Water Quality and Economic Incentives in Crop Production

Dr. Alejandro Plastina
Assistant Professor of Economics
North Raccoon River Watershed Management Coalition
October 18, 2019 - Lake City, Iowa

IOWA STATE UNIVERSITY
Extension and Outreach

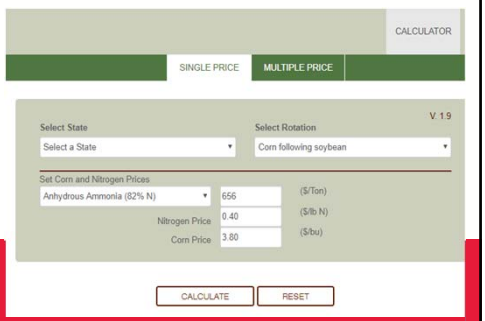
Overview

1. Motivation: Optimal Nitrogen use
2. Reflection: Why higher N rates?
3. Extension: framework to analyze farmers incentives

IOWA STATE UNIVERSITY
Extension and Outreach

Corn Nitrogen Rate Calculator

- **Maximum return to N (MRTN)** for selected prices of N and corn
- Based on research trials conducted with:
  - ➢ spring sidedress applied N
  - ➢ or split preplant/sidedress applied N



http://cnrc.agron.iastate.edu/nRate.aspx

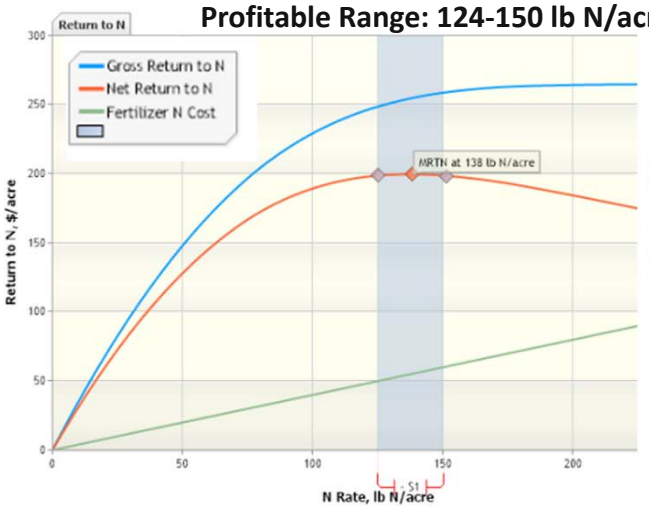
IOWA STATE UNIVERSITY
Extension and Outreach

Optimal N use: Corn following Soy

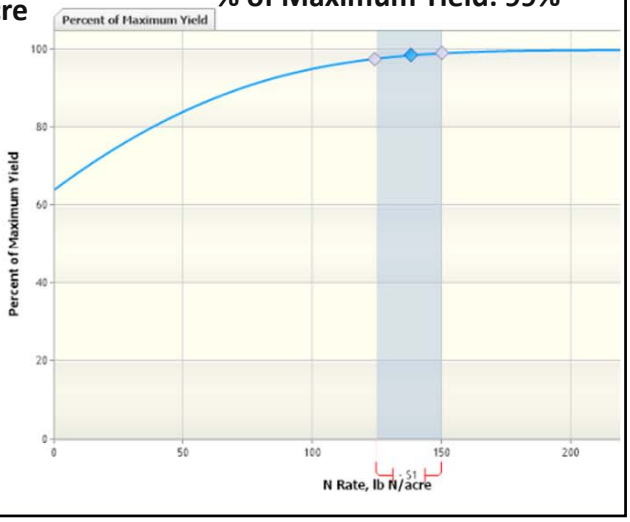
Corn price $3.80/bushel; N price $0.40/lb

MRTN: 138 lb N/acre

Profitable Range: 124-150 lb N/acre



% of Maximum Yield: 99%



Why higher N rates?

1) Corn following corn requires more N
2) Corn price uncertainty
3) Local availability of manure
4) N cost-effective to ↑ yields & ↓ their variability:
   - ✓ Bragging rights
   - ✓ Higher Revenue Guarantee in Crop Insurance
   - ✓ Government Payments based on Yield History
   - ✓ Land value

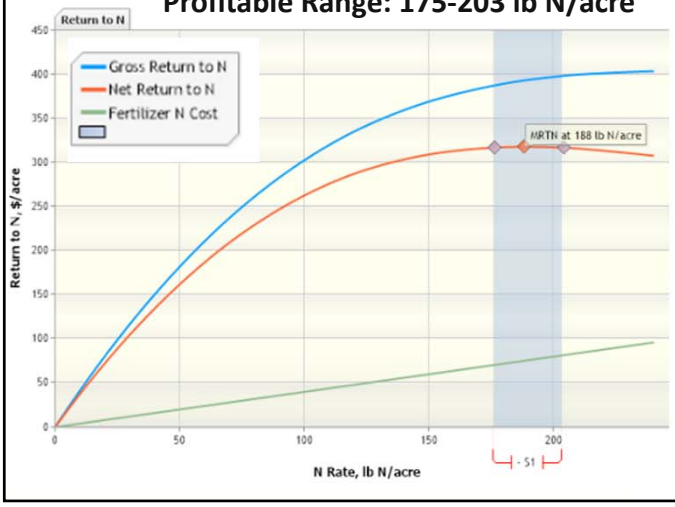
IOWA STATE UNIVERSITY
Extension and Outreach

1) Corn following Corn

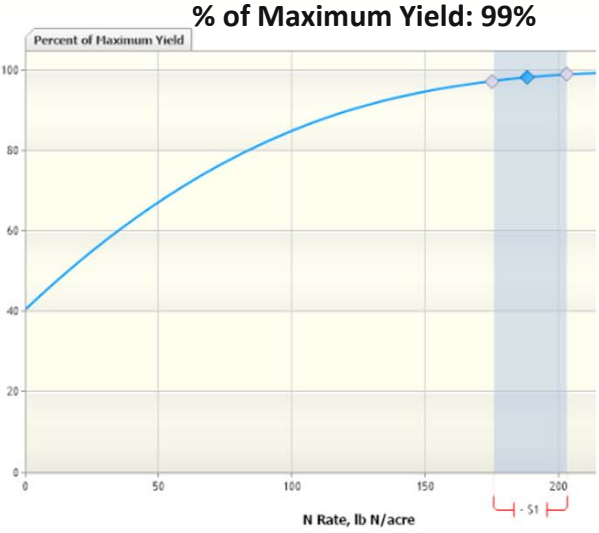
Corn price $3.80/bushel; N price $0.40/lb

MRTN: 188 lb N/acre

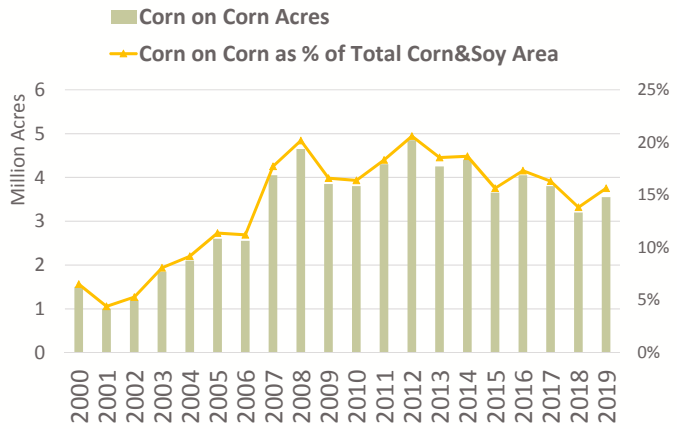
Profitable Range: 175-203 lb N/acre



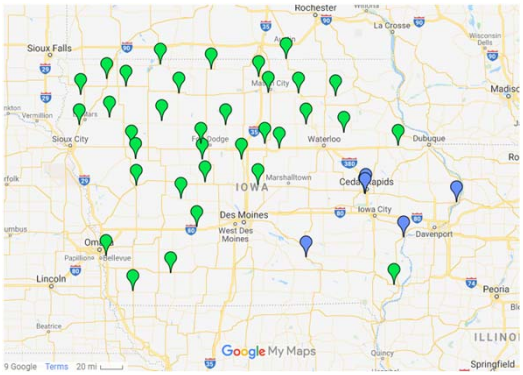
% of Maximum Yield: 99%



1) Corn following Corn



Ethanol Plants in Iowa



IOWA STATE UNIVERSITY
Extension and Outreach

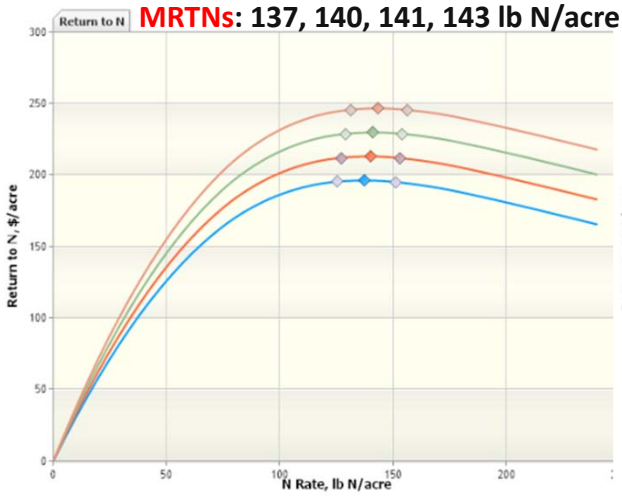
Corn following corn area: A.Plastina's estimations based on NASS data

2) Corn price uncertainty

Corn prices **$3.75, $4.00, $4.25, $4.50** ; N price $0.40/lb

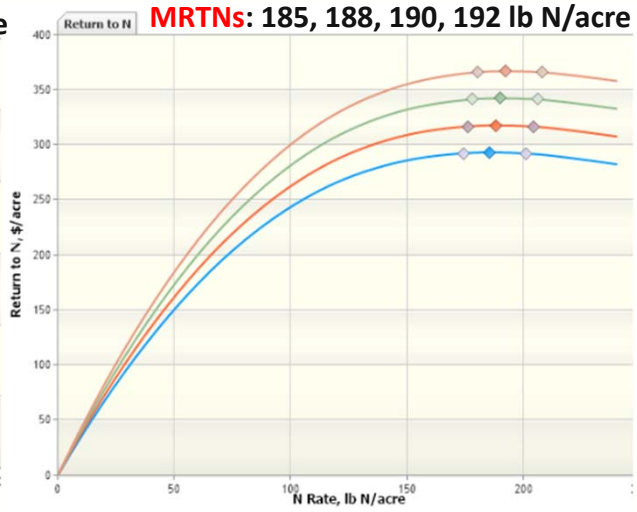
Corn following Soybeans

MRTNs: 137, 140, 141, 143 lb N/acre



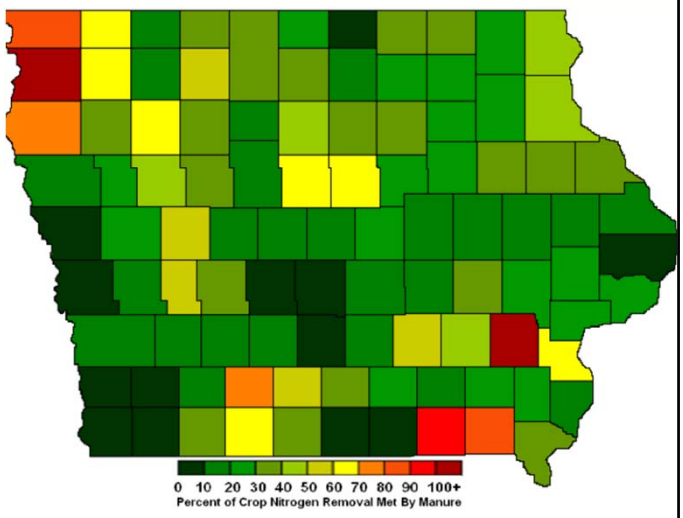
Corn following Corn

MRTNs: 185, 188, 190, 192 lb N/acre



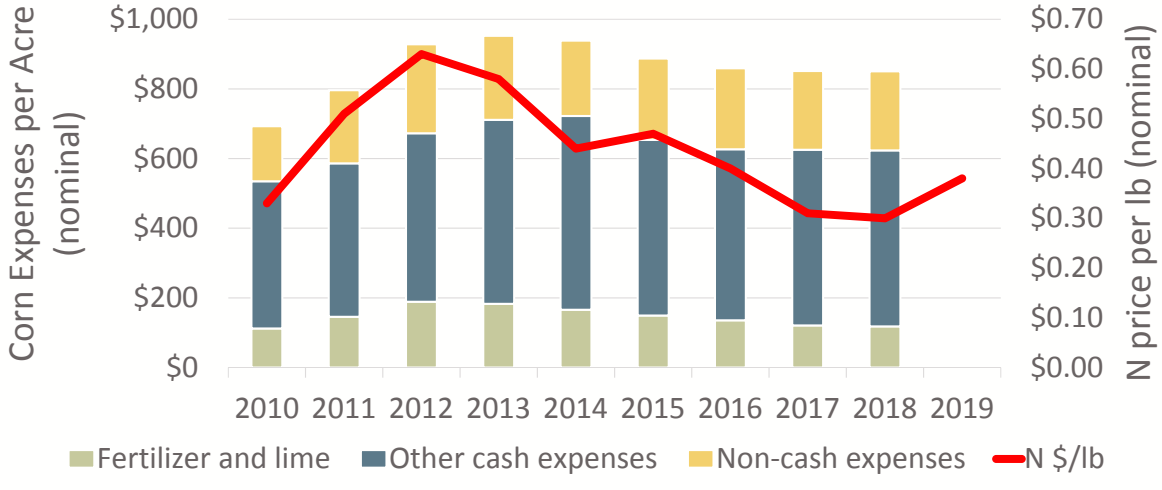
3) Local availability of manure

Percent of Crop Nitrogen Removal Met by Manure



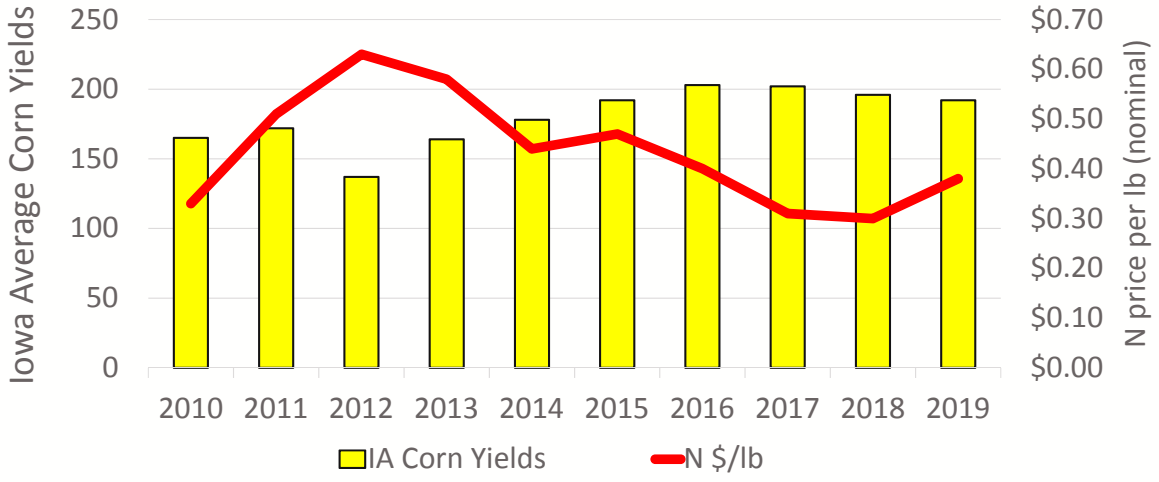
Source: Iowa State Manure and Nutrient Management Lab (2014)

4) N relative cheap way to protect / increase corn yields



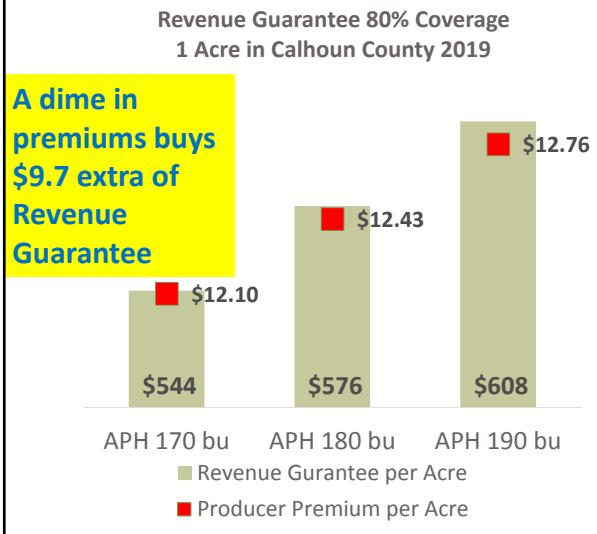
Source: ISU Ag Decision Maker Files C1-10 and A1-20

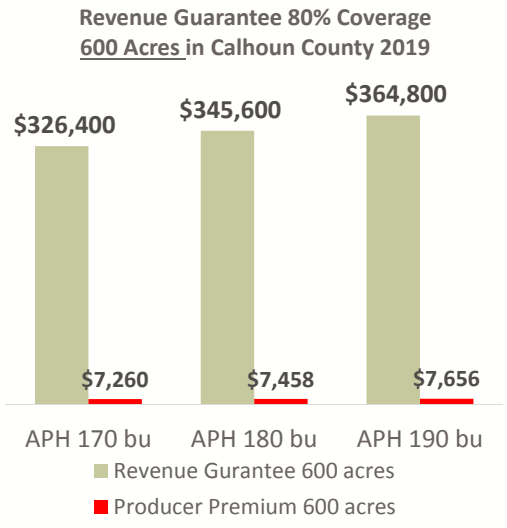
4) N relative cheap way to protect / increase corn yields



Source: USDA/NASS and ISU Ag Decision Maker File A1-20

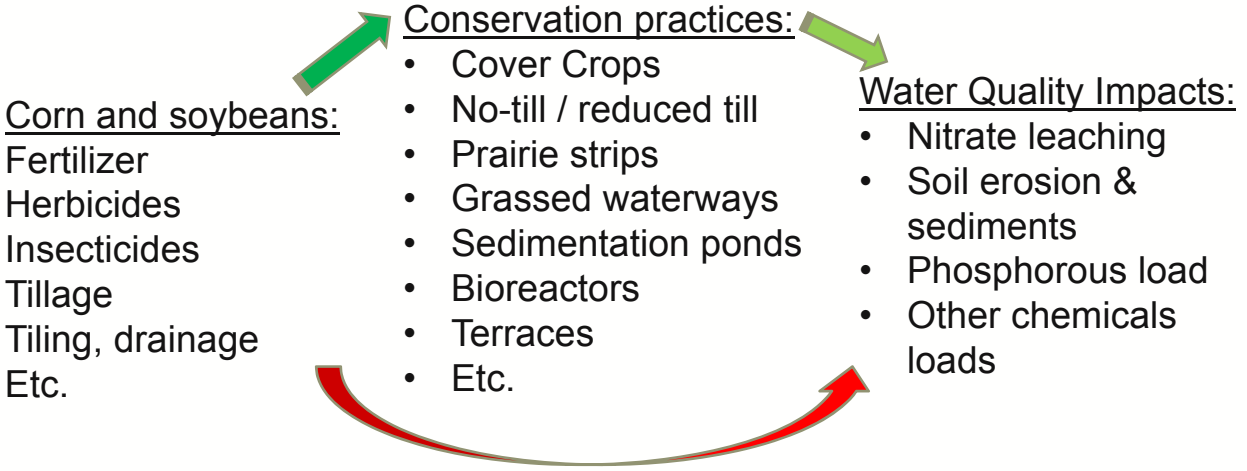
Crop Insurance: higher APH yield, higher revenue guarantee





Extension: a simplified framework to evaluate incentives

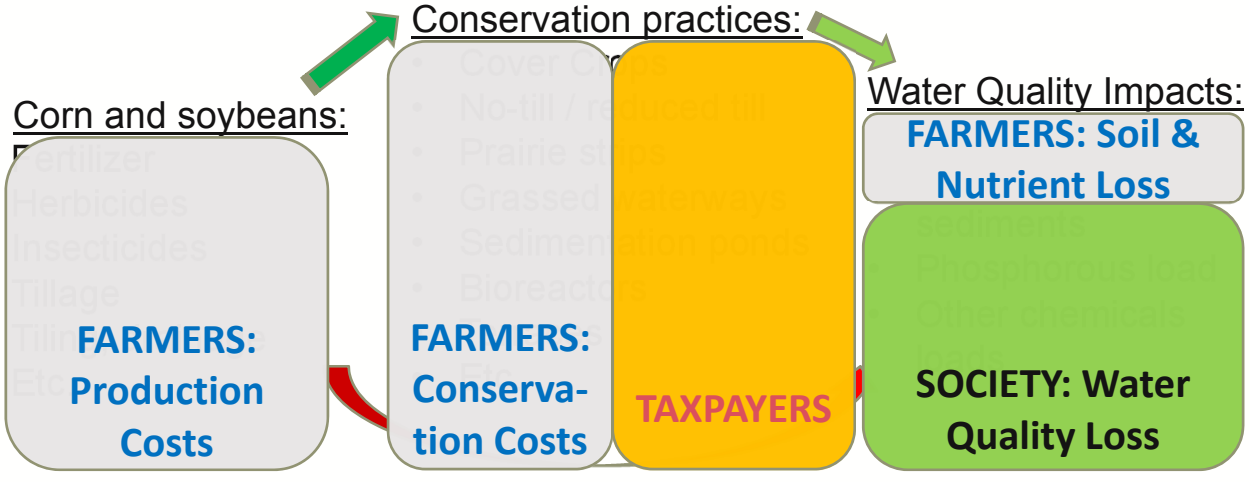
1) How are costs shared between farmers and others?



Source: Alejandro Plastina

Extension: a simplified framework to evaluate incentives

1) How are costs shared between farmers and others?



Source: Alejandro Plastina

Extension: a simplified framework to evaluate incentives

2) What incentives do farmers face?

Conservation practices:

Corn and soybeans:

Water Quality:

Example: Cover Crops

A) FARMERS: Production Costs

FARMERS: tion Costs

C) FARMERS: Soil & Nutrient Loss

What can farmers do different to minimize their short-term costs?
- ✓ **Save on inputs ↓ A**
- ✓ **If ROI in Conservation Practices is LOW, B=0**
- ✓ **C may be hard to change anyway**

Source: Alejandro Plastina

Extension: a simplified framework to evaluate incentives

2) What incentives do farmers face?

Conservation practices:

B) FARMERS

Corn and soybeans:

Water Quality:

A) FARMERS: Production Costs

C) FARMERS: Soil & Nutrient Loss

What can farmers do different to minimize their short-term costs?
- ✓ **Save on inputs ↓ A**
- ✓ **If ROI in Conservation Practices is HIGH, Invest in Conservation Practices**
- ✓ **C ↓**

Example: Terraces

Source: Alejandro Plastina

Extension: a simplified framework to evaluate incentives

3) How about Social Costs?

Conservation practices:

Corn and soybeans:

TAXPAYERS

Water Quality Impacts:

SOCIETY: Water Quality Loss

Social Costs are External to the Farm.
A business will NOT internalize those costs unless:
a) Mandated to do so.
b) Farm Market Segmentation on Sustainable Standards → Expected ROI > 0

Example: Cover Crops Programs sponsored by General Mills, Unilever, etc.

Source: Alejandro Plastina

Extension: a simplified framework to evaluate incentives

4) What about Long Term Benefits for Farmers?

Corn and soybeans:

A) FARMERS: Production Costs

Conservation practices:

B) FARMERS: Conservation Costs

D) Long Term Benefits for Farmers:
- Soil Health → Higher Land Values
- Carbon Sequestration → $ C market
- Farm resiliency to weather variability
- …many more

Water Quality:

C) FARMERS: Soil & Nutrient Loss

Source: Alejandro Plastina

Extension: a simplified framework to evaluate incentives

5) Aren't Long Term Benefits attractive enough to change practices?

A) FARMERS: Production Costs

B) FARMERS: Conservation Costs

C) FARMERS: Soil & Nutrient Loss

CERTAIN and FRONTLOADED COSTS

BENEFITS UNCERTAIN and DISTANT IN THE FUTURE

D) Long Term Benefits for Farmers:

- Soil Health → Higher Land Values
- Carbon Sequestration → $ C market
- Farm resiliency to weather variability
- …many more

Source: Alejandro Plastina

Further problems with Long-Term Benefits in Iowa

- Land is NOT traded on Soil Health, but acreage and CSR2
- No current market for Soil Health
- Incipient market to sell sequestered carbon credits (Indigo, SHI, etc.), but potential for Iowa may be limited (tiling, cornstalks harvested, no summer cover crops, etc.)
- 95% of Iowa farms use Crop Insurance (80%-85% coverage levels) to manage weather & price risks

Concluding comments

- Temporary land retirement from production (CRP) is popular but expensive
- Limited adoption of other voluntary conservation programs (e.g. cover crops 4% of arable land in Iowa)
- Big transfers to farmers to incentivize conservation practices might become unpopular among urban taxpayers
- Mandatory programs (regulation & enforcement) are unpopular among farmers

IOWA STATE UNIVERSITY
Extension and Outreach

Thank you for your attention!

Questions? Comments?

Alejandro Plastina
plastina@iastate.edu

https://www2.econ.iastate.edu/faculty/plastina/

IOWA STATE UNIVERSITY
Extension and Outreach