Benefits of Windbreaks

- Reduce Soil Erosion
- Crop Protection
- Energy Conservation
- Snow Control
- Livestock Protection
- Aesthetics/Visual Screening
- Niche products
- Wildlife Habitat
Purpose of this Study

• Answer the two most commonly asked questions:
  – What are the Long-term financial benefits of Windbreaks on crop yields?
    • Used discounted cash flow analysis
  – What are the Long-term financial benefits of Shelterbelts on confined animal production?
    • Used discounted cash flow analysis of estimated reduction in energy costs
Long-term Yield Impacts
Windbreak Economic Model

- Incorporates costs of site preparation and tree/shrub establishment
- Estimates both new establishment costs and renovation costs
- Calculates yield impacts at 1/2H – 11H for each year, based on expected tree growth rates.
Study Design

• Step 1: Determine costs for Windbreak and Shelterbelt establishment
• Step 2: Conduct a sensitivity analysis of costs for possible site prep and windbreak design variances
• Step 3: Apply estimated costs and expected revenues to a Discounted Cash Flow model
• Step 4: Compare the PV of the model with and without the windbreak.
Costs of Establishment

• Site Preparation (1 acre):  
  – Chemical Prep on Cropland Sites $30.01  
  – Chemical Prep on NonCropland Sites $35.98  
  – Mechanical Prep $49.42  
  – Mechanical Prep w/ Temporary Cover $106.89  

¹1 Acre = 30’ wide x 1452 ’ long
Tree and Shrub Establishment (1 Acre)

• Design Considerations:
  – 3 row (30 ft wide x 1452 ft long)
    • 1 row shrubs, 1 row evergreens, 1 row deciduous trees
  – 6 row (60 ft wide x 762 ft long)
    • 2 row shrubs, 2 row evergreens, 2 row deciduous trees

• 12 different possible spacing combinations x 2 different windbreak lengths x 4 possible cost levels = 96 cost scenarios (48 were analyzed).

• Range of tree Costs: $1,050 – 9,785 ($5,533)
Total Cost of Establishment (1 acre)

• Site Prep + Tree and Shrub Establishment Costs
  – Range: $1,080 - $9,892
    • ($0.75 - $6.80 per linear foot for a 30 ft wide windbreak)
    • Average: $6,152 ($4.24 per linear foot for a 30 ft wide windbreak)

• Area of Protection
  – Increases as the trees increase in height (1.1 acres in year 1 to 44 acres in year 40)
Yield Impacts

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Soybean Yield and Windbreak Protection (Leeward Side)

- **Yield (bushels)**
  - 30
  - 35
  - 40
  - 45

- **Windbreak**
  - 1/2 h
  - 1 h
  - 2 h
  - 3 h
  - 4 h
  - 5 h
  - 6 h
  - 7 h
  - 8 h
  - 9 h
  - 10 h

- **Distance From Windbreak**
  - (h = height of trees)

- **Values**
  - **LOSS**
    - 27.6
    - 29.6
  - **GAIN**
    - 33.6
    - 39.5
  - **Field Average**
    - 31.5
  - **33.6**
  - **33.6**

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x = height of windbreak

Baldwin - Ridgetown College
## Yield Impact

<table>
<thead>
<tr>
<th>H</th>
<th>Impact</th>
<th>Yield</th>
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<td>1/2H</td>
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<tr>
<td>1H</td>
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<td>4H</td>
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<td>9H</td>
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<td>11H</td>
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What are the Long-term financial benefits of Windbreaks on crop yields?

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<th>20 Years</th>
<th>40 years</th>
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<td><strong>Soybeans (85 bu/$13)</strong></td>
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<td>0.89</td>
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Wheat (45 bu/$7)
Additional Comments

- Both Windbreak Scenarios outperform the no Windbreak Scenario if the tallest trees (large conifer or deciduous) grow at a rate of 4.5 feet per year.
- This analysis assumes only the impact on crop yield, not the impact on wildlife or any other non-market benefits.
- The higher the yields and values of the crops the higher the financial impact.
- The higher the discount rate the lower the NPV and B/C Ratio.
Impact on Confined Animal Feeding Operations

• Reduction in Heating Costs
  – 17.5%-25% reduction in winter heating costs
  – A study by Agriculture and Agri-Food Canada indicated that Windbreaks/Shelterbelts cut heating costs by 26%.
Economic Analysis

• Average Heating Costs:
  – 2000 gallons of LP Gas per year at $2.86/gal = $5,720
  – 5000 gallons of LP Gas per year at $2.86/gal = $14,300

• 17% reduction in cost:
  – $972 - $2,431 per year savings
  – NPV(6%,20): $11,149 - $27,883

• 25% reduction in cost:
  – $1,430 - $3,575 per year savings
  – NPV(6%,20): $16,402 - $41,005
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The Center for Agroforestry
University of Missouri
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Questions?