Best Management Practices - BMPs

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What are BMPs?
Why do we need them?
How do they work?
Examples for Southern Region
BMPs are ..

✅ Source and transport measures that prevent or limit sediment, nutrients, pesticides etc. loss in runoff from fields to surface or ground water
Why do we need them?

- Protect water quality for designated uses
  - Local & regional issues
- Sustainability
- Economics
Troubled waters

Illinois River

Tahlequah: 10,362

Phosphorus load in pounds per year

- 10,000 and over
- 4,000 to 9,999
- 1,000 to 3,999

SOURCE: “Oklahoma State University Clean Lakes Study” (1997)
Point source reductions easy to document

Springdale WWTP effluent
Downstream P concentration

Sampling period, July 2002 to June 2003

Brian Haggard, U of A
Hypoxia in the Gulf

1. Nutrient-rich water flows in.
2. Algae grow, feed and die.
3. Zooplankton eat algae.
4. Bacteria feed on fecal pellets and dead algae.
5. Bacteria deplete the water of oxygen.
6. Marine life flees (2.0mg/l) or dies (1.0mg/l).
Once in lower river system nutrients tend to be transported directly to Gulf

Proximity to large rivers increases risk

Accentuates contribution from lower states
N & C but no P added

N, C, & P added
Processes of P loss

Soil erosion & particulate P

Crop N harvest 15%

Release of soil P → dissolved P

P leaching is small

Tile flow

Subsurface flow

Soil P immobilization - 80%

Total P - 5%
Timelags are important for N

Nitrate in runoff is small – 5%
Nitrate losses in leachate are large – 25%
Crop N harvest 50%

NH₃ - 2%
N₂O - 13%

Total N

Soil N immobilization - 5%

Nitrate leaching

Days/wks
Weeks/mo
Years
Decades
Examples: Source BMPs
Farm gate measures

Customize feed rations

Lactating dairy cows - Wu and Satter, 2000

R² = 0.74
Farm gate measures

✓ Customize feed rations

Low phytic acid corn
Farm gate measures

- Customize feed rations
- Enzymes in feed
Farm gate measures

- Customize feed rations
- Enzymes in feed
- Environmental soil testing
Manure P rate and runoff P

Dissolved P in runoff, mg/L

Poultry litter added, kg P/ha

None 50 100
Subsurface injection of litter
Application method and runoff P

Runoff P, mg/L

Time after P applied, days

Poultry litter 100 kg P/ha

Surface Plowed Subsurface placement
Examples:
Transport BMPs
Conservation tillage
Conservation tillage

No-till reduced erosion from wheat 95%

Total P, mg/L vs. Runoff vs. Total N, mg/L graphs showing the comparison between conventional tillage and no-till practices over the years 1980 to 1995. The graphs illustrate a significant reduction in Total P, Runoff, and Total N in the no-till compared to conventional till wheat. The data suggests a 95% reduction in erosion from wheat when converted to no-till.
Conservation compromises

Infiltration increased 33%

Runoff - Dissolved P, mg/L

Converted to no-till

Leached - Nitrate, mg/L

Converted to no-till

Conventional till wheat
Rotational grazing
Stream exclusion
Stream crossing minimizes time cattle in stream
Alternative water sources
Ponds can be water source and trap sediment and P runoff
Edge of field vegetative filters
Fenced buffers
Riparian buffers

Outflow - kg/ha/yr - Inflow

- Surface runoff
- Subsurface flow

87%  79%
Issues and challenges

- Adaptive management
- Reduction efficiencies
- On-farm verification and demonstration
- Monitoring
Documenting change & adapting management

Maumee River watershed

Sandusky River watershed

Lake Erie

MIchigan

Ohio
Documenting change & adapting management

- No-till increased from 0 to 50%
- 5% land put in CRP
- Nutrient management plans implemented
  - Fertilizer P use decreased 30%
  - 25% less manure applied
Trends in P - Maumee River

Annual flow-weighted concentration, ppm

Dissolved P

75% decrease

Peter Richards, Heidelberg College, OH
Trends in P - Maumee River

Annual flow-weighted concentration, ppm

- Weather exacerbated management trends
- Adaptive management may have reduced nutrient loss:
  - Incorporation of fertilizer and manure
  - Winter cover crops
  - Spring fertilization

Peter Richards, Heidelberg College, OH
Existing data on BMP effectiveness

- Manure mgt. system (14) decrease P loss by -28%
- Conservation tillage (13) increase P loss by +5%
- Riparian / strip buffers (34) decrease P loss by -20%
- Nutrient mgt. plan (14) decrease P loss by -40%

Effect on dissolved P loss, %

-100 Decreased loss 0 Increased loss 100

Gitau et al. JSWC, 2005
Discovery Farms Project
State-wide coverage

- **NW AR - poultry & beef cattle farming**
  - Evaluate BMPs, grazing mgt., legume use

- **East AR - wheat / soybean production**
  - Reduced tillage, nutrient use eff., BMPs

- **South & east AR - Rice production**
  - Water use & harvesting, reduced tillage, nutrient use eff., BMPs
How will it benefit farmers?

- Document water quality benefits of BMPs
- Promote economic and sustainable options
- Demonstrate to other farmers what works
- Highlight success stories
Thank you ……. 