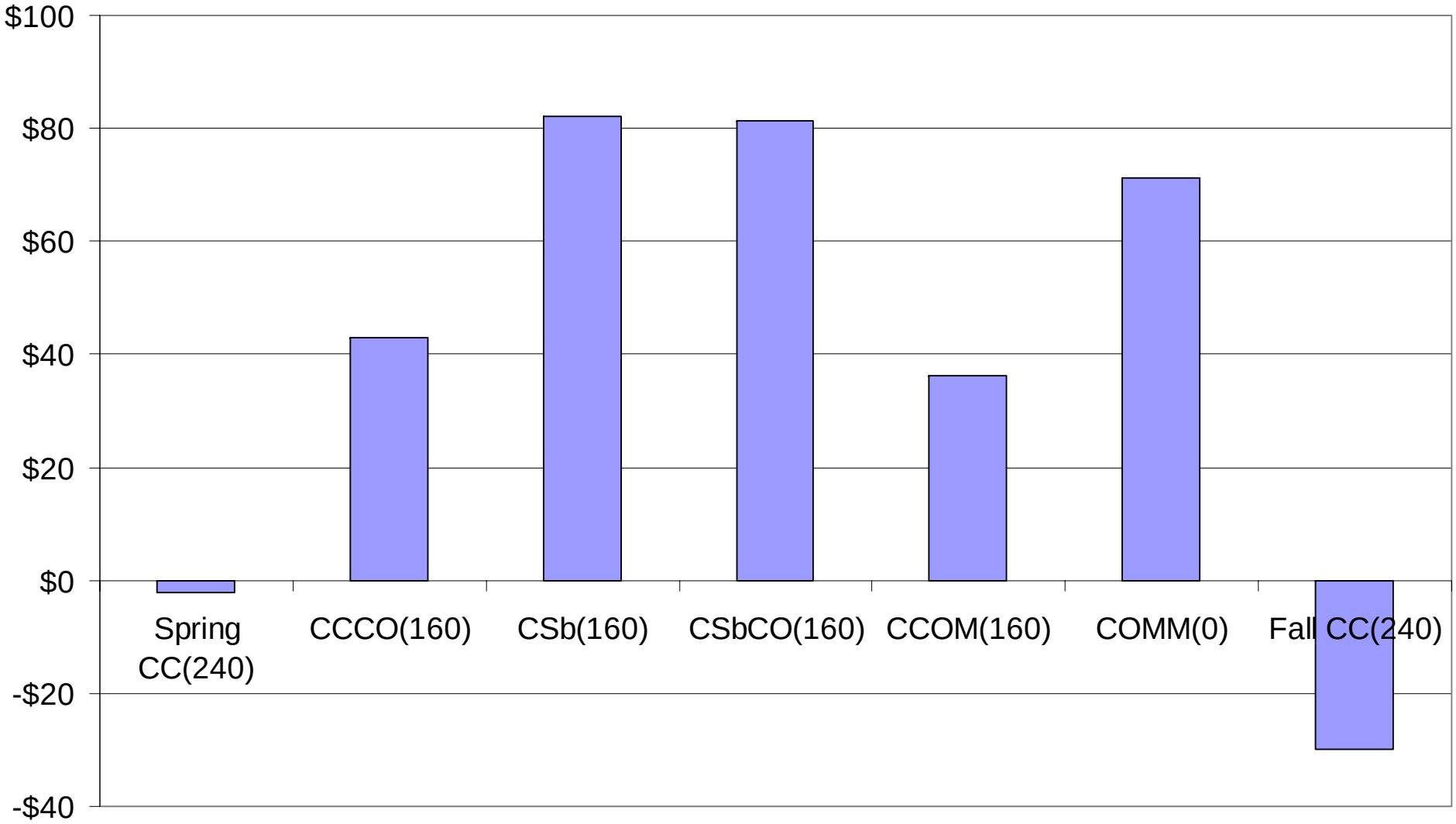


Rotation Impacts

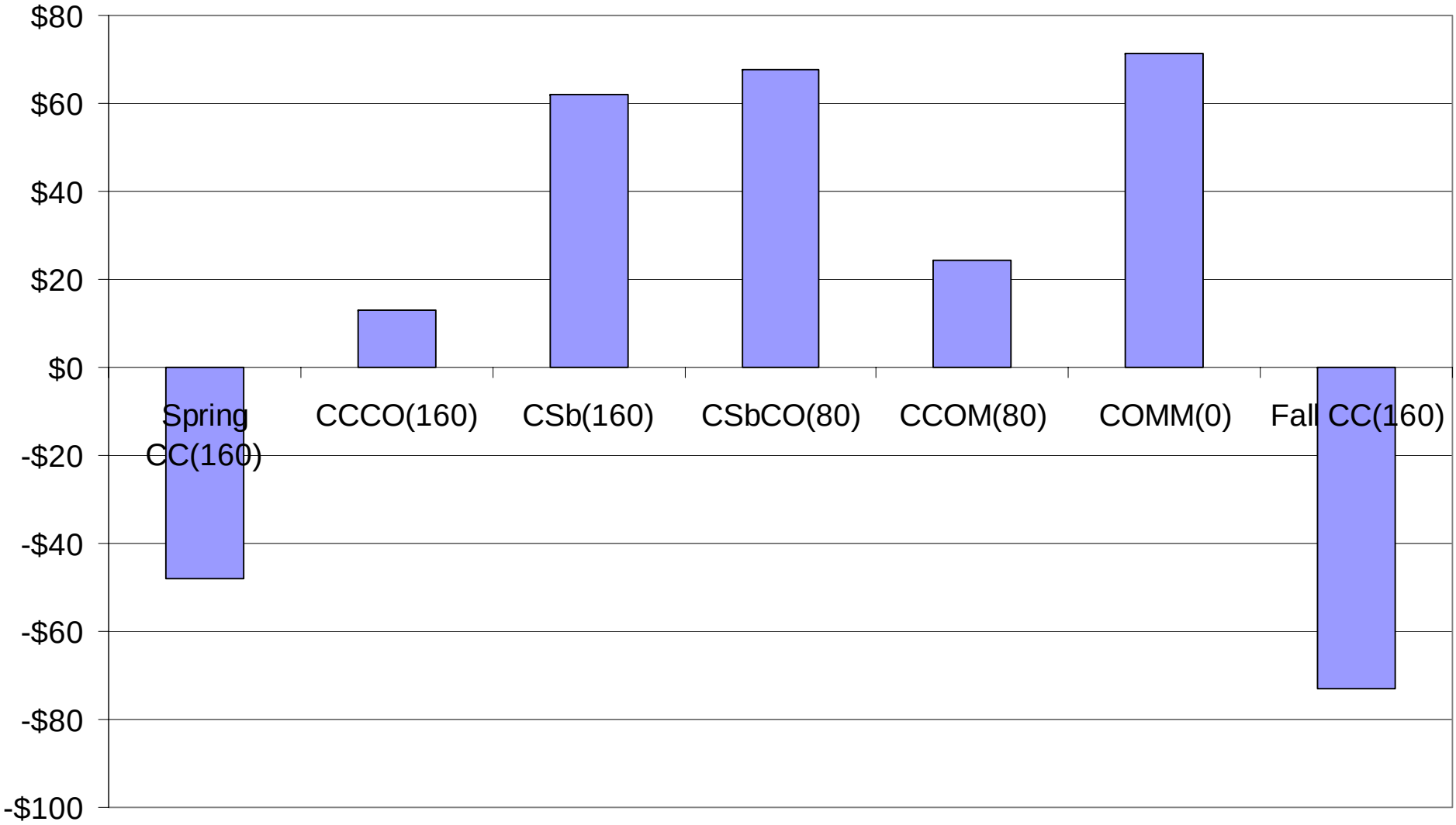
Assumptions for Rotation Data

- Yields from research plots at the North Central Research farm, Kanawha, IA
- Four N levels tested; 0, 80, 160, 240
- All N is applied in the form of urea
- Operations and input use are consistent with practices in the area
- Base prices; $2.34 Corn, $5.50 Soybeans, $1.80 Oats, $80 alfalfa, $40 Straw

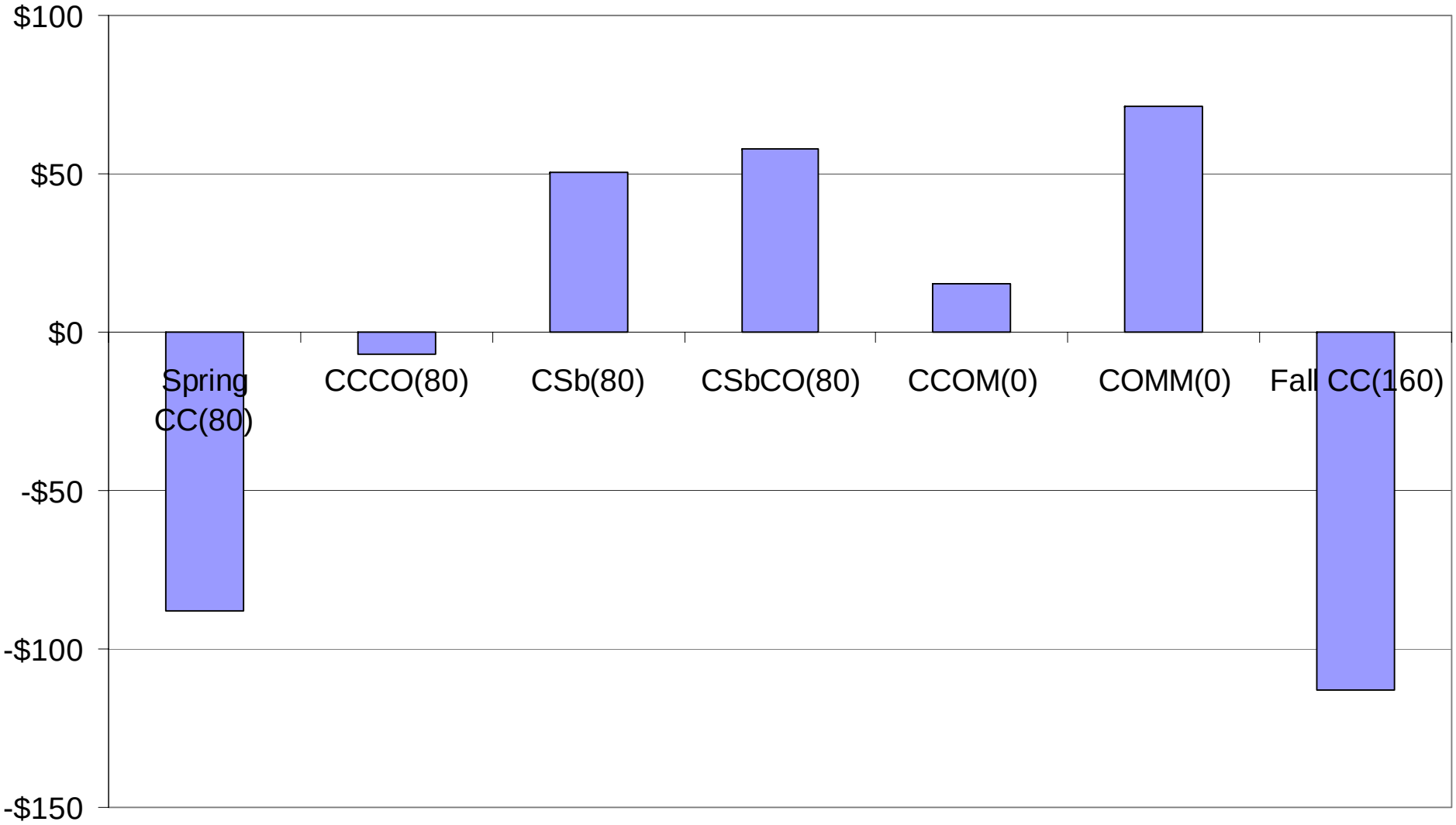
Highest N Use Return to Land Using Base Prices with $.25 N



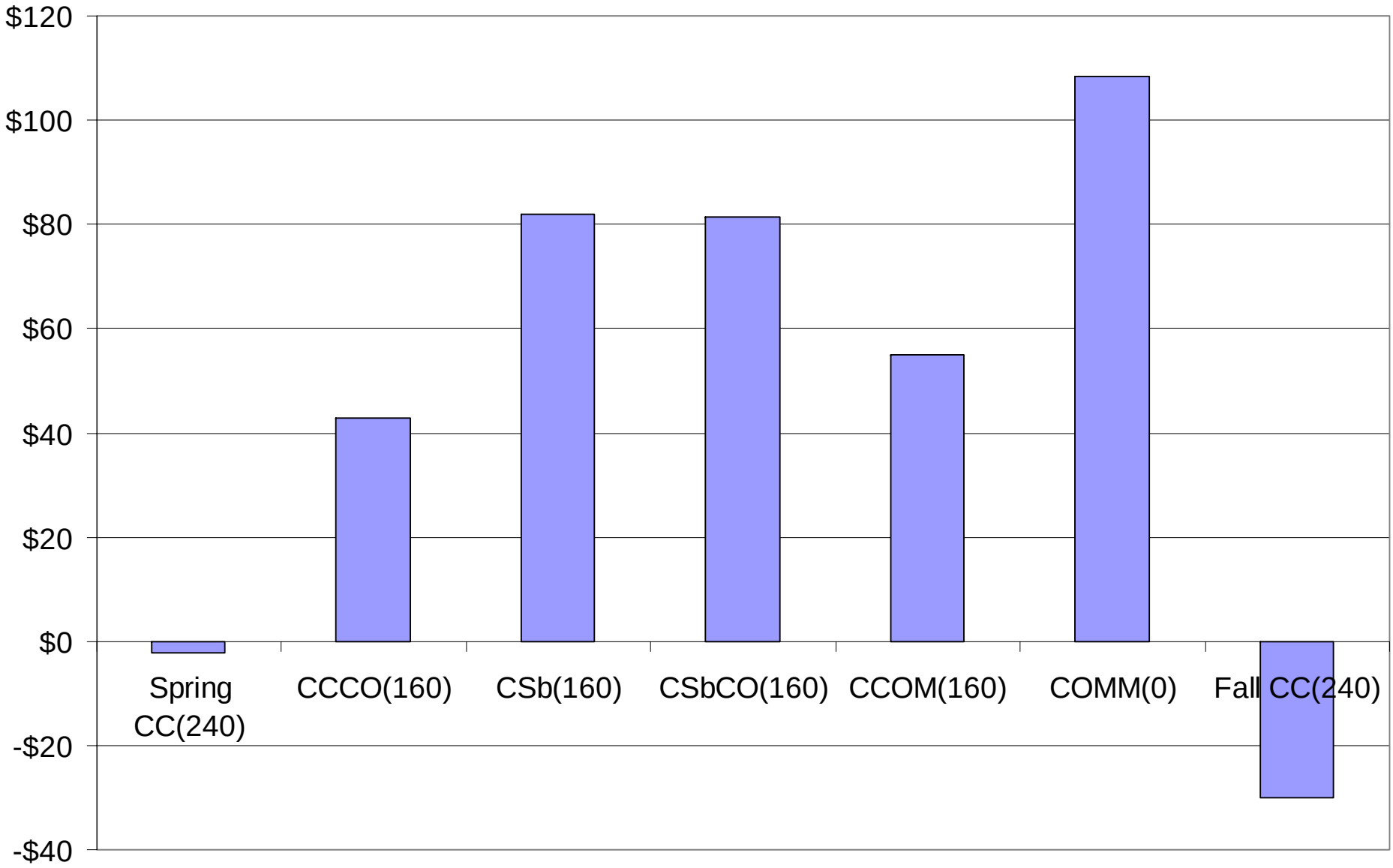
Highest N Use Return to Land Using Base Prices with $.50 N



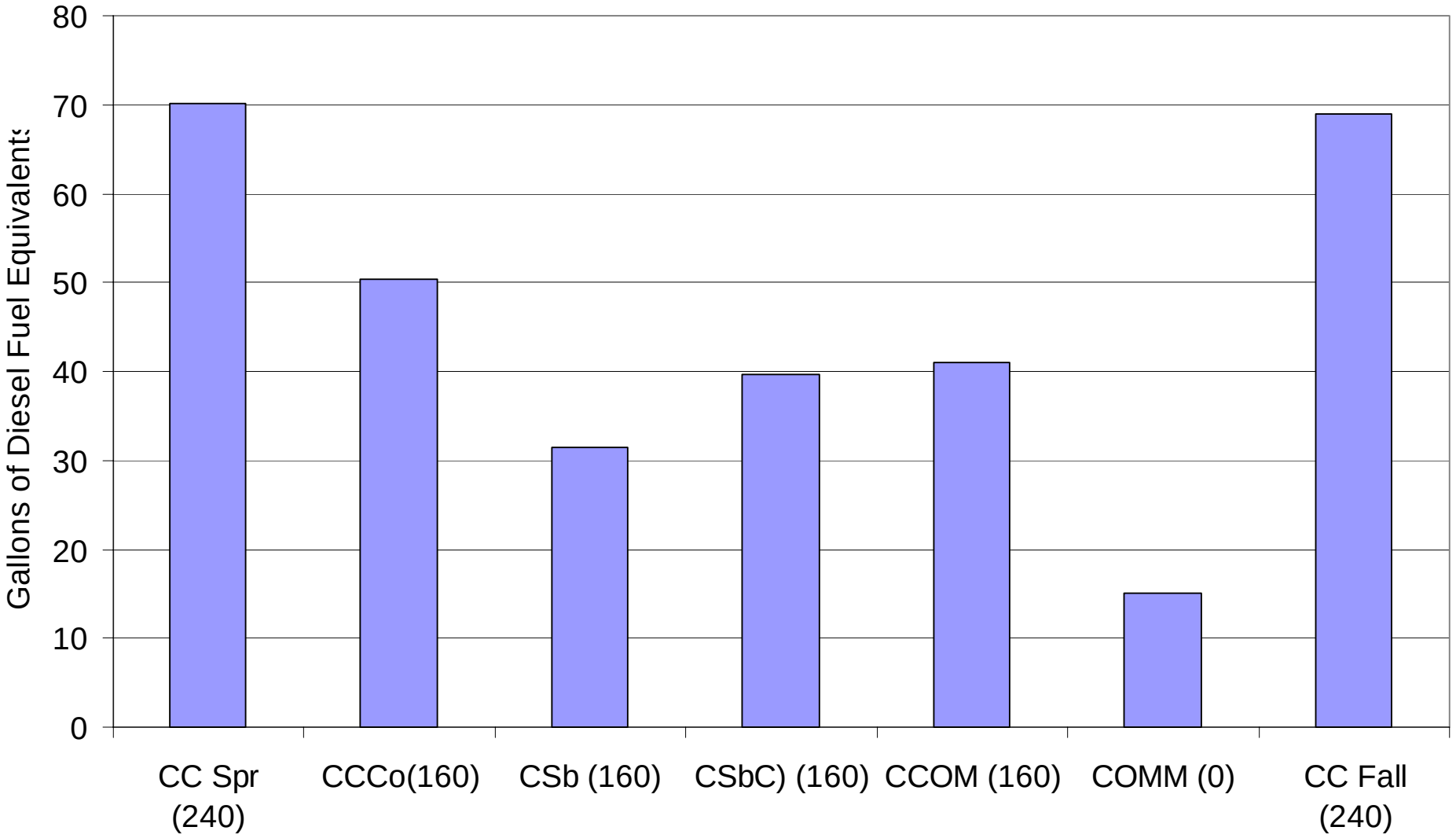
Highest N Use Return to Land Using Base Prices with $.75 N

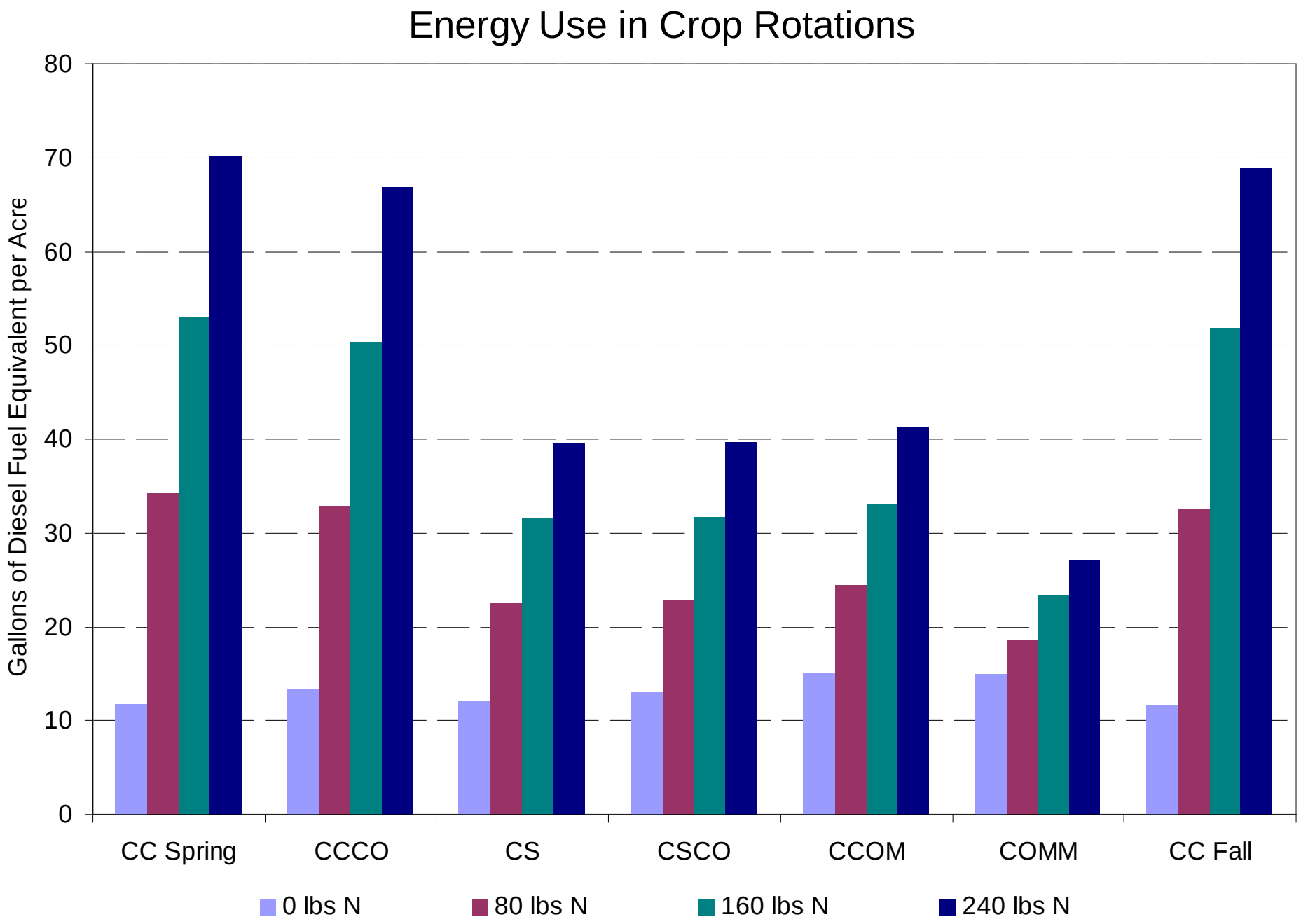


Highest N Use Return to Land with $100 Alfalfa and $.25 N

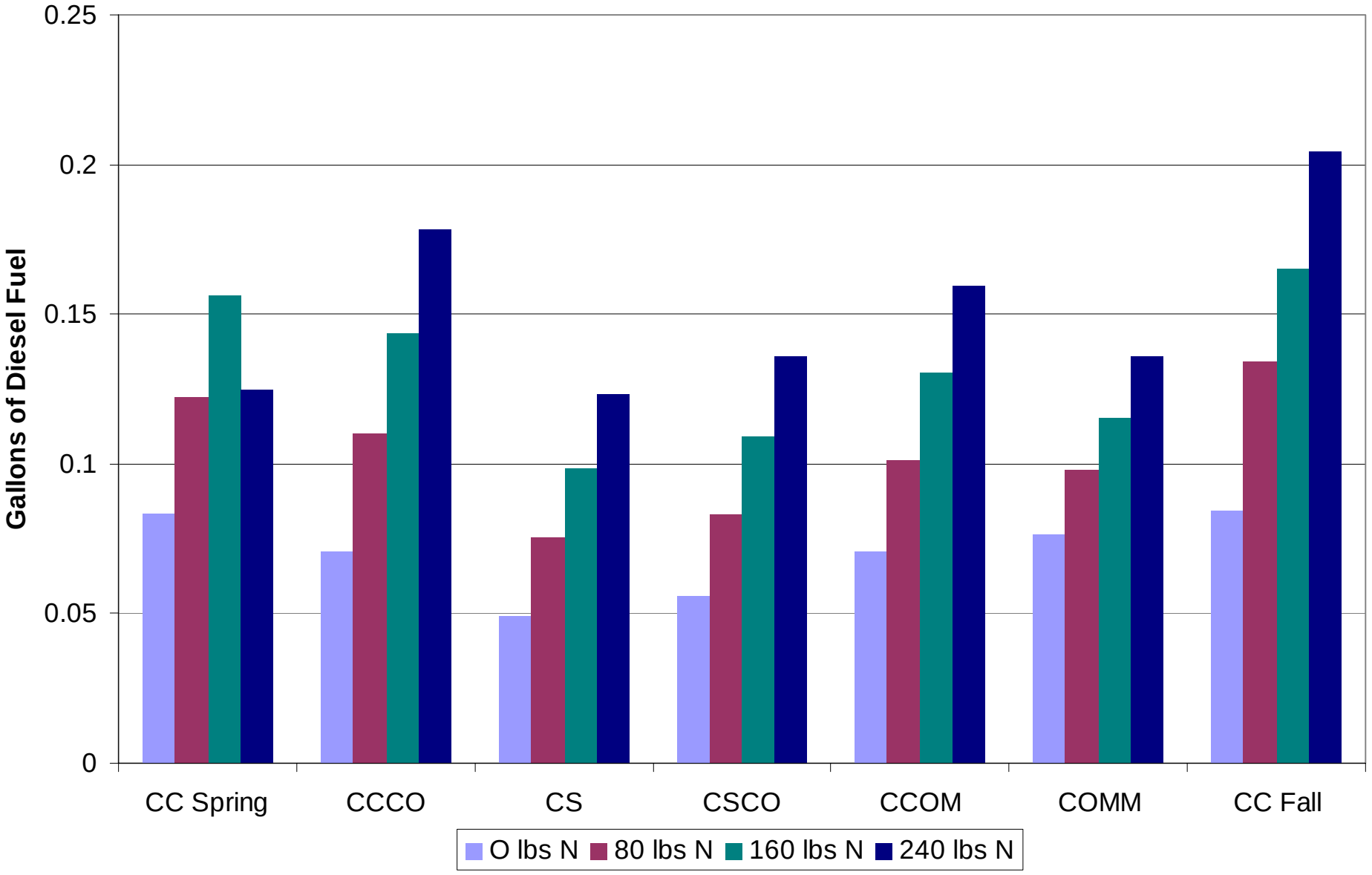


Energy Use by Rotation for N Use with Highest Return to Land




Energy Use in Crop Rotations
Gallons of Diesel Fuel Equivalent per Acre
80
70
60
50
40
30
20
10
0
CC Spring
CCCO
CS
CSCO
CCOM
COMM
CC Fall
0 lbs N
80 lbs N
160 lbs N
240 lbs N

Gallons of Diesel Fuel Used per $1 of Gross Revenue



Final Thoughts

- U.S. agriculture has become fossil fuel energy intensive, especially for fertilizer
- The price for fossil fuel energy will be subject to supply and demand shocks; it will remain volatile but show an upward trend
- Farmers' options are limited in the short run with conservation being the key, in the longer run different equipment and possibly rotations may be more attractive options

So What Can be Done?

- Conservation of energy use was a very successful strategy in the 1970s
- Think about energy use and where there are ways to save it or alter the use
- Watch fertilizer levels
- Consider moisture content of varieties

So What Can be Done?

- Consider energy cost adjustments in leases
- Remember conservation of energy
- Follow sound farm management and marketing practices
- Remember Machinery

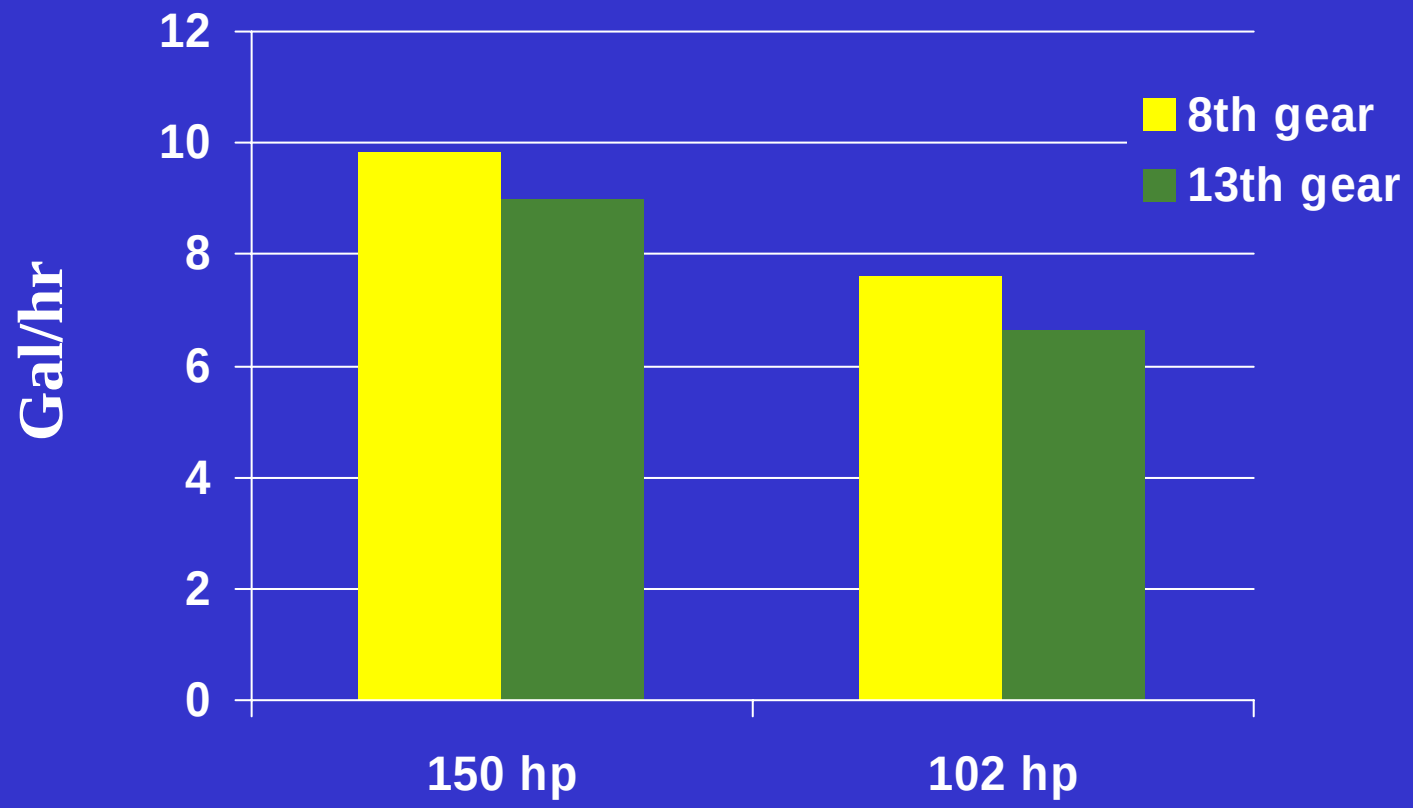
Field operation	Diesel, gal/ac
Subsoil	1.7
Field cultivate	0.7
Plant	0.6
Spray	0.2
Harvest	1.4

Maintenance schedule

- Follow manufacturer recommendations
- Filter and fluid changes
- Missouri study: 99 tractors
- After changing fuel and air filters:
    - Power increased by 3.5%
    - Fuel savings estimate of 100 gal over 500 h

Gear up/Throttle down

- Similar to over-the-road travel
- Lighter drawbar loads (<65% rated power)
- Strategy not suitable for PTO work
- Fuel savings can be significant
    - 5 – 15% at 75% power
    - 15 – 30% at 50% power
- Don’t lug engine



208 hp 4WD Tractor

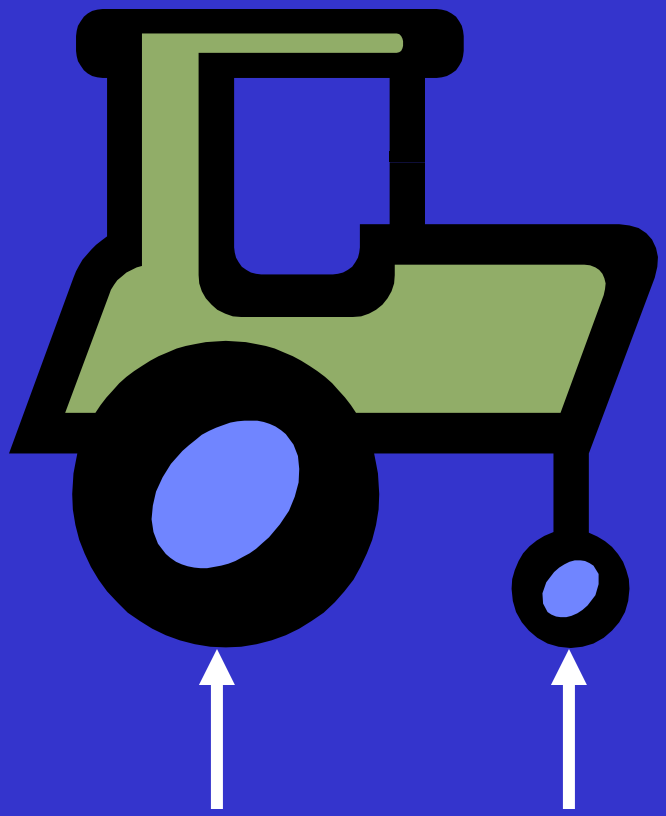
Deere 8570
OECD tractor test

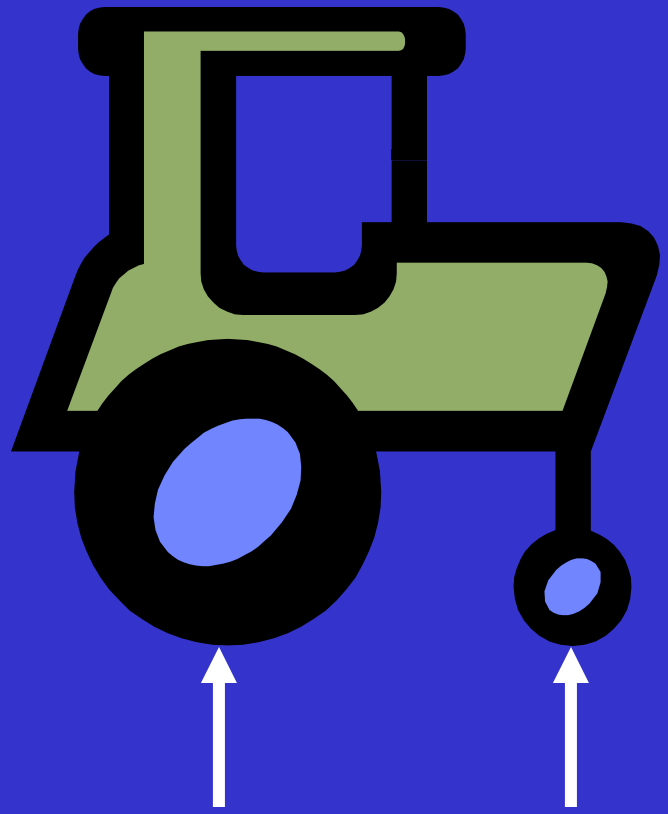
	Lb/Hp		
	Speed		
Tractor type	< 4.5 mi/h	5 mi/h	> 5.5 mi/h
2WD	130	120	110
FWD	130	120	110
4WD	110	100	90

Example:

300 hp 4WD tractor pulling subsoiler/ripper at 5 mi/h

100/lb/hp x 300 hp = 30,000 lb total tractor weight





%Front/%Rear

	Hitch		
Tractor type	Pull type	Semi-mounted	Vertical load
2WD	25/75	30/70	NR
FWD	35/65	35/65	40/60
4WD	55/45	55/45	65/35

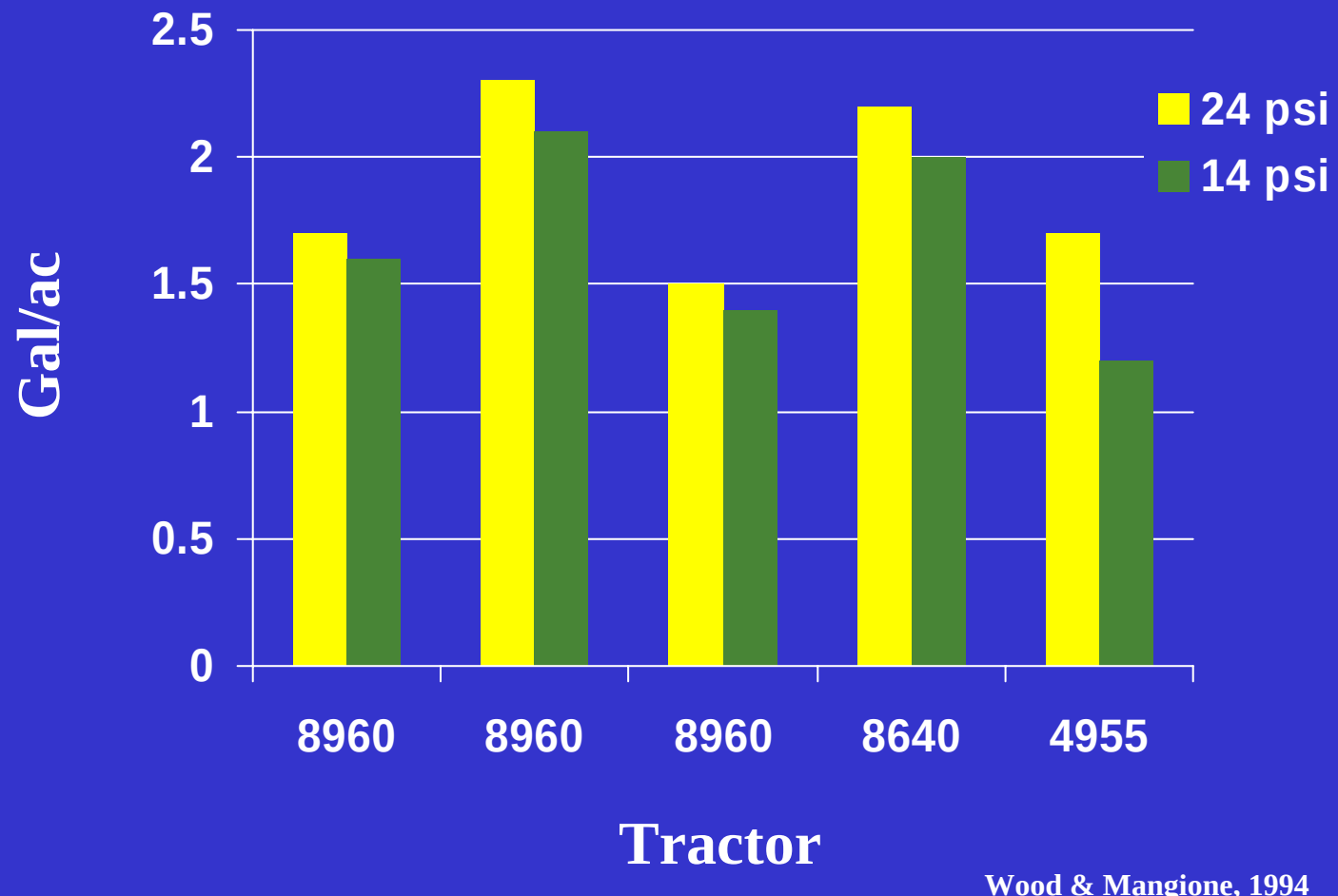
Example:

300 hp 4WD tractor pulling subsoiler/ripper at 5 mi/h

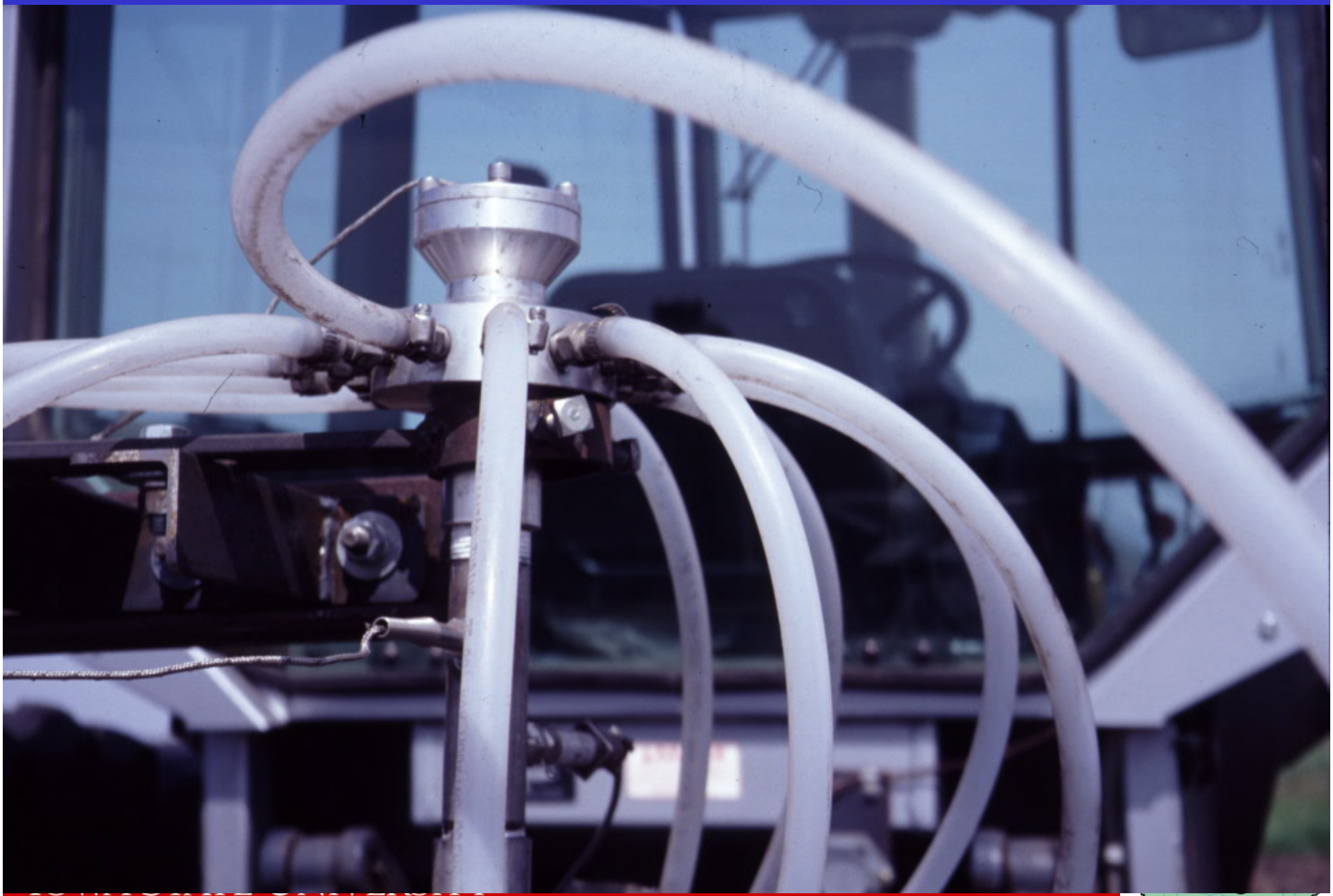
100/lb/hp x 300 hp = 30,000 lb total tractor weight

Front-axle weight = 0.55 x 30,000 lb = 16,500 lb

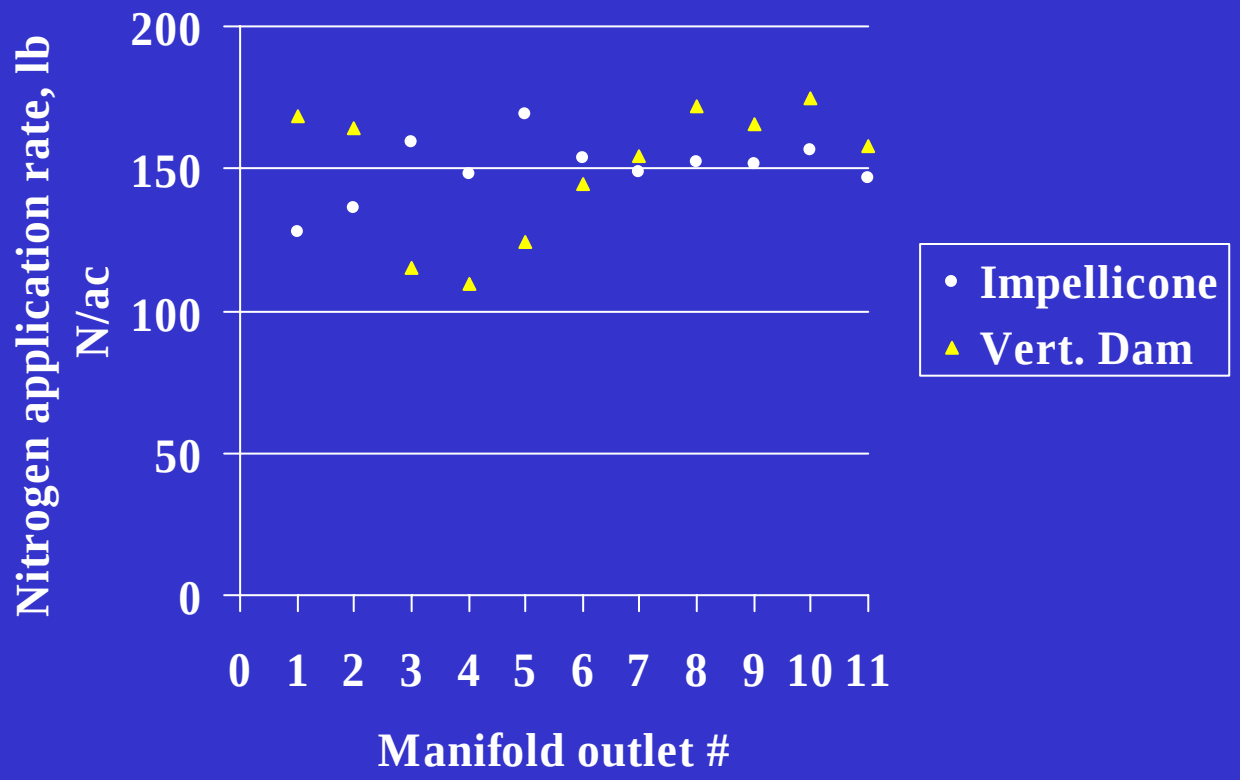
Rear-axle weight = 0.45 x 30,000 = 13,500 lb



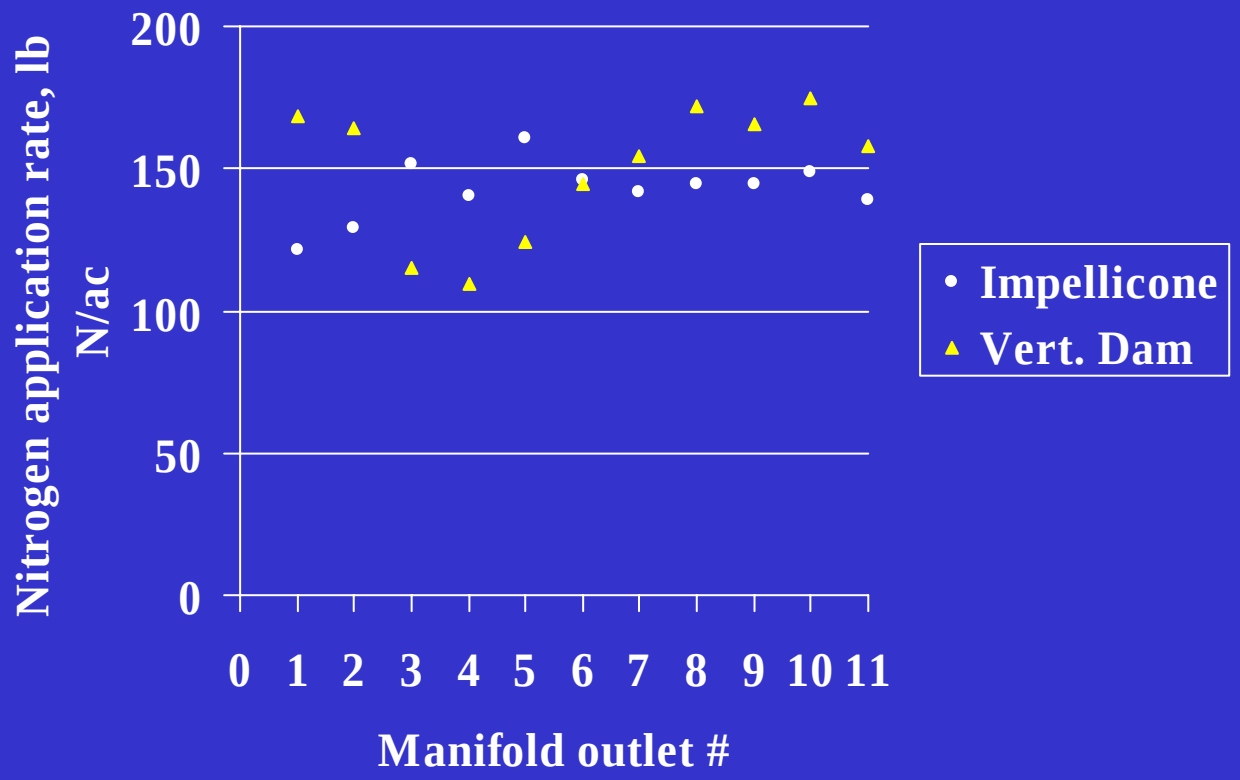
Wood & Mangione, 1994



University Extension



June '03
I 9
V 16



95% I rate
I 9
V 16