Lessons Learned Using Vegetative Environmental Buffers for Poultry Farms

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Opportunities Using Trees for Vegetative Environmental Buffers

Planting Trees and Shrubs for Curtailment of Dust and Air Pollutants

Pilot program for cost share developed by U of Conn. CE and Conn. State ASCS Office in 1991.

Timing of Initiative Not Right for Conn. Delmarva NO trees or scrubs next to houses.

DMV Nuisance Complaints (conversion to tunnel ventilation in 1990s)

Industry Issues, Trends & Trees

Tunnel, windowless houses larger farms & expansion

Rural encroachment + conflict/zoning

Emissions

Stakeholder meeting Dec. 2000
Initial Test Encouraging

- Dust and ammonia reduction with a single, immature Leyland cypress tree:
  - 30% less dust
  - 18% less ammonia

Goals of Vegetative Environmental Buffer (VEB)

1. Visual screen
2. Windbreak + Shade
3. Vegetative filter
4. Biosecurity

Funding for VEB Studies

- Sussex Conversation District- 2001 (demo planting)
- Delaware Landscape and Nursery Assoc.-2001 (tree species)
- EPA/DNREC NPS Program Section 319-2002 (air & water quality)
- NRCS Agroforestry-2002 (implementation)
- US Poultry and Egg Assoc.-2002 (production)
- USDA/NRI-2004 (continuation of environment and implementation)

2001 Demo Tree Plan

- Tree plan =
  - East: red cedar for screen (visual + noise)
  - North: red cedar for windbreak
  - West: red cedar + white pine for windbreak, screen & filter.
  - South: white pine + red cedar for screen

Lessons Learned!

- Plan/plant early!
- Cheap not best
- Irrigate
- Weed control
- White pines???
- Care???

Production Benefits

- Reduce snow drifting
- Reduce heating cost
- Reduce cooling cost
- Maintain fan efficiency
- Reduce airborne farm-to-farm disease spread
Temperatures in Sun vs Shade

Surface Temperatures Around Houses

Influence of Woods on Broiler Production (USPEA Funding)

Microclimate

Fan Performance

Temperature differential on E-W wooded farm compared to the E-W open farm.

Implications of farms surrounded by dense woods:
- Heat accumulation on S and W sides in warm weather
- Although less wind chill in winter, may have colder night time air temperatures

VEB to Reduce Backpressure on Fans

VEB reduces wind directed toward fans & aids in maintaining fan efficiency

- 15 mph = 15.5% reduction in fan cfm and 4.4% increase in amperage.
**Reduce Farm-to-Farm Air-Borne Disease Transmission**

LT spread on Delmarva (Johnson, et al. 2001)
- Distance from LT farm not as important as direction of wind from that farm
- Downwind farms 4x more likely to get LT
- N-S oriented houses 40% more likely to get LT than E-W houses
- Conventional houses 3 ½ more likely to get LT than tunnel houses

VEB = 16% less aerobic bacteria aerosols

**Environmental Benefits**

- Reduce ammonia
- Reduce runoff
- Reduce groundwater nitrates
- Convert CO₂ to O₂
- Low cost program to partially address future air quality & emissions challenges

**Between Houses on Same Farm**

- Reduce ammonia
- Reduce runoff
- Reduce groundwater nitrates
- Convert CO₂ to O₂
- Low cost program to partially address future air quality & emissions challenges

**VEB Opposite Tunnel Fans**

“Reduces” Dust (57%), Ammonia (55%) and Odor (27%)

VEB = 16% less aerobic bacteria aerosols
**Wind direction and crop behind VEB**

“appears” to influence odor reduction

- Soybeans in 2002 & 2004 (~28%)
- Corn in 2003 & 2005 (~0%)

Need openness behind VEB.

- VEB near odor source more effective (50’ vs 200’)

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**Impact of a Poultry Farm on Nitrate-N (8’ wells)**

- Need more openness behind VEB
- VEB near odor source more effective (50’ vs 200’)

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**Water Quality at UD VEB Planting**

- Spring & Fall 2004 to 2007

**Nitrate-N (ppm) in Test Wells**

- All Well Data
- Questionable data removed

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**Neighbor Relations**

- Benefits:
  - Creates positive image
  - Landscape appearance & increase property value
  - Blocks view of houses, waste facilities and routine farm activities
  - Out-of-Sight-Out-of-Mind!!
  - Attractive farms have less odor (Mikesell, et. al., 2001)
  - Reduces odor, dust, feathers, noise, etc.

**DMV Neighbor Relations Trends**

- Increasing number of nuisance complaints and more stringent zoning ordinance.
- ~40% complaints are dust/feathers, 40% odor & 20% visual, noise, etc.
- Direction/location of tunnel ventilation a major issue.
- Proactive industry neighbor policy with bmp’s (includes VEB)
**VEB Challenges**

- Poor soils
- Moisture extremes
- Marginal care/maintenance
- Species resistant to ammonia emissions and particulate loading

**90% Tree Mortality**

- Proper distance, tree selection & design?
- High particulate loading
- Drought
- Insects
  (Maintenance!!!!!!)

**Compacted Subsoil!!!**

**Moisture Stress**

**Maintenance and Care**
Dust!

White Pine
High Cedar
Pink and Cypress

Netting to Reduce High Particulate Loading

Wic. Soil Cons. District

Blowing or Washing to Removal of High Dust Load?

Develop and Evaluate Misting System for Trees at Tunnel Fans

- Increase efficacy?
- Wash-off dust
- Reduce stress
(NRCS Agroforestry funding)

Develop tree plan before building poultry houses!

VEB Distance from Fans

- Fan efficiency decreased <4 times fan diameter
- Plume distribution 10 times fan diameter
- Planting distance near maximum plume distance ???
**Rule-of-Thumb**

- Minimum of 10x fan diameter (ie 4ft diameter = 40 ft)
- Add ~5ft for each additional fan (ie 3 fans = 55 ft)

**VEB Too Close to Fans**

**Fan Type on Tree Growth**

**Temperature Difference Between Fan and Open Area During Cold Weather**

**Summer Tunnel Fan Temperature Plume (Fan On)**

- Dust on trees with complex leaf shapes not as much concern as feather/down matting!!!
- Planting distance and tree selection critical opposite fans!!!
Distance May Depend on Tree Selection, Density and Arrangement of Plant Material

Deciduous or waxy leaf tree as prefilter

Distance from Tunnel Fans
(13, 26 and 39’ for GGA, RC and HW; SH, Shrubs)

Distance from Tunnel Fans
(13, 26 and 39’ for GGA, RC, HW; SH, Shrubs)

Trees Between Houses for Shade
(and Emissions?)

- 13 ft all die
- 26 ft some HW live
- 39 ft some HW live
- GGA, RC, SH??
- Shrubs encouraging

Impact on Health May Take Years

Livability Between Houses & High Emission Loading Area
**Eastern White Pine**
- Emissions kill within 1 yr
- Very difficult to establish
- Deer damage

**Demo Farm Tree Mortality**

**Eastern Red Cedar**
**Advantages:**
- Density, diverse soils, hardy

**Disadvantages:**
- Except seedlings, limited availability
- Mortality from particulates
- Defoliate due to ammonia?
- Some bagworms
- Some storm damage

**Spartan Juniper**
**Advantages:**
- Good density and growth
- Attractive
- Columnar shape

**Disadvantage:**
- Some wind and bag worm damage

**Leyland Cypress**
**Advantages:**
- Available at low cost
- Attractive
- Good growth

**Disadvantages:**
- Mortality and maintenance issues!!

**Green Giant Arborvitae**
**Advantages:**
- High ammonia emissions
- Available and reason cost
- Hardy and more disease resistant than leyland cypress

**Disadvantage:**
- Matting if first row opposite fans
**Steeds and Nellie Stevens Holly**

- **Advantages:**
  - High dust/particulate loads
- **Disadvantages:**
  - Poor livability/moisture stress!!!

**Bald Cypress**

- **Advantages:**
  - Hardy and wind tolerant
  - Good in wet areas

**Hybrid Willow**

- **Advantages:**
  - Fast growth!!!
  - High emission, nutrient and moisture conditions

**Rose Acre Complex**

(5 yrs)

**Hardy Shrubs**

- Elaeagnus Fruitlandii
- Euryonymus Manhattan

**Wind Damage – Too Much Water?**

- March 2005
- June 2006
- March 2007
- June 2007
Between House Plantings

- Nellie Stevens Holly
- Honey locust
- Chinese juniper
- Hybrid willow
- Osage orange

New, Tuff-As-Nails Plant!!

Poke Berry!!!

Form of Plant Material

Proper installation, water and weed control perhaps more important than plant form.

Irrigation Methods

Hand: Time & Commitment

Bury supply line and emitters.

Effort & $$$

Drip: Installation, water use & placement

Punch emitters and cover with poly/wool mat.

Weed Control Demo

Proper installation, water and weed control perhaps more important than plant form.
**Cumulative White Pine Mortality (%)**

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**% Growth of Green Giant Arb – 1.5yrs**

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**Proper Design, Installation, Maintenance and Care!**

**Design VEB For Each Side of Each Farm And Try To Meet ALL Objectives**

**Summary**

- **Emission reductions** encouraging, continue to better define this program
- Provides a long-term, low-cost, partial solution to emerging poultry industry issues (maybe one of most cost-effective BMP’s for emissions)
- Neighbor relations has driven interest (local/national/international)
Summary (cont.)

- VEB concept has been well received (national/international)
- Growers need technical assistance in designing, implementing and maintenance of VEB
- Poultry companies committed to VEB for farms