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USDA Agricultural Outlook Forum 2007

The Conservation Decision: Economics of Conservation and Precision Agriculture

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Agricultural Research Service, USDA

Presented: Thursday, March 1. 2007

Conservation Cropping Systems

Cover Crop and Residue Management

Conservation Tillage and Cash Crop Planting

Nutrient and Pest Management

Conservation Cropping Systems

Cover Crop and Residue Management

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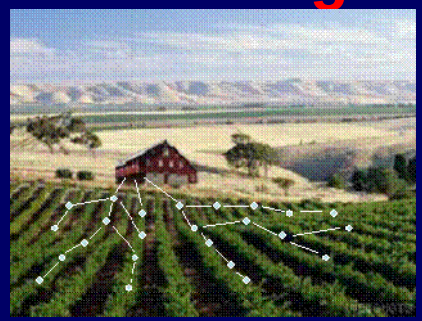
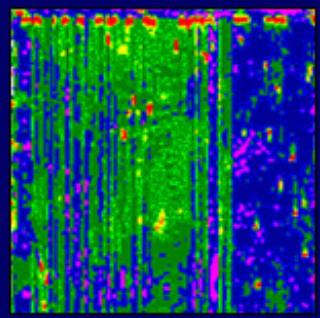
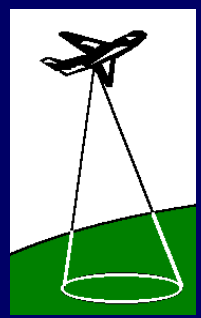
Nutrient and Pest Management

Precision Agricluture







Benefits & Costs of Conservation and Precision Agriculture

Potential Conservation/Precision Ag Benefits

Improved Profitability

- ***Higher Crop Yields/Revenues***
- ***Lower Producion Costs***
- ***Reduces Risk***
- ***Long-term Sustainability***
- ***Better Management***
- ***Less Time, Less Inputs & Equipment***

Better Environment

- ***Less Soil Erosion***
- ***Protects Water Quality***
- ***Improved Soil Health/Productivity***
- ***Improved Wildlife/Rural Landscape***

Sources:Batte, 2000; Bergtold and Goodman, 2006; Christensen, 1985; Snapp *et al*., 2005

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Potential Conservation/Precision Ag Costs

Increased Direct and Indirect Costs

- ***Lower Crop Yields/Revenues***
- ***Higher Production Costs w/Technology, Cover Crop, Equipment***
- ***Higher Human Capital Requirement (with Scarce Labor Resources)***
- ***More Intense Crop Management***
- ***Time Management More Crucial***

Environmental Costs

- ***Precision Ariculture May Not Reduce Fertilizer/Pesticide Usage in Some Areas***

Sources:Batte, 2000; Bergtold and Goodman, 2006; Christensen, 1985; Snapp *et al*., 2005

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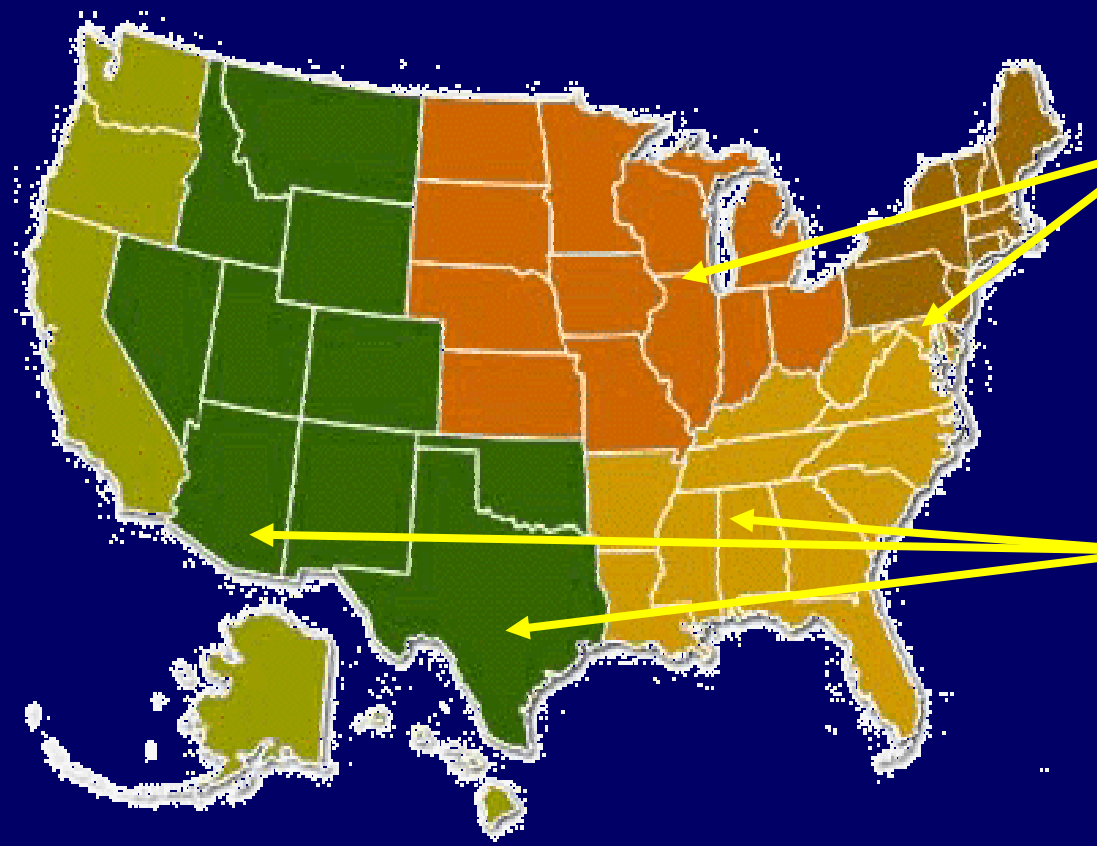
1. Increase/Decrease Profit & 2. Help/Hurt Environment

Profitability of Conservation Systems Across the United States (some evidence)



Profitability for Corn-Soybean Rotations:

Conventional Tillage = $93/ac

Conservation Tillage = $100/ac

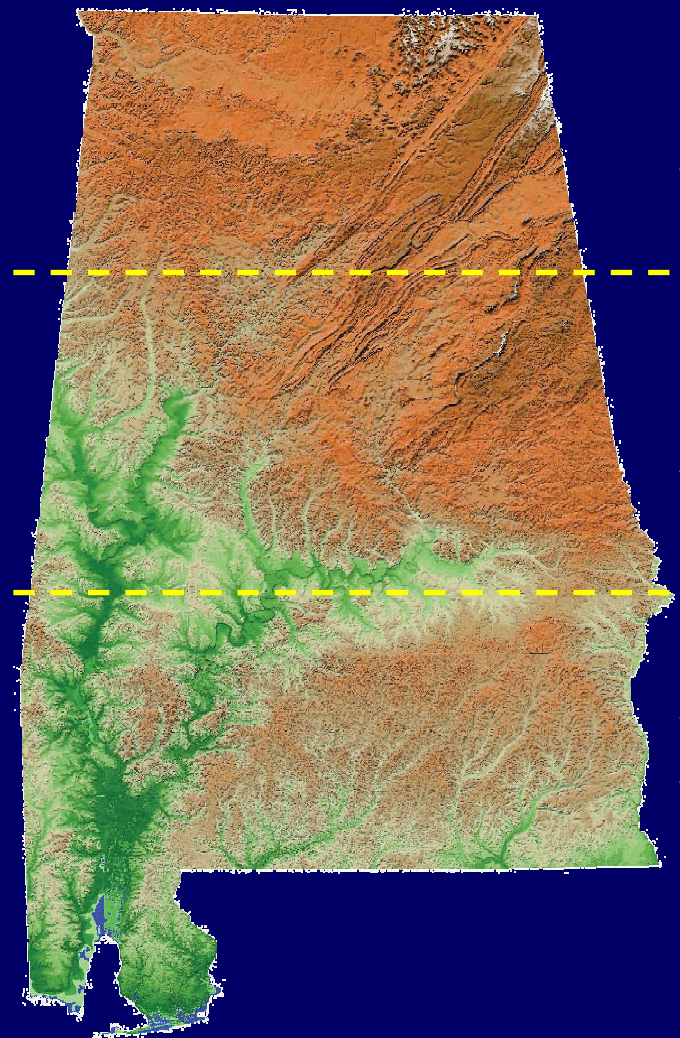
Profitability for Cotton Production Systems:

Conventional Tillage = $94/ac

Conservation Tillage = $108/ac

Source: Buman *et al*., 2004, 2005

Potential Cost Savings ($/acre) of Converting to a Conservation Tillage System from a Conventional System



Northern Alabama

	Corn	Cotton	Peanuts
Labor	$11.00	$23.00	N/A
Machinery	$20.00	$38.00	N/A

Central Alabama

	Corn	Cotton	Peanuts
Labor	$6.00	$18.00	N/A
Machinery	$15.00	$34.00	N/A

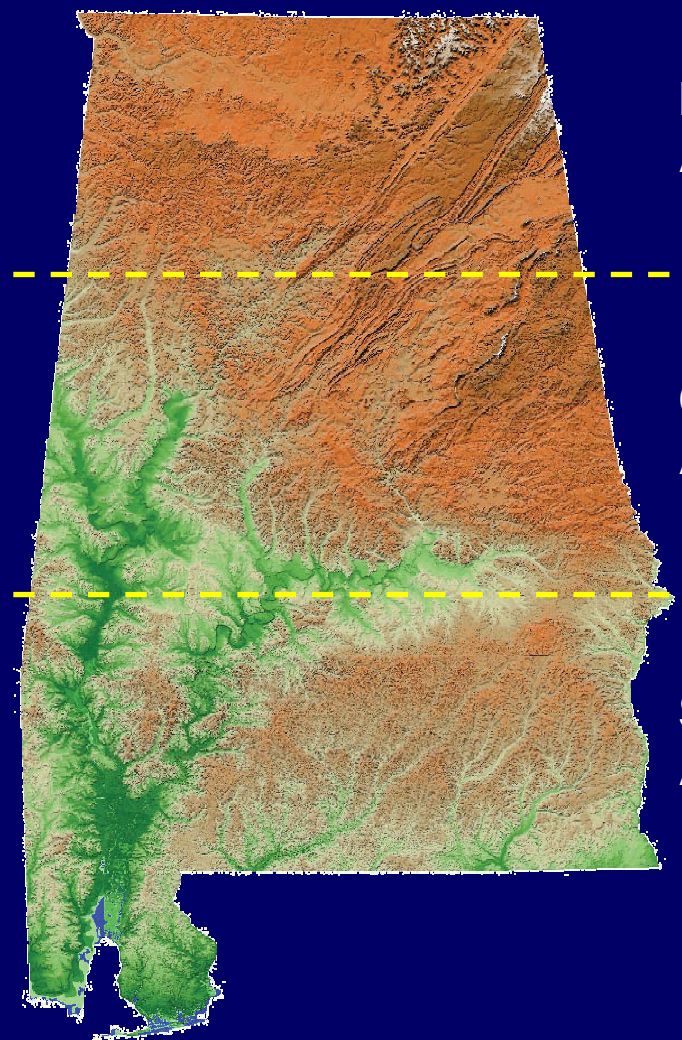
Southern Alabama

	Corn	Cotton	Peanuts
Labor	$6.00	$18.00	$13.00
Machinery	$15.00	$34.00	$21.00

Assumptions: Use no-till in N. Alabama and strip-till in central and S. Alabama. All systems include the use of a winter cover crop. Savings based on crop budgets.

Source: Bergtold and Morton, “Conservation Tillage Systems Learning Tool”, 2006

Potential Increases in Profit ($/acre) when Converting to a Conservation Tillage System from a Conventional System



Northern Alabama

	Corn	Cotton	Peanuts
Change in Profit	$66.00	$29.00	N/A

Central Alabama

	Corn	Cotton	Peanuts
Change in Profit	$12.00	$57.00	N/A

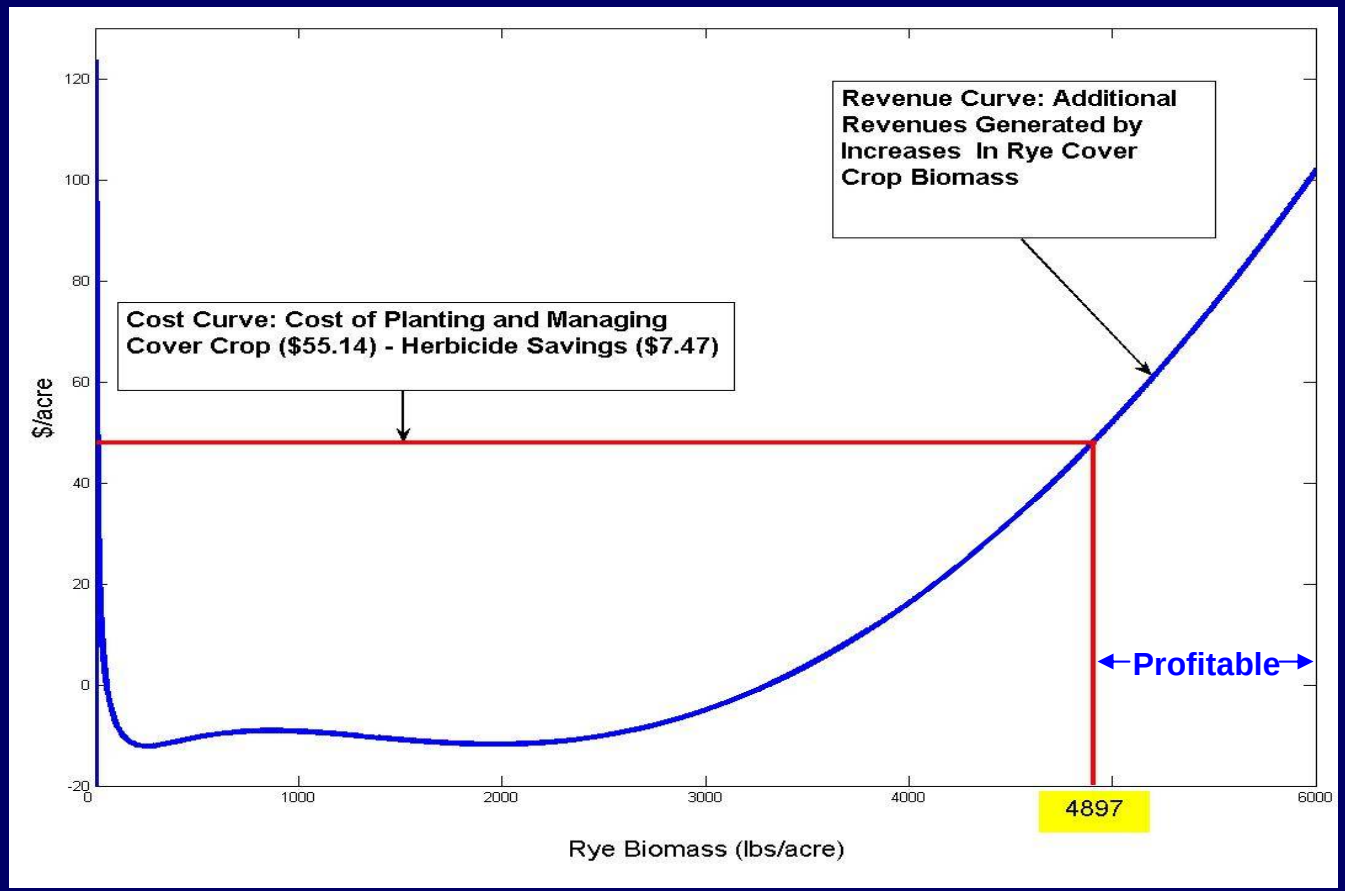
Southern Alabama

	Corn	Cotton	Peanuts
Change in Profit	$60.00	$41.00	$107.00

Assumptions: Use no-till in N. Alabama and strip-till in central and S. Alabama. All systems include the use of a winter cover crop. Yields are estimated using data from 30 independent studies conducted across AL and GA. Prices: $4.07/bu for corn, $0.58/lb for cotton, and $0.19/lb for peanuts. Costs are from crop budgets.

Source: Bergtold and Morton, "Conservation Tillage Systems Learning Tool", 2006

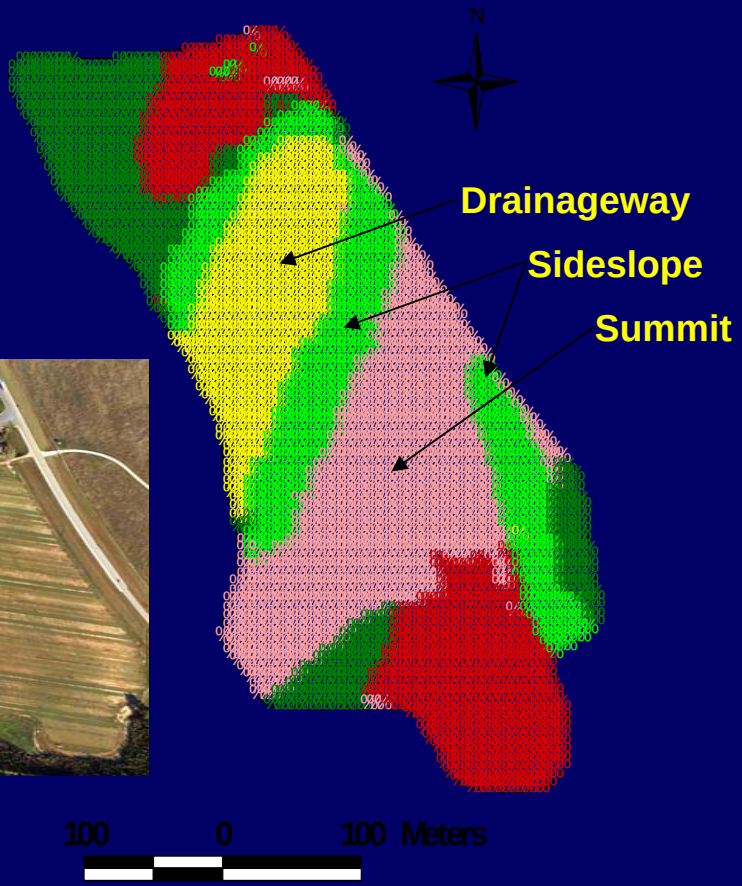
Economic Benefit of Cover Crops (Rye prior to Cotton)



Cover Crops can potentially increase profits by helping improve soil producitity, reduce erosion, and provide weed suppression.

Source: Morton *et al*. 2006.

Profitability of Conservation over Conventional Tillage Systems Across the Landscape for Cotton (EVS, 2003)



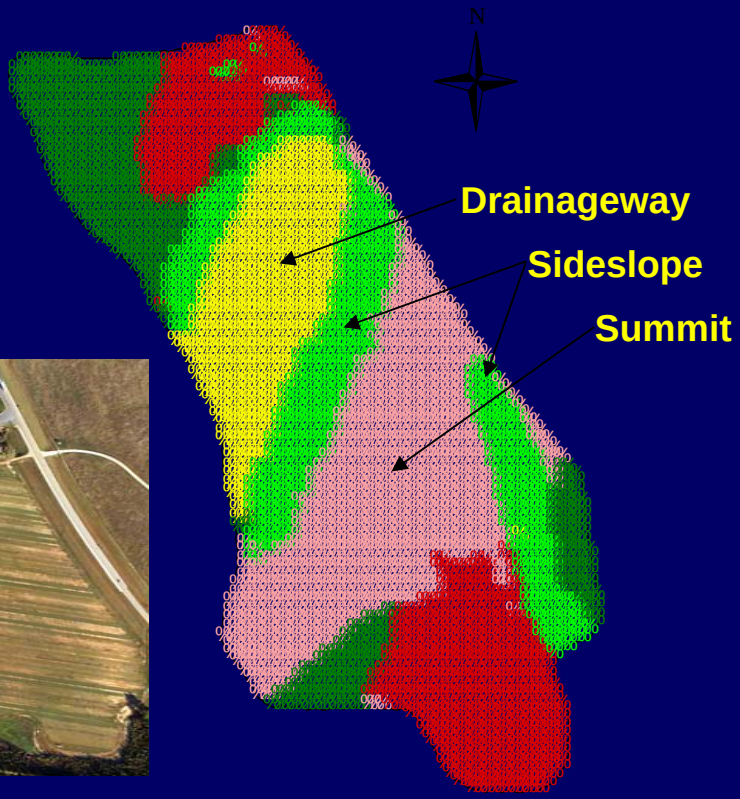
Landscape	Conventional Tillage (CT)	Conservation Tillage(NT)	Difference of NT over CT
Drainage-way	**$207**	**$258**	**+ 19%**
Sideslope	**$239**	**$325**	**+ 26%**
Summit	**$273**	**$367**	**+ 26%**

Note: The conservation tillage system included a high residue cover crop mixture of black oat and rye. In addition, profit calculations include farm payments and NRCS EQIP payments.

Conservation tillage systems can increase productivity of low and high producing areas across the field.

Source: Bergtold *et al.*, 2005; Terra *et al*., 2005.

Profitability of Conservation over Conventional Tillage Systems Across the Landscape for Cotton (EVS, 2004)



Landscape	Conventional Tillage (CT)	Conservation Tillage(NT)	Difference of NT over CT
Drainage-way	**-$6**	**$58**	**+ $64**
Sideslope	**-$74**	**-$8**	**+ $66**
Summit	**-$47**	**$3**	**+ $50**

Note: The conservation tillage system included a high residue cover crop mixture of black oat and rye. In addition, profit calculations include farm payments and NRCS EQIP payments.

In years with adverse weather (e.g. drought or hurricane), conservation tillage can help reduce losses.

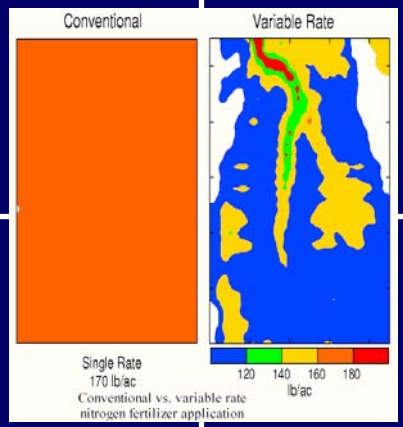
Source: Bergtold *et al.*, 2005; Terra *et al*., 2005.

Benefits of Variable Rate Application of Nitrogen with GPS for different crops (Texas)

Corn

- Yield Increase: 7.7 to 15.4%
- NPVR Increase: 13.7 to 60.5%

N applied increased by 70% to 191% across the field



Grain Sorghum

- Yield Increase 6.8%
- NPVR Increase: 7.9%

N applied changed by -96% to +59% across the field

Cotton

- Yield Increase: 0.16 to 4.0 %
- NPVR Increase: 0.19 to 4.5 %

N applied changed by -43% to +58% across the field

Peanuts

- Yield Increase: 2.3%
- NPVR Increase: 2.54%

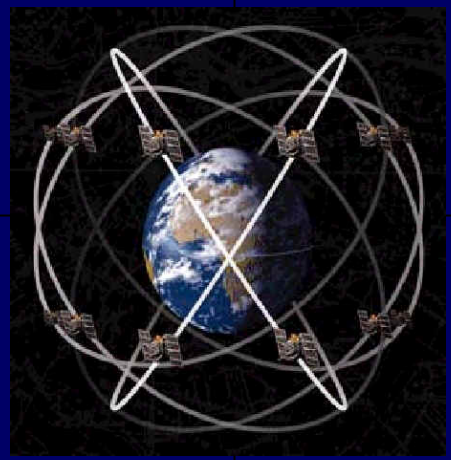
N applied changed by -81% to +42% across the field

NPVR = Net Present Value of Returns

Source: Watson *et al*., 2005

Auto-guidance & GPS As Key Components in Precision Agriculture

Auto-guidance systems (automatic steering) w/GPS can provide economic benefits by *controlling in-field traffic* and increasing the accuracy of variable-rate input application technologies

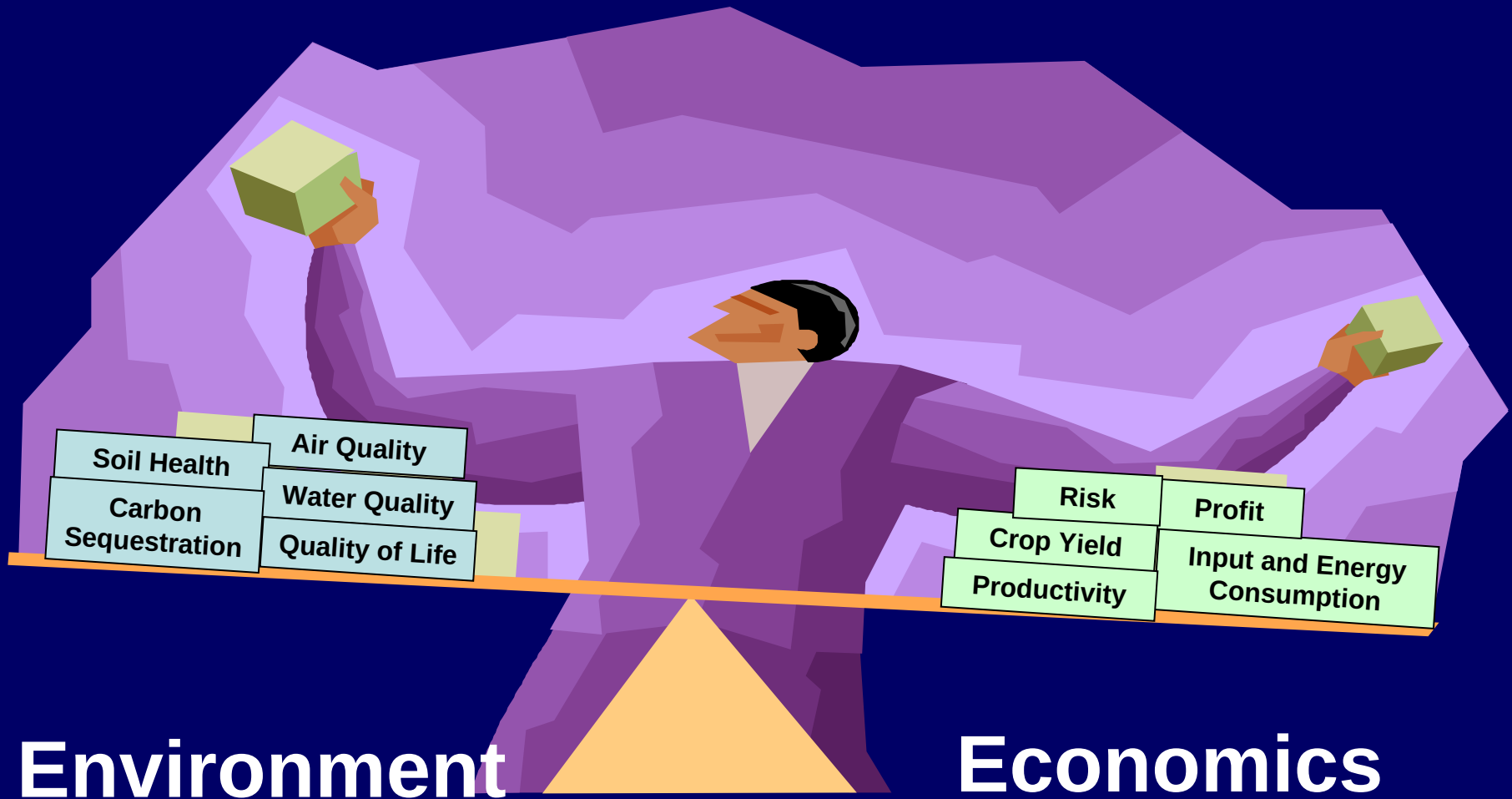


Adoption of GPS technologies such as yield-mapping and soil mapping fall behind other precision technologies, due to a steeper learning curve, especially for analyzing spatial data (Griffin *et al*., 2004)

Lambert and Lowenberg-DeBoer (2000) summarize a number of studies using GPS for yield mapping to apply variable rate inputs. These studies showed that using the yield maps reduced costs by $20 for P and $8 for K.

Controlled traffic helps to improve producivity and profitability. Bergtold *et al*. (2006) show that as the tillage pass in conservation tillage systems moves away from theplanted row, yields drop by 24-52% and profits by 38-83%.

Making the Conservation Decision



Environment **Economics**

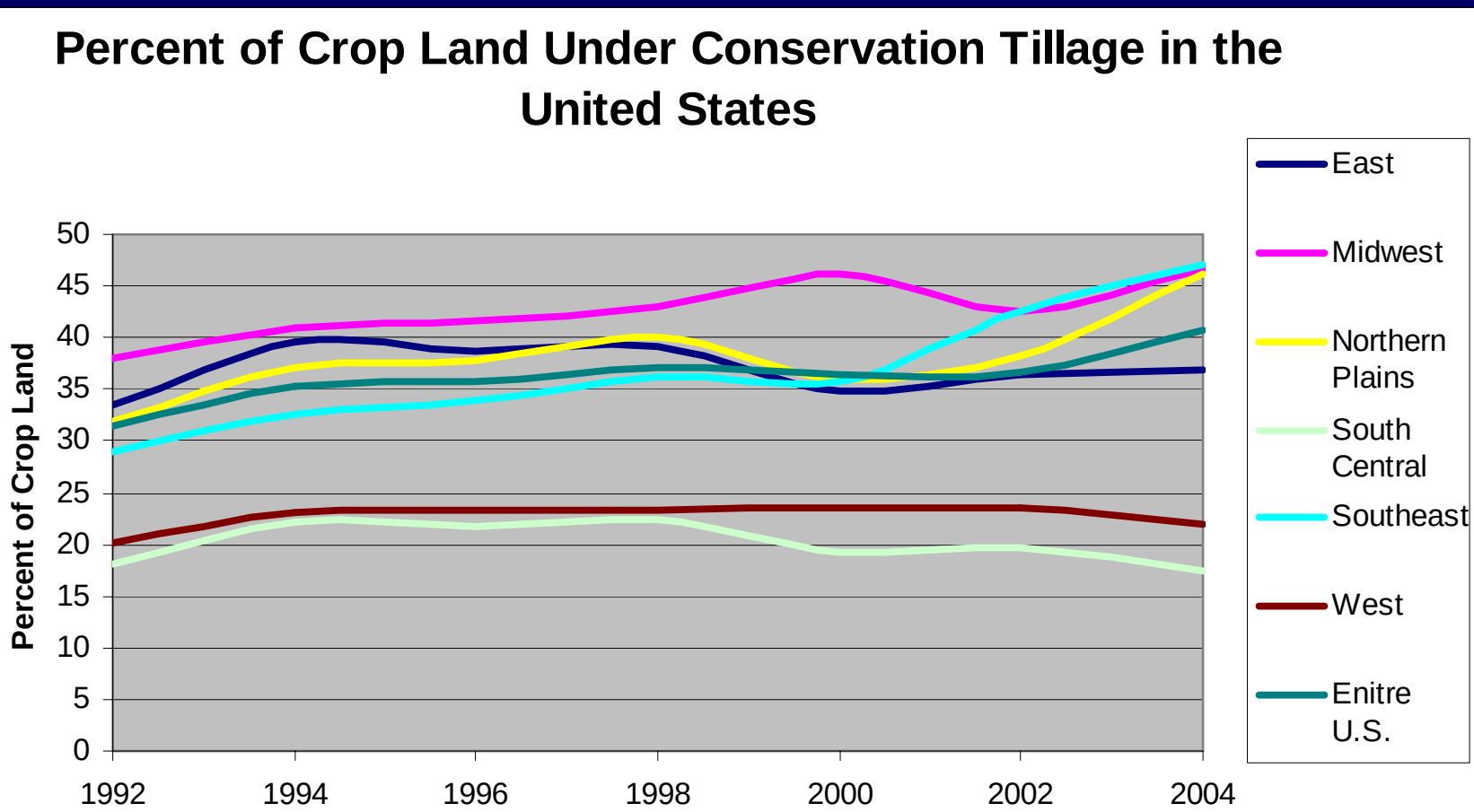
Making the Conservation Decision

Factors affecting the adoption of practices include:

- Farm Size and Crops Grown
- Race, Gender or Age
- Educational Level and Farm Experience
- Environmental Attitudes and Beliefs
- Willingness to Learn
- Willingness to Pay for New Technologies
- Existence of Cost Share/Incentive Payments
- Conservation Program Requirements
- Farm Characteristics and Demographics, etc.

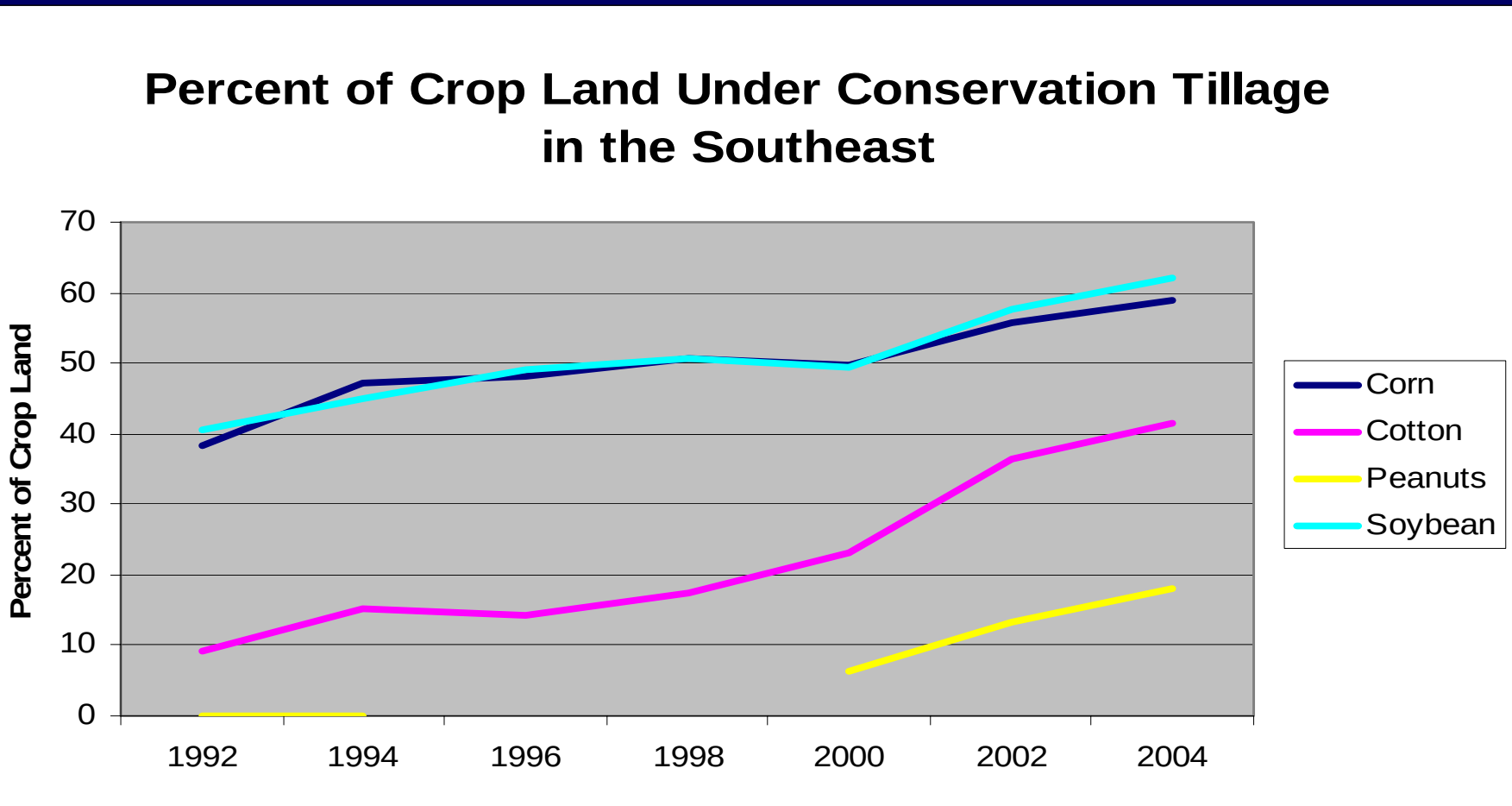
Sources:Bergtold and Molnar 2005; Hudson and Hite, 2003; Molnar *et al.*, 2001; Uri, 1999; Wu and Babcock, 1998

Adoption of Conservation Tillage for all Crops Across the United States



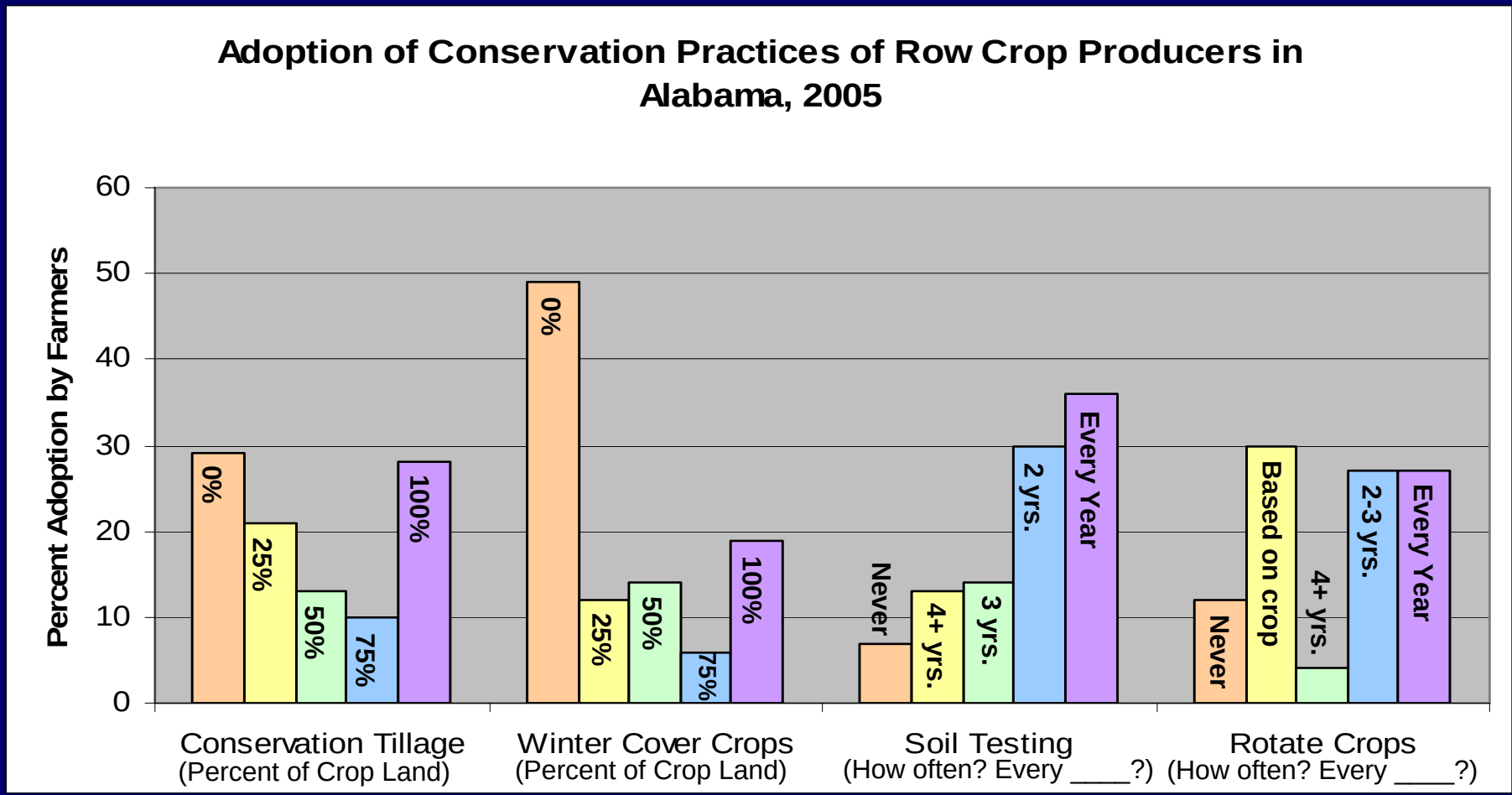
Source: CTIC, 2005

Adoption of Conservation Tillage by Crop in the Southeast



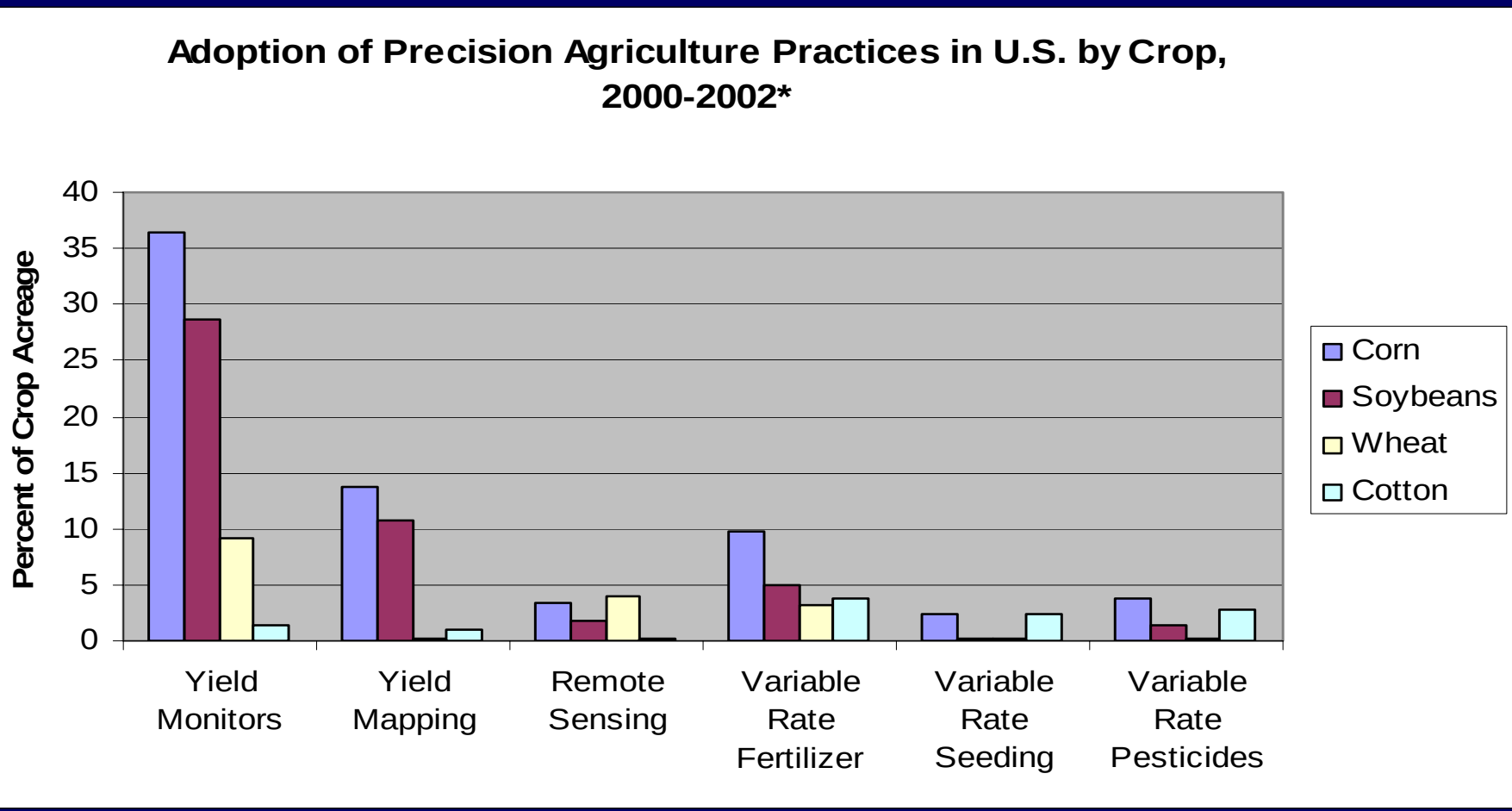
Source: CTIC, 2005

Adoption of Conservation Tillage Practices in Alabama



Source: Bergtold and Molnar, 2005

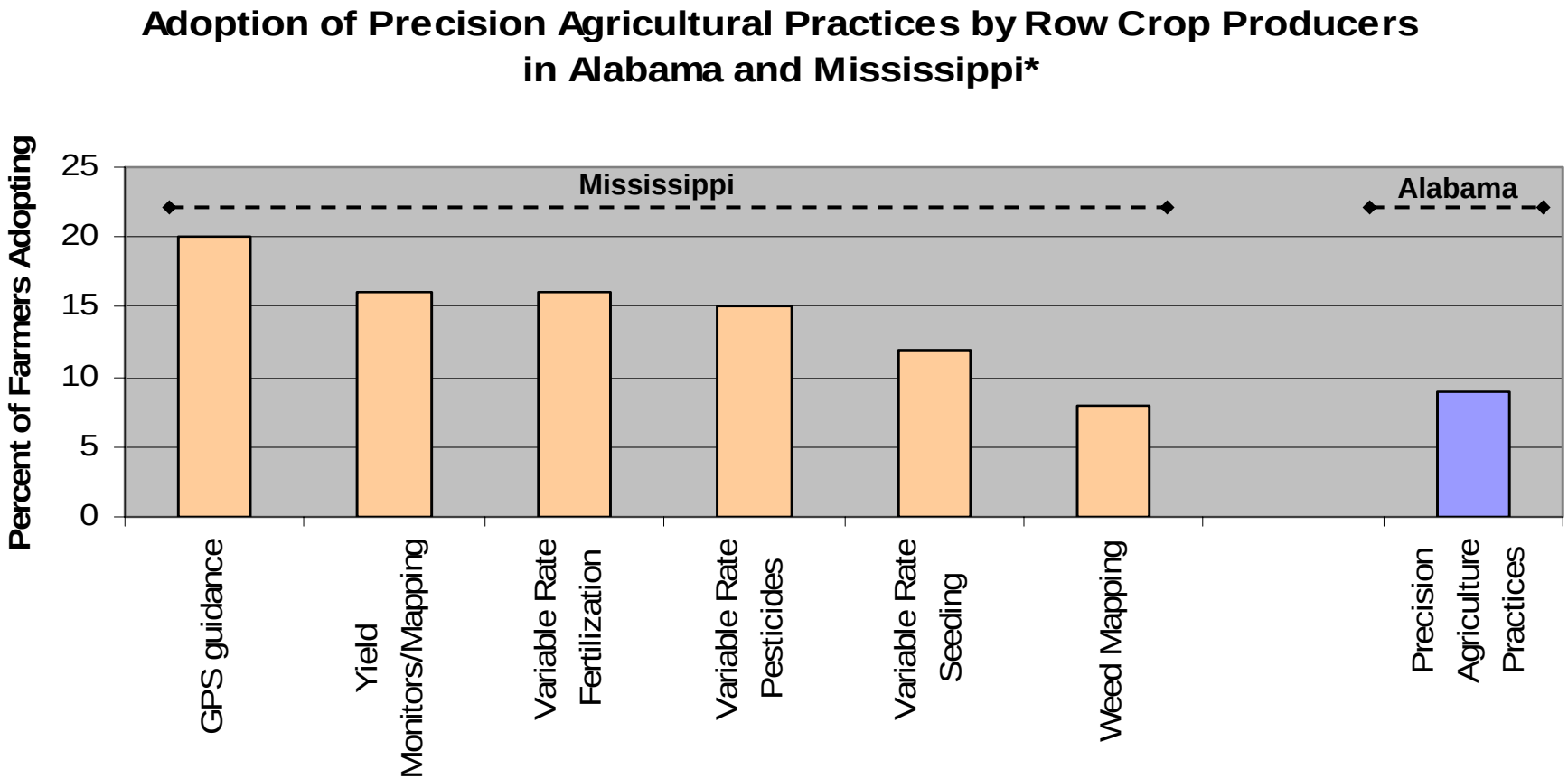
Adoption of Precision Agriculture by Crop in the United States



* Estimates represent data from most recent year survey data was available.

Source: Griffin *et al.* , 2004

Adoption of Precision Agriculture by Farmers in the Southeast



* Estimates represent data from most recent year survey data was available.

Source:Bergtold and Molnar, 2005; Hudson and Hite, 2003

Transitioning To Conservation Tillage Systems and Adopting Precision Agricultural Technologies

Barriers to Adoption:

- **Human Captial Investment** – Learning Technology, Know-How, Access to Information
- **Financial Investment** - dependent on farm size and potential return
- **Uncertainty and Risk** – risk averse farmers may avoid if expected returns low
- **Scarce Resources –** especially time and labor

Potential Avenues to Overcome:

- **Extension and Outreach** – Provide workshops, field days, and other events to educate farmers
- **Cost Share/Incentive Payments** – Promote adoption througth involvement in EQIP, CSP, etc.
- **Access to Information –** Develop enough evidence to ensure farmers, and get farmers connected.
- **Educational Opportunities –** Provide incentives to get educated, especially in agricultural disciplines

Conclusions

Conservation and Precision Agriculture can:

1. **Increase Crop Yields and Profits**
2. **Improve Long Term Sustainability**
3. **Help the Enviroment and Society**