

Irrigation Efficiency in Chihuahua, Mexico

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Based on work done by Aaron Hobbs, unpublished paper “The U.S./Mexico Water Dispute: Impacts of Increased Irrigation in Chihuahua, Mexico” May 2003

U.S./Mexico Water

- **Allocations of Rio Bravo/Rio Grande Under 1944 Treaty**
- **Mexico Water Deficit**
 - **726,153 acre-feet**
 - **Lost LRGV Business Activity from Withheld Minimum Annual Inflows: \$135 Million (John Robinson)**
- **Issues/Problems**
 - **Drought Conditions and Greater Water Demand**
 - **Low Irrigation Efficiency (40%)**
 - **Population & Trade Growth Along Border**
 - **Ground Water Depletion**

Objectives

- **Overview of Water Treaty Provisions**
- **Review Cropping Patterns in Chihuahua, MX**
- **Estimation of Irrigation Water Use in Chihuahua & Savings from Improved Irrigation Efficiency**
- **Discuss Potential Policy Options to Mitigate Impacts of Water Debt with Mexico**

1944 Water Treaty

Administered by International Boundary & Water Commission (IBWC-El Paso)

Delimits Rights to International Waters of Tijuana, Colorado, and *Rio Grande (Rio Bravo)* Rivers from Fort Quitman, Texas to the Gulf of Mexico

U.S. Receives $\frac{1}{3}$ of Total Flows or Minimum of 350,000 Acre Feet (af)/Year from Rio Grande River Below Fort Quitman

Mexico Receives 1.5 million af/Year from the Colorado

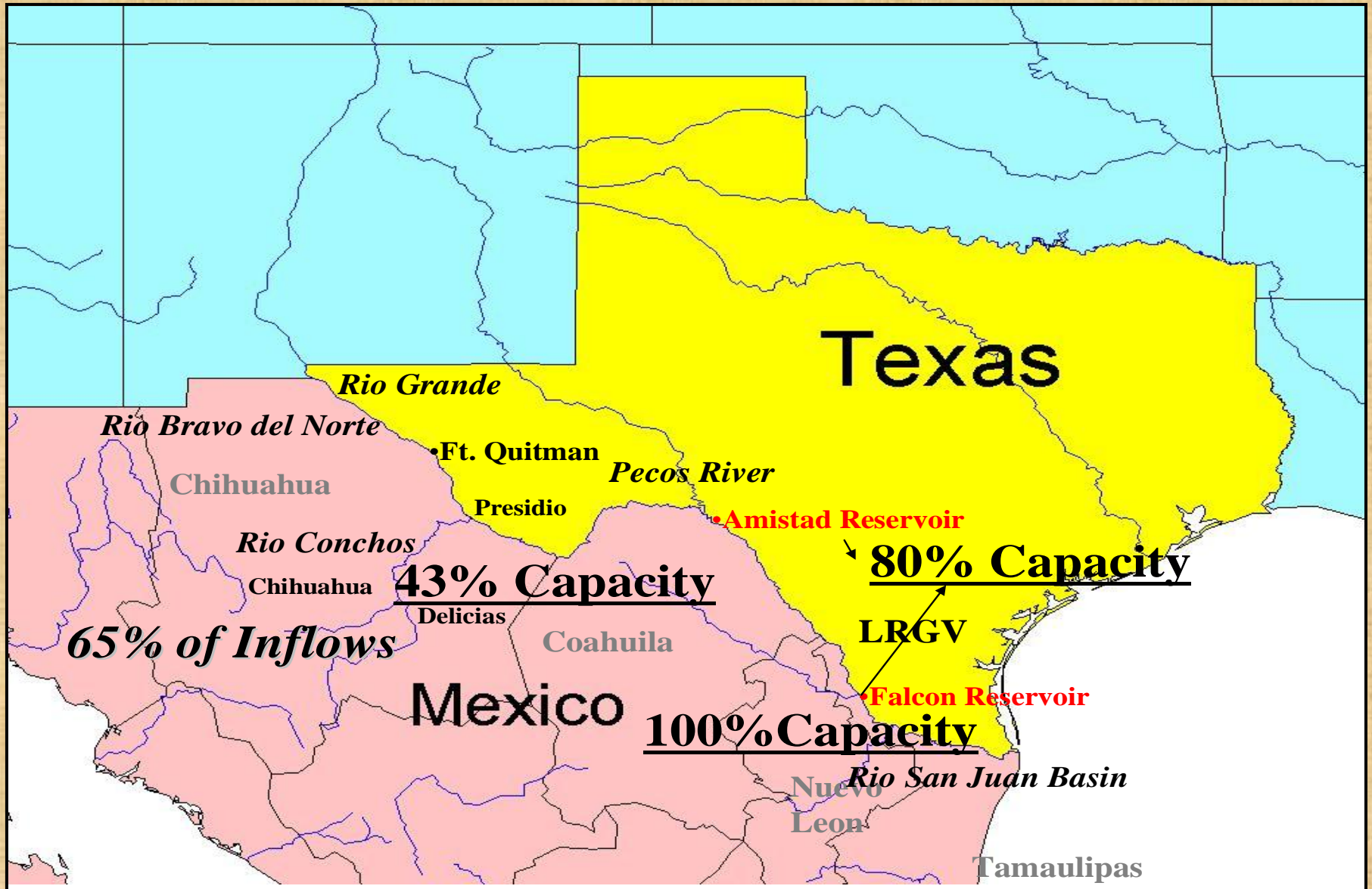
Mexico Receives $\frac{2}{3}$ of Rio Grande, ALL of Waters from San Juan & Alamo Rivers & Half of the Flow from Rio Grande Below Falcon Dam

1944 Water Treaty

Contingencies for Drought

- ***Extraordinary Drought-What is it?***
 - **When Mexico has Difficulty Delivering Run-off of 350,000 af/Year**
 - **Any Deficiencies at the End of 5 Year Cycle *SHALL* Be Made Up in Following Cycle**
 - **Whenever Conservation Capacities of U.S. in Two International Reservoirs Are Filled, a Cycle *SHALL* Be Terminated & All Debits Fully Paid**

Tributaries & Reservoirs



Study Area

Francisco I. Madero Reservoir, Delicias

**282,000 acre-feet capacity, 134,000 acre-feet on
July 20, 2004**

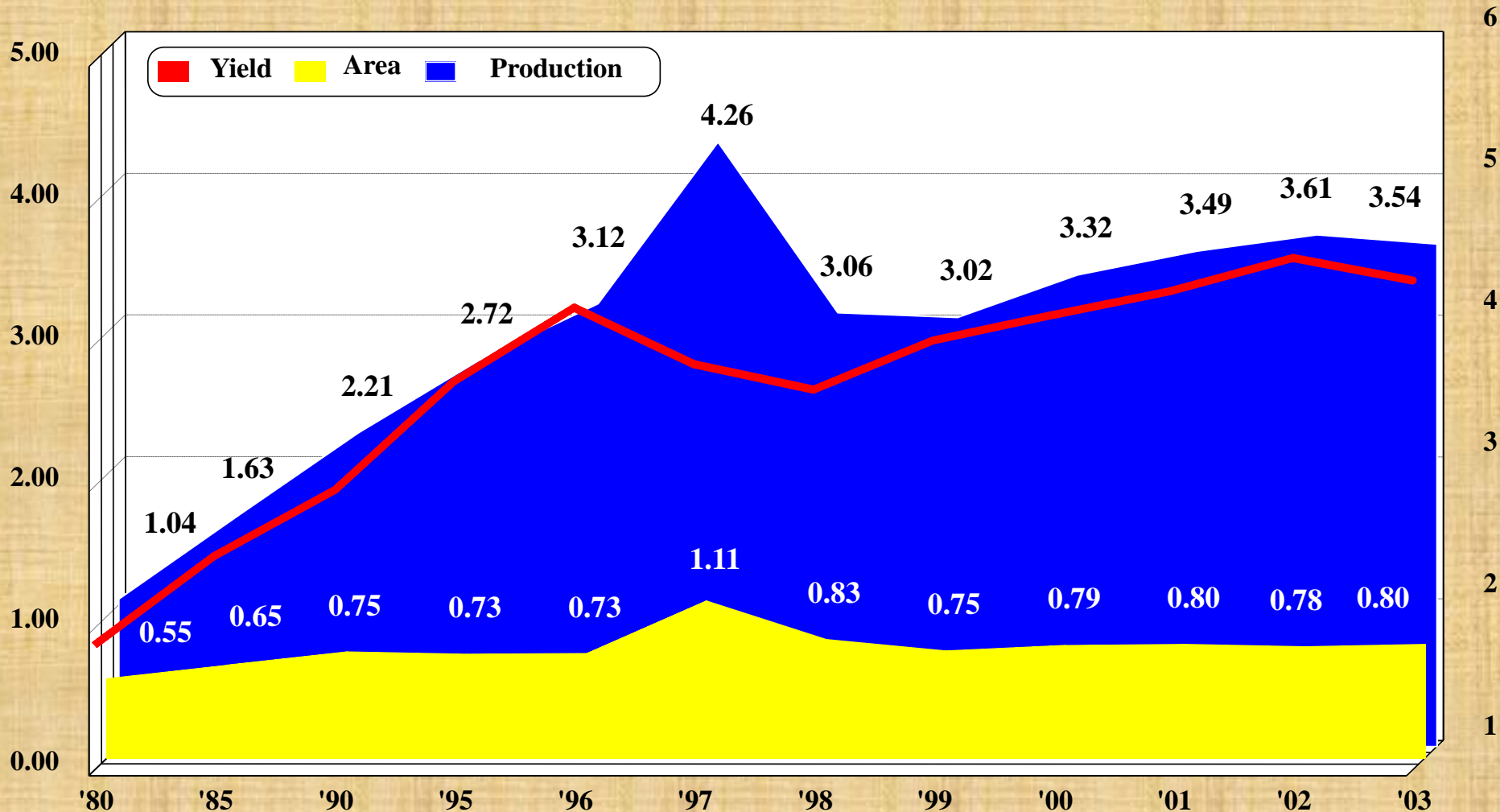
Present level: 1,002,480 acre-feet (2/14/05)



Irrigated Crop Production, Chihuahua, Mexico, 1980-2003

Area (Million H. Acres) and Production (Million Metric Tons)

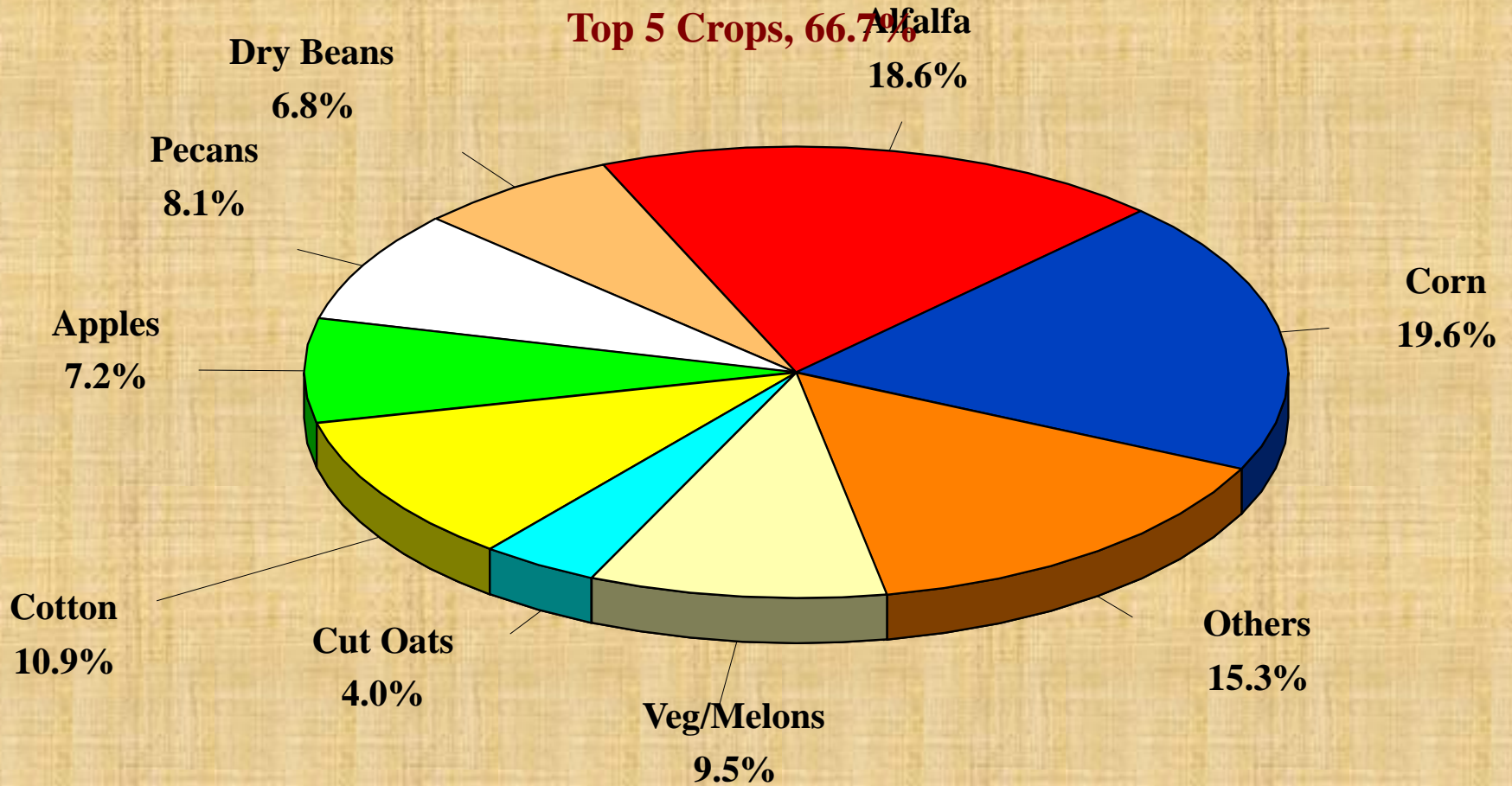
Yield (MT/HA)



Irrigation Crop Acreage in Chihuahua, MX 2003

Total Acreage: 797,289

Top 5 Crops, 66.7%



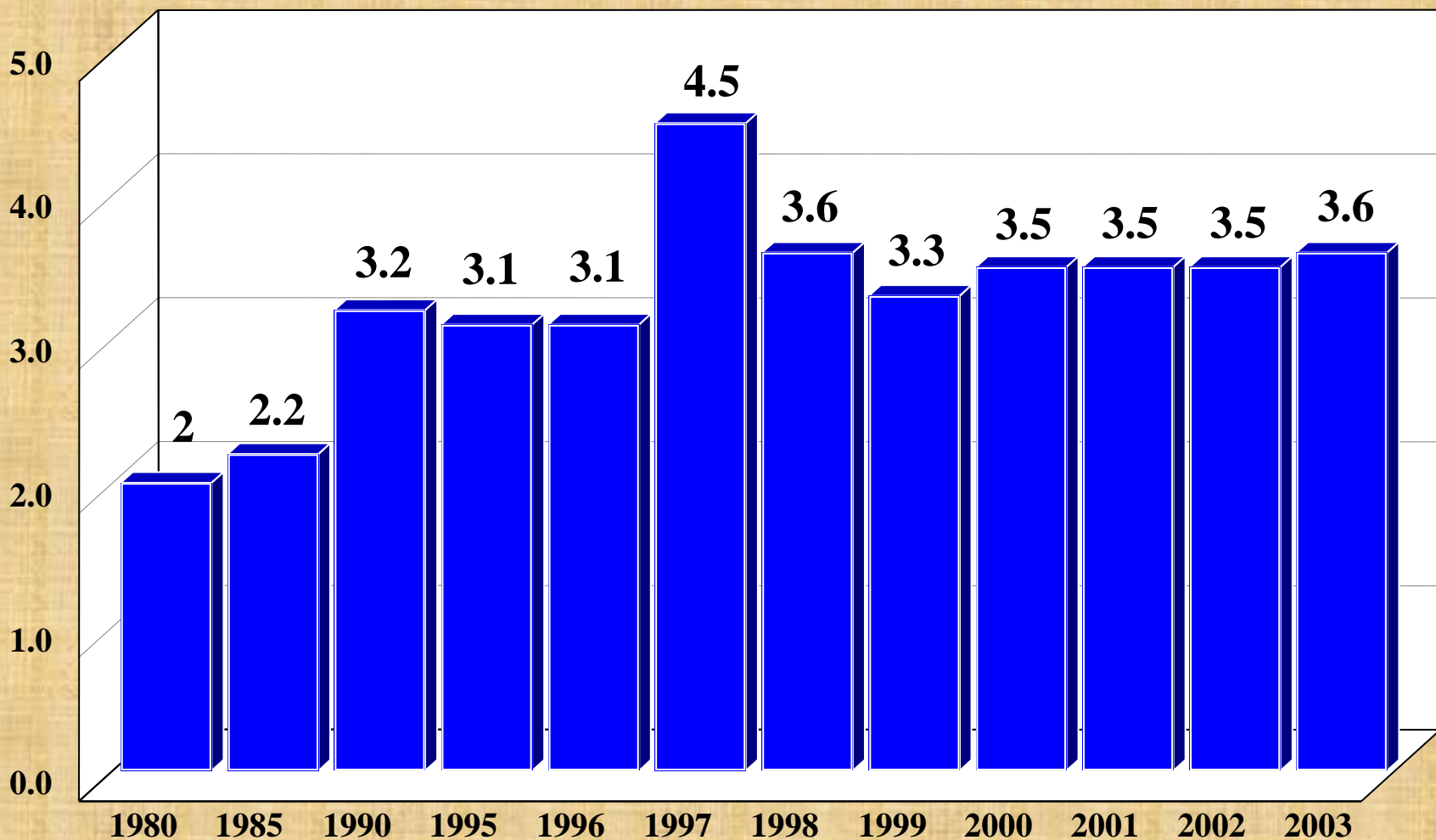
Estimates: CNAS; Total of 27 crops included in study.

Penman-Monteith Irrigation Water Use Example

- **Alfalfa ETo: 56.45 inches**
- **Crop Coefficient: 0.8833**
- **Seasonal ETo: $56.45 * 0.8833 = 49.86$**
- **Annual Rainfall: 13.78 inches**
- **Estimated Irrigation Water Use:
 $49.86 - 13.78 = 36.08$ acre-inches**
- **Estimated Irrigation Water Use in Acre-
Feet for Year: $36.08 / 12 = 3.01$ acre-feet**

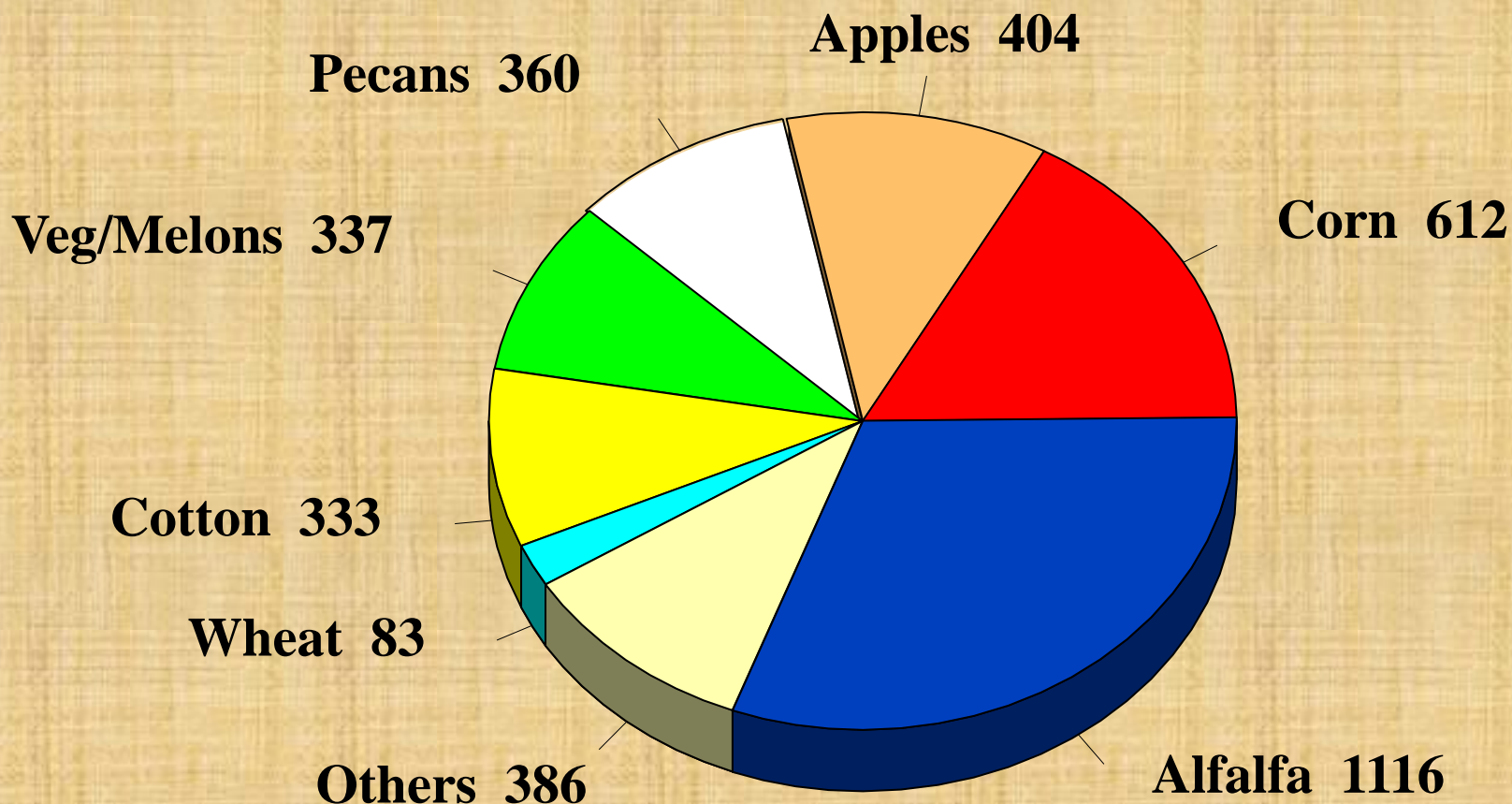
Irrigation Water Use in Chihuahua, MX

Million Acre-Feet



Author's Estimates, CNAS

Estimated Irrigated Water Use in Chihuahua, MX 2003 (1,000 acre foot)



Estimates: CNAS; Total of 27 crops included in study.

Apparent Irrigation Efficiency

-Delicias Irrigation District-

<u>Crop</u>	<u>Percent</u>
Alfalfa	38
Pecans	36
Peanuts	14
Corn	32
Wheat	58

**Furrow & Flood Irrigation Dominant, Some
Center Pivot, Sprinkler Systems in Use**

What is Value of Chihuahua Irrigation Water?

- **\$424/acre-foot (\$652/ac in LRGV)**
 - **Total Value of Irrigated Production/Total Water Used Net of Rainfall**
- **Improving Irrigation Efficiency from 40 to 60% in Chihuahua**
 - **Saves 1.1 million acre-feet/year**
 - **Valued at \$472 million/year**

Policy Options

- **Retaliatory Duties on Mexican Agricultural Products**
- **Direct Compensation for Texas Producers**
- **Divert Flows from Colorado River**
- **Construct New Water Delivery System**
- **Improve Existing Water Delivery Systems & Adopt More Efficient Irrigation Technology in U.S. and Mexico**

Conclusions

- **Irrigation Water Use Has Increased**
- **Switch from Surface Water to Aquifer**
- **Switch to More Water Intensive Crops & Higher Yields**
- **Antiquated Institutional Framework?**
- ***Extraordinary Drought* Needs Rigorous Definition**
- **Stakeholder Input Crucial to Future**
- **Environmental Consequences of Population & Trade Growth Are Important**