Subsurface Application of Dry Poultry Litter

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Poultry Litter Analyses

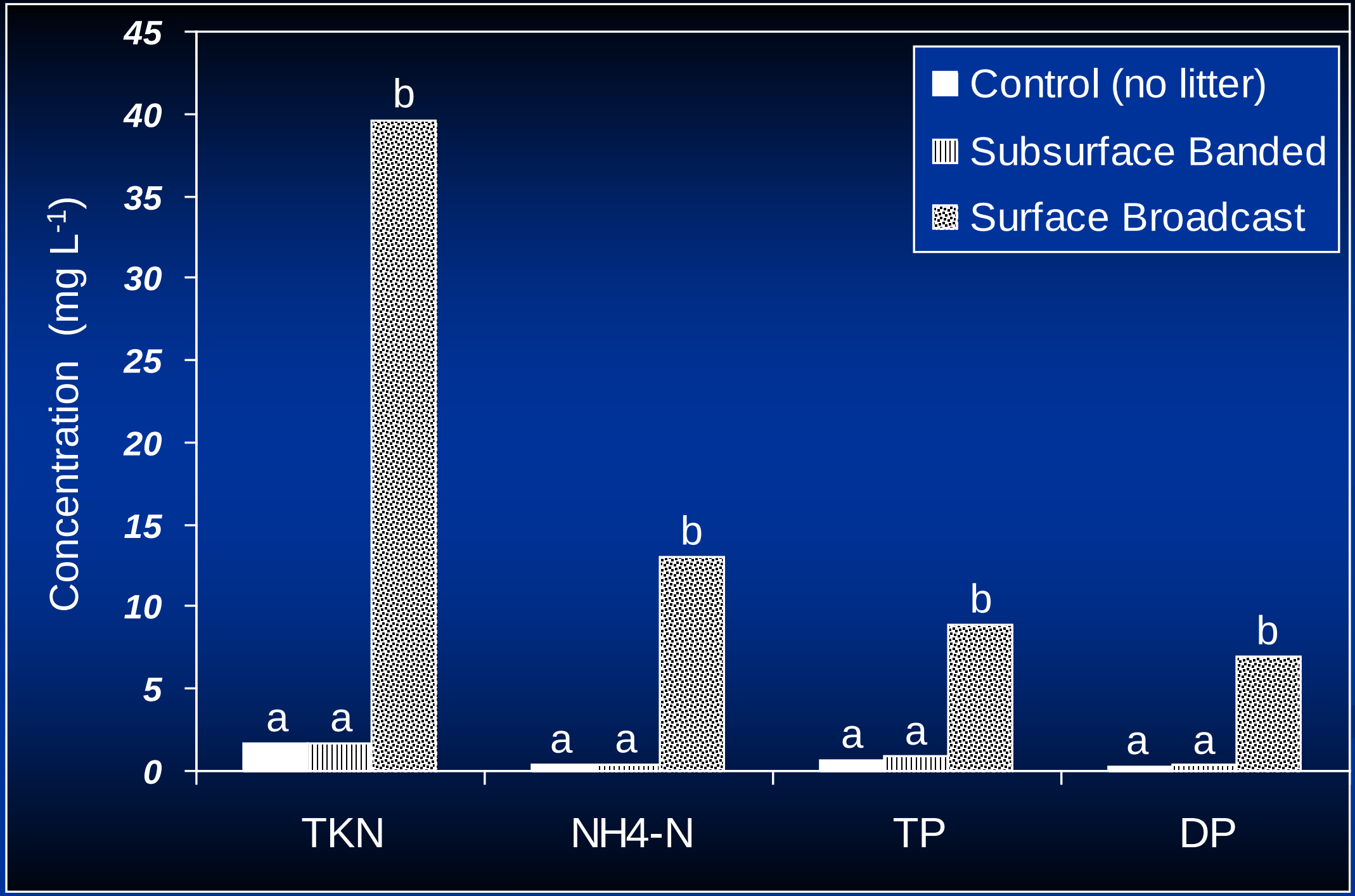
pH	7.6
Water Content	23.20%
Carbon	28.46%
Nitrogen	2.38%
Phosphorus	0.98%
Potassium	2.02%
Calcium	1.48%

When dairy manure slurry was injected into the soil:

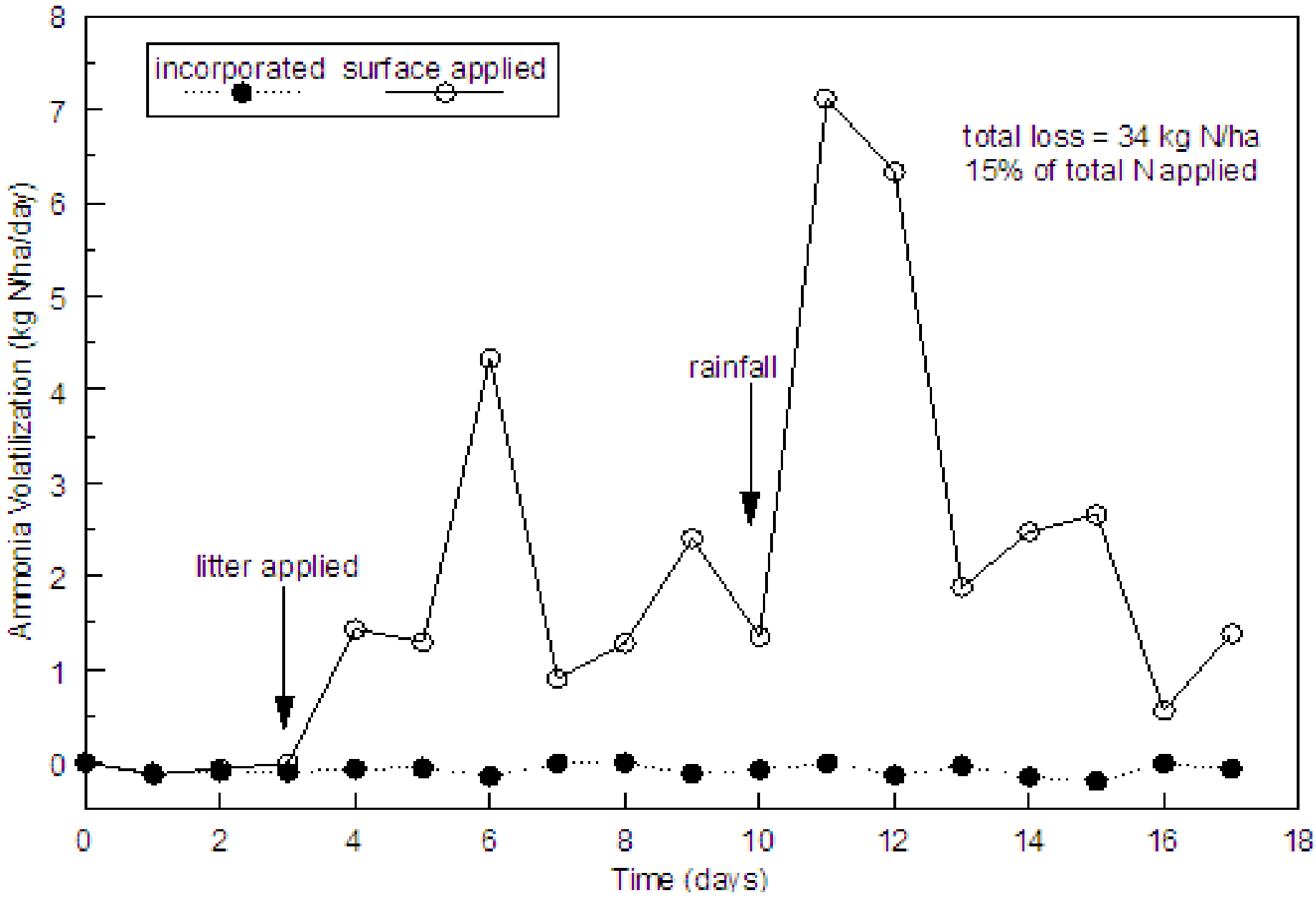
- N losses by ammonia volatilization were reduced from 25% to less than 1% (Thompson et al., 1987).
- N and P losses in runoff were almost completely eliminated (Ross et al., 1979).

Using a knifing technique to apply dry poultry litter below the surface of perennial pasture, we hoped to:

- Minimize damage to the grass and soil structure.
- Improve water quality by decreasing nutrient losses in runoff.
- Decrease N losses to the atmosphere.
- Increase forage yield and quality by retaining nutrients in the soil, and possibly improve CEC, aeration, and water-holding capacity of the soil.


Control (no litter)
Subsurface Banded
Surface Broadcast
Concentration (mg L-1)
45
40
35
30
25
20
15
10
5
0
a
a
b
a
a
b
a
a
b
a
a
b
TKN
NH4-N
TP
DP

MAY 7 2004


incorporated
surface applied
total loss = 34 kg N/ha
15% of total N applied
rainfall
litter applied
Ammonia Volatilization (kg N/ha/day)
Time (days)
0
1
2
3
4
5
6
7
8
0
2
4
6
8
10
12
14
16
18

Poultry litter applications tend to increase soil phosphorus levels.

- Plants need only 1 kg of P for every 8 kg of N (P:N ratio = 1:8).
- Poultry litter usually contains at least 2 to 3 kg of P for every 8 kg of N (P:N ratio = >2:8).
- Nitrogen losses from surface-applied poultry litter can be as high as 50% (P:N ratio = >4:8).
- The excess P accumulates in the soil.

How does subsurface litter application help decrease phosphorus (P) losses?

- P losses in runoff from surface-applied poultry litter easily override P losses from the soil, often by 1000% or more. Subsurface application can prevent P losses from the litter.
- Subsurface application retains more litter N in the soil, thereby decreasing the amount of litter required to meet crop needs and greatly slowing the rate of excess P accumulation in the soil.
- Any residual P accumulation from subsurface litter occurs deeper in the soil where it is much less available for transport in runoff.

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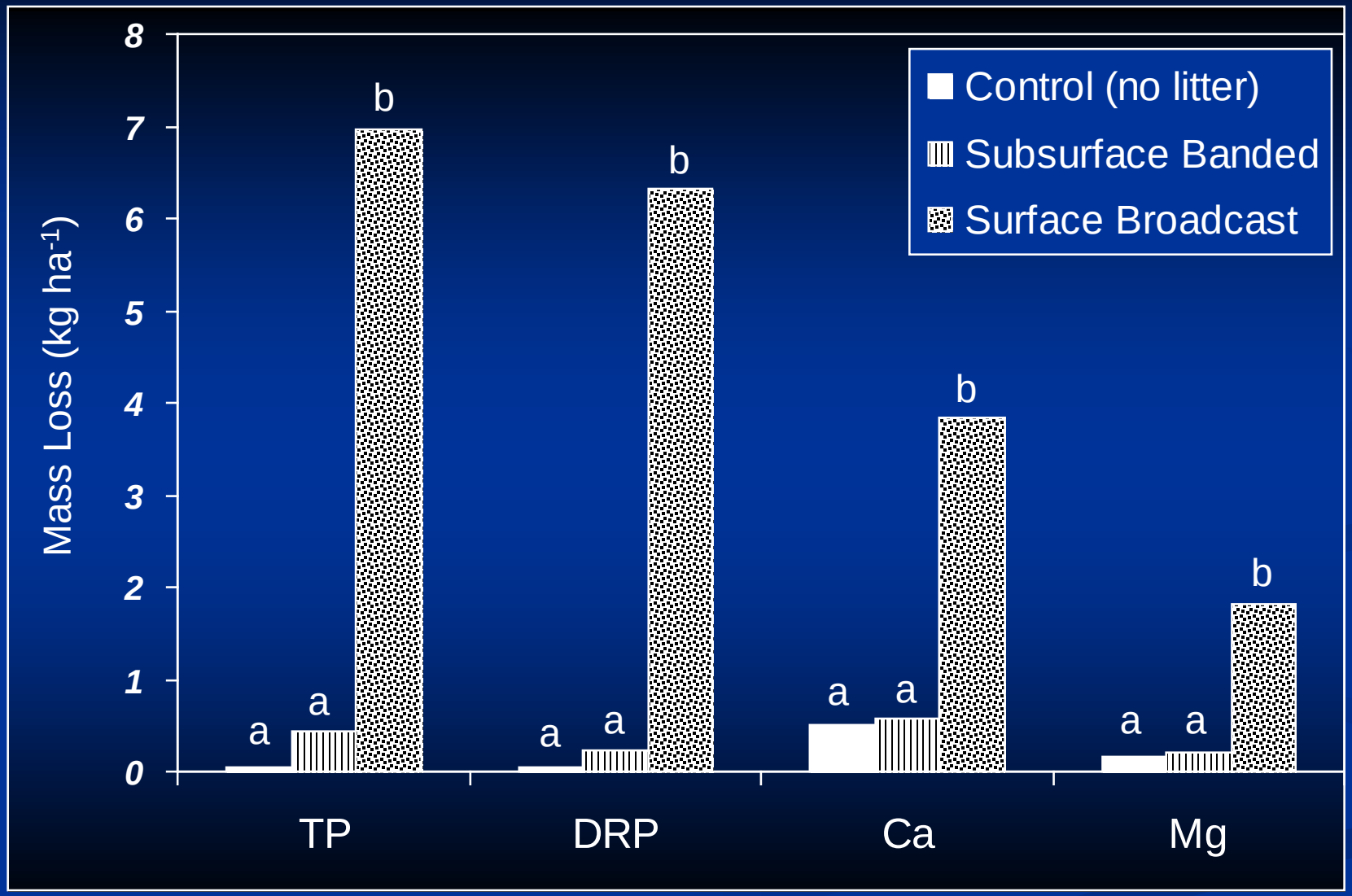
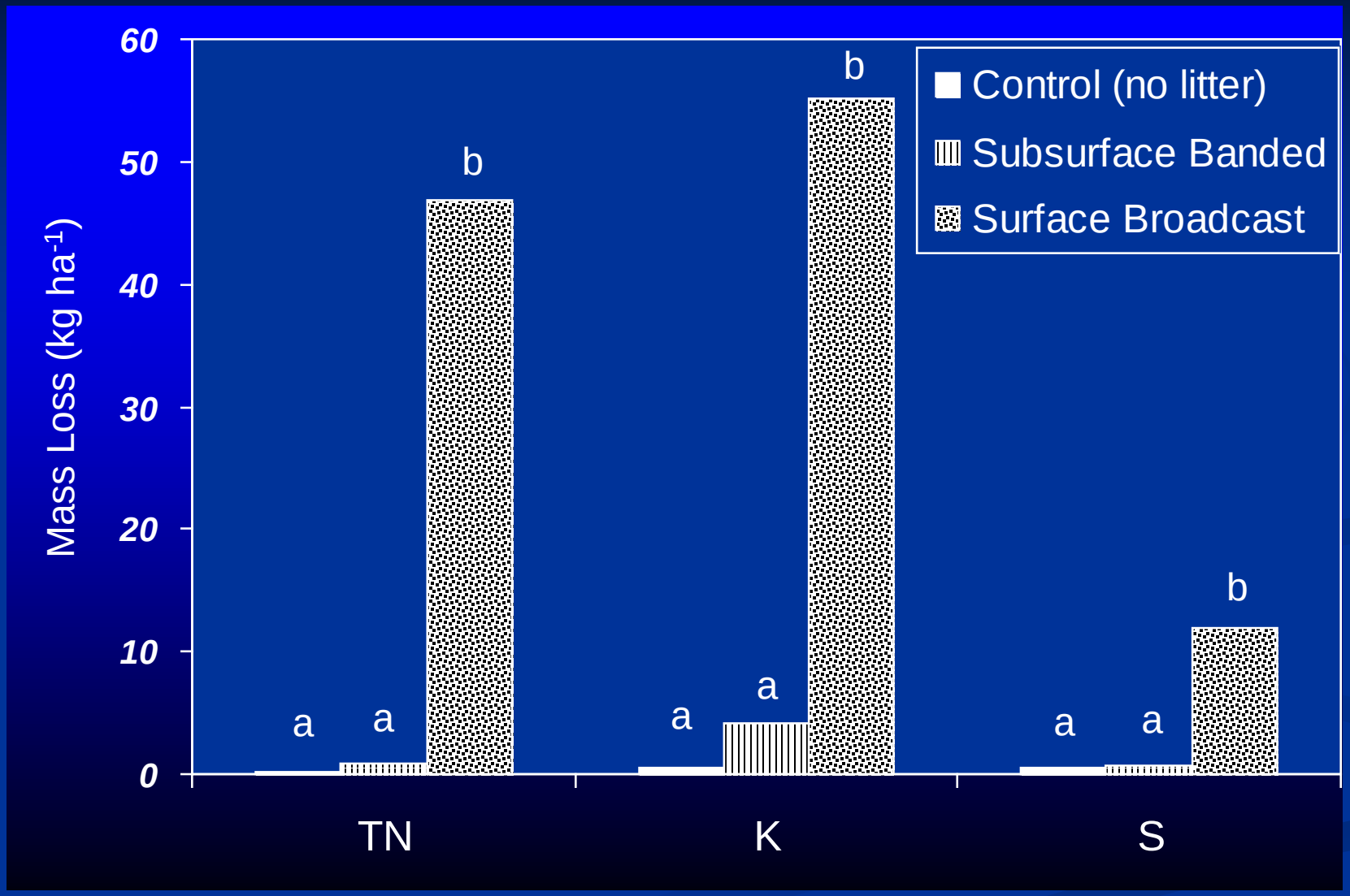

Mass Loss (kg ha-1)
8
7
6
5
4
3
2
1
0
Control (no litter)
Subsurface Banded
Surface Broadcast
a
a
b
a
a
b
a
a
b
a
a
b
TP
DRP
Ca
Mg


Mass Loss (kg ha-1)
60
50
40
30
20
10
0
a
a
b
a
a
b
a
a
b
TN
K
S
Control (no litter)
Subsurface Banded
Surface Broadcast

USDA-ARS Subsurface Applicators

Variable Spacing

Developed by Dr. Tom Way

USDA-ARS, Alabama

Fixed Spacing

Developed by Dr. Dan Pote

USDA-ARS, Arkansas

Subsurfer

USDA-ARS
Dale Bumpers Small Farms Research Center
Booneville, AR

How it works:

- Opening discs open slot.
- Pulverized litter (internal patented mechanism) is delivered to the slot.
- Closing wheels seal the soil surface.
- Can be adjusted to meet a variety of rates.
- Greater accuracy and precision across a range of rates.

No litter is left on the surface.

Subsurface Band of Litter in a Pasture

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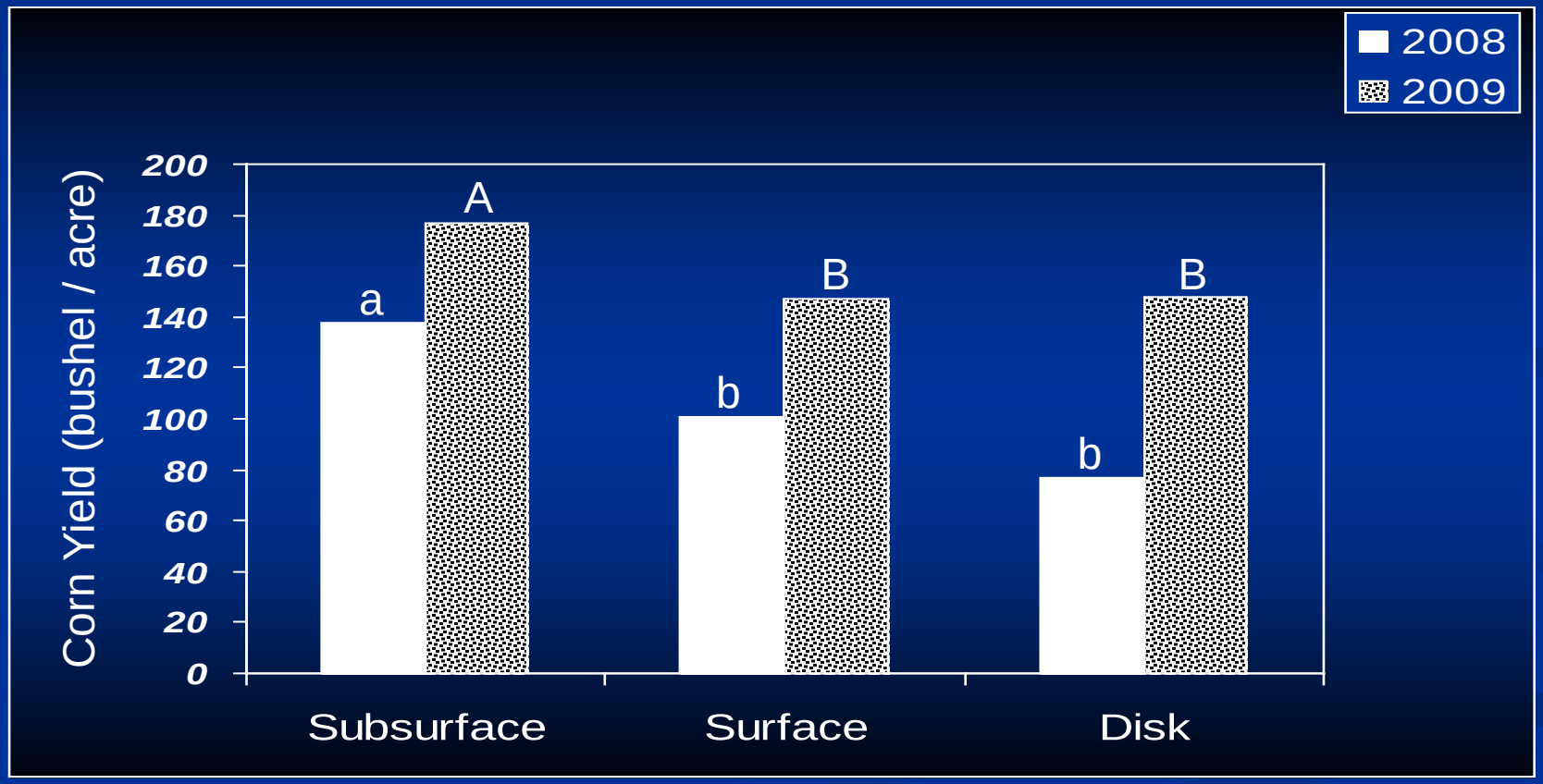
POULTRY LITTER
SUBSURFER
USDA
ARS

Effect of Poultry Litter Application Method on No-Till Corn Yields



- PLSub plots had areas of no or delayed germination
- 2010 had **11%** reduction in population (2011 was **2.5%**)
    - Treatment application and planting on same day
    - **11.5 cm** of precipitation and **15°C** average temperature for 10 days after planting

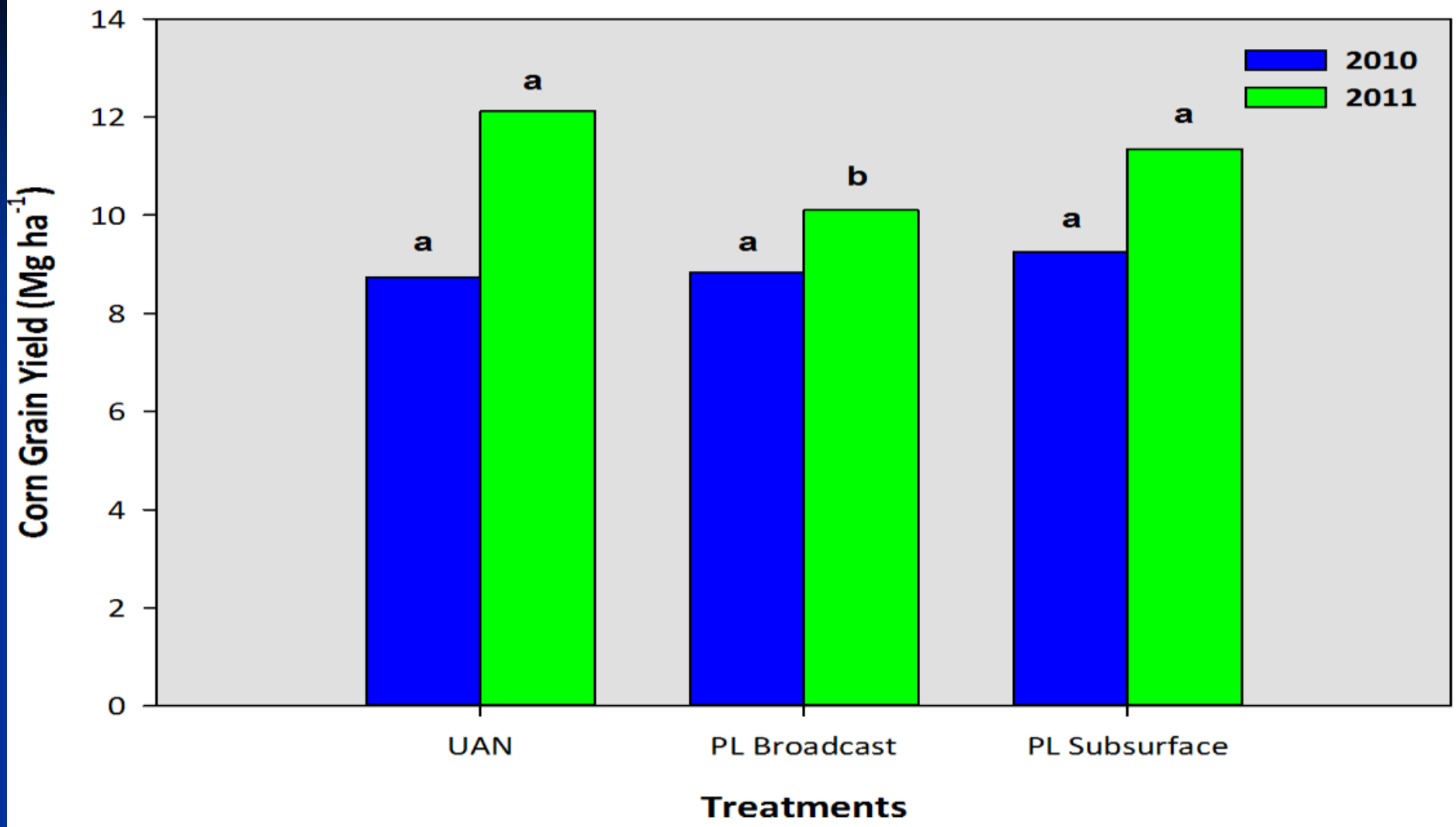


Figure 2. Corn grain yield response to 28% UAN, poultry litter surface broadcast, and poultry litter subsurface banded as nutrient source for 2010 and 2011. Within each year, bars having the same letters are not significantly different according to LSD 0.05 level.

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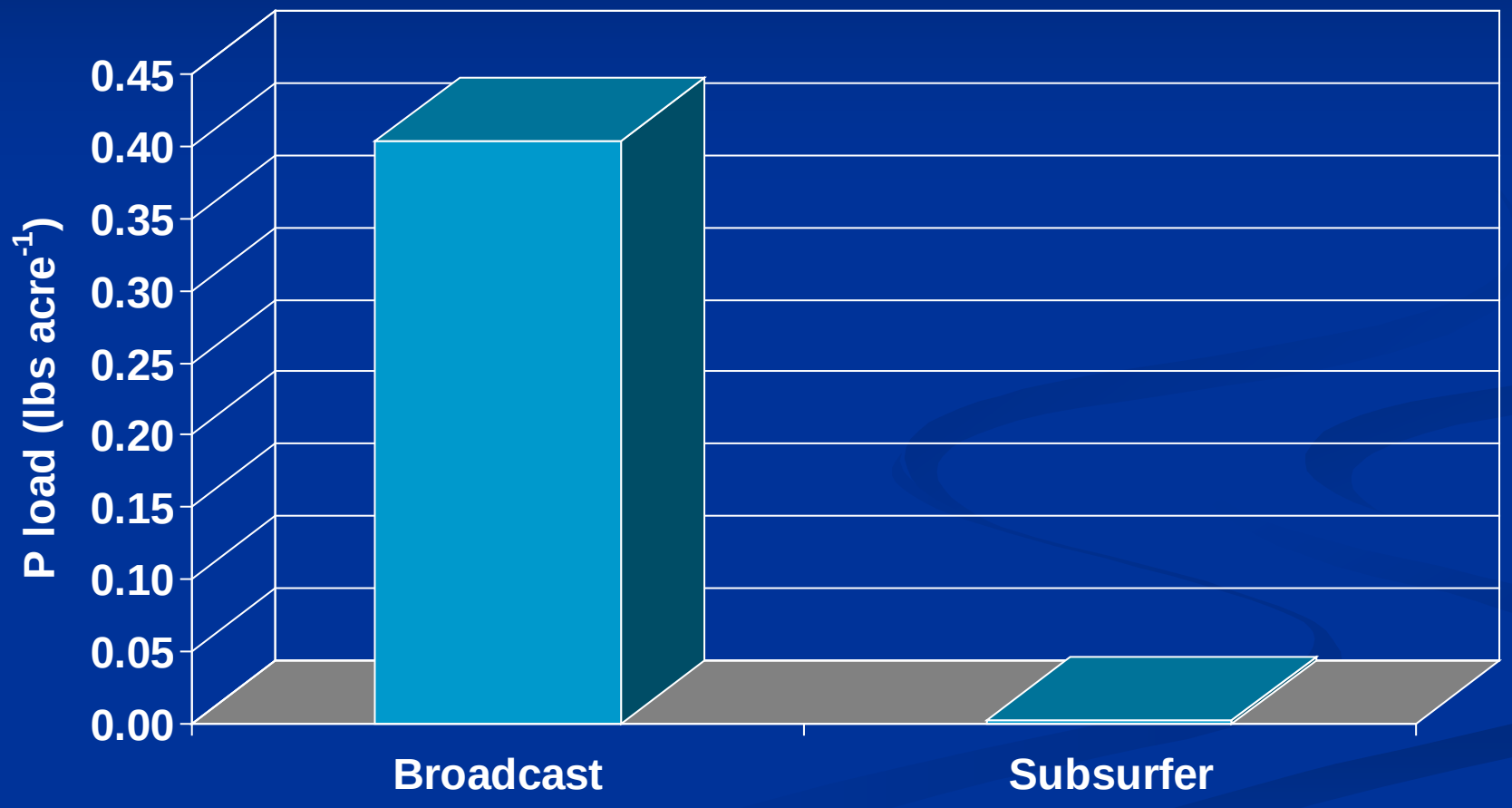
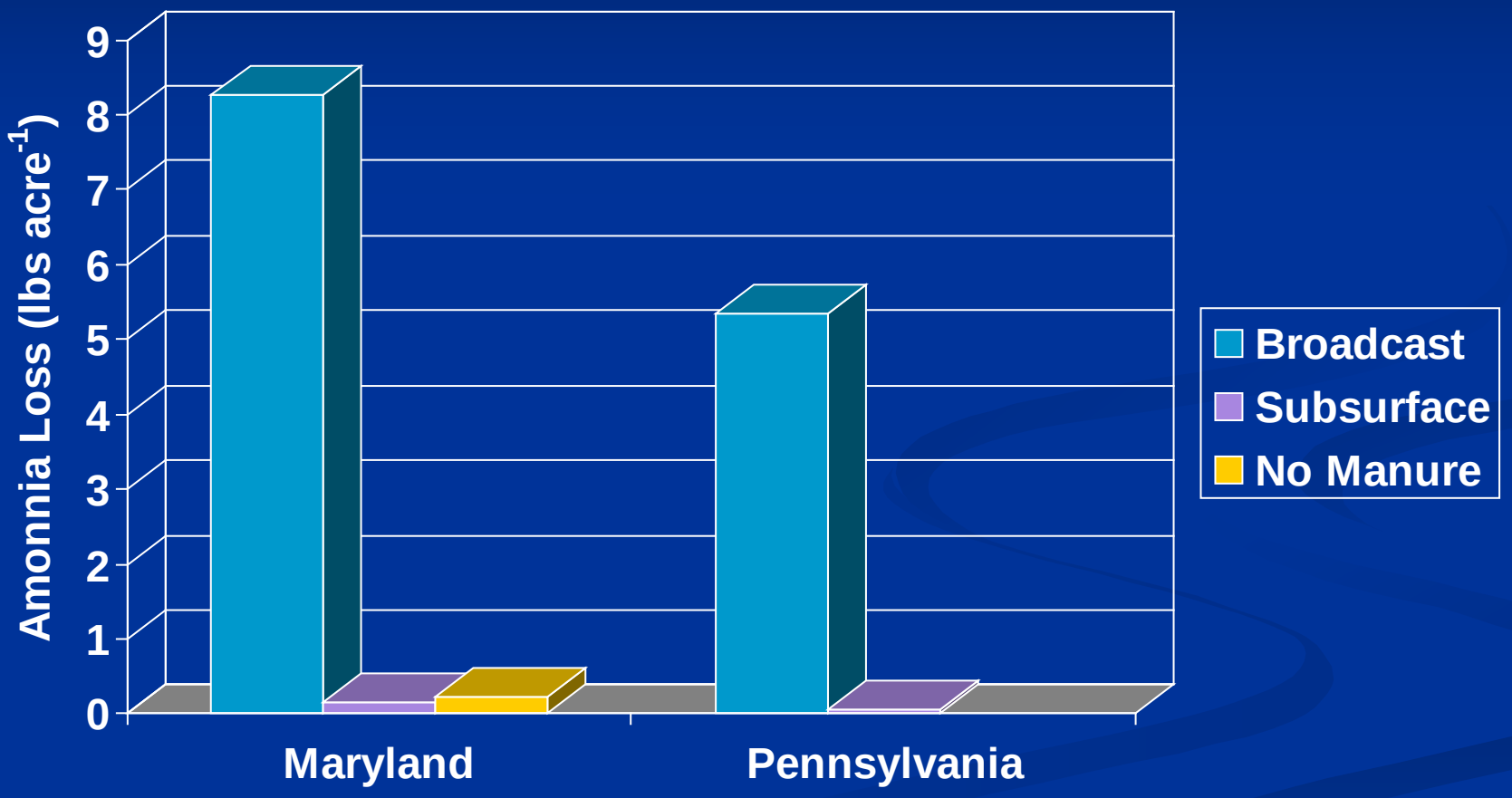
22/07/2010

Phosphorus Loss in Runoff



Ammonia Loss



Subsurfer Litter Recommendations

- Dusty dry, moisture content <25%, preferably <20%.
- Litter particle sizes (including dead birds and large chunks of dry cake) are no problem.
- Relatively free of large gravel and other foreign objects.

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Poultry Litter Subsurfer

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Dale Bumpers Small Farms Research Center
Booneville, Arkansas

Benefits of the Subsurface Application Option for Crops Fertilized with Poultry Litter

- Decrease litter application rates and/or increase crop yield by preventing N loss as volatilized ammonia.
- Increase precision and uniformity of litter application placement.
- Precisely control litter application rates, including very low rates that are not feasible when surface applying litter using conventional spreaders.
- Improve water quality by preventing most nutrient losses in surface runoff.
- Increase rain infiltration and retention when soil conditions have been dry.
- Control nuisance odors often associated with surface applications of litter.
- Add organic matter below the soil surface.

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