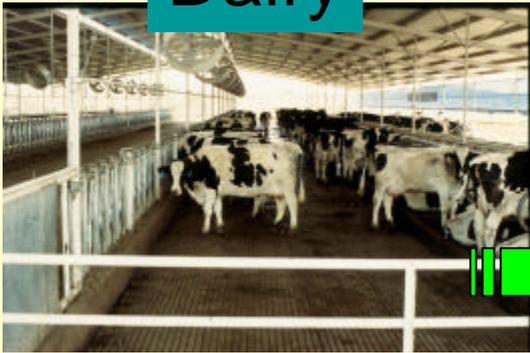


Cycling Municipal Biosolids between Agricultural and Urban Lands in Turfgrass Sod

D.M. Vietor, N.E. Hansen,
C.L. Munster, R.H. White,
T.L. Provin, & B.T. McDonald
Texas A&M Univ.

History: A system for exporting manure P through turfgrass sod

Dairy



Compost



Topdress



Transplant

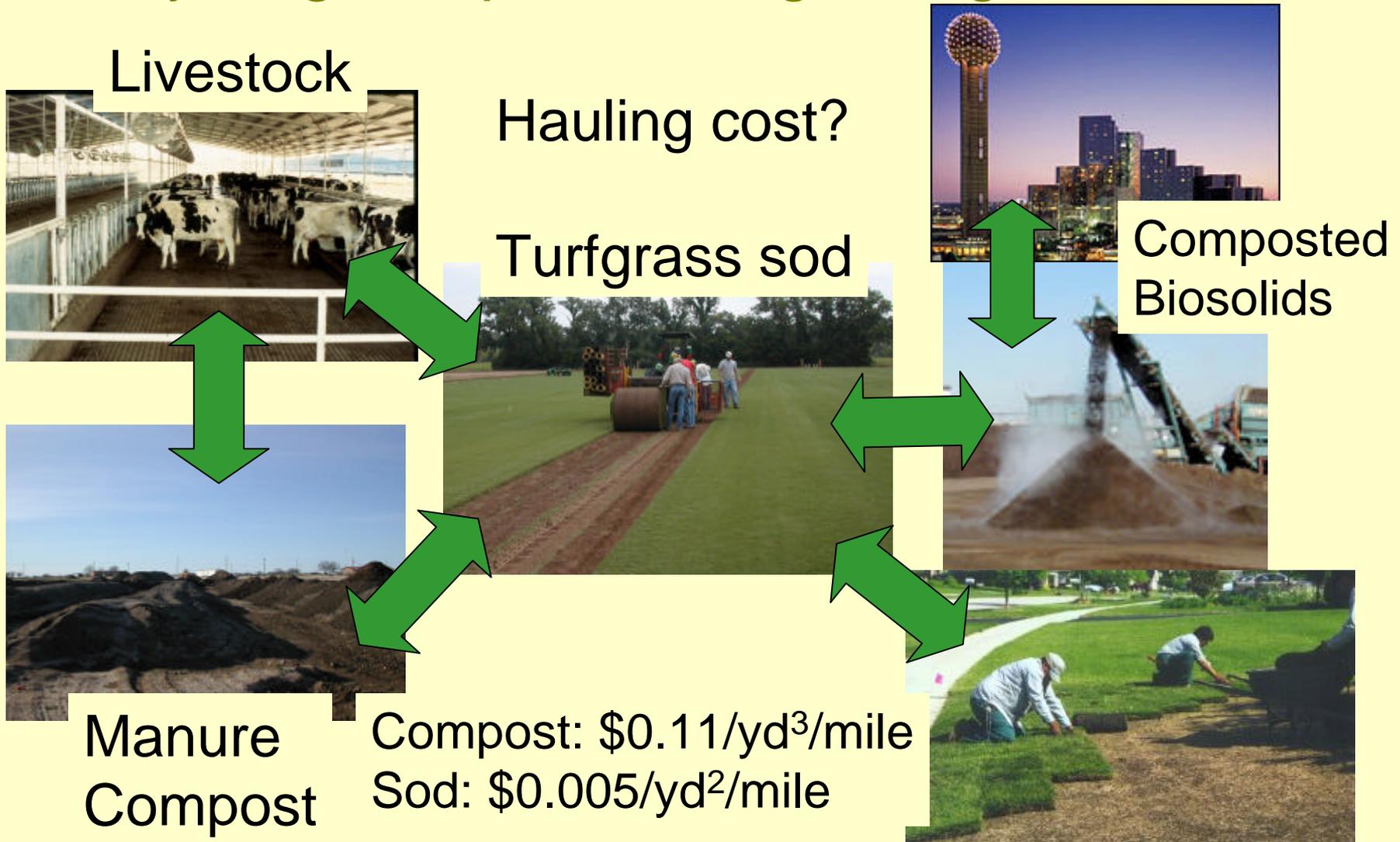


Harvest



Turfgrass sod

Economic constraints on system for cycling compost through turfgrass sod



Feasibility of cycling composted biosolids through turfgrass sod?

- Economic niche
- Agricultural land near city
- Small to mid-sized turfgrass operations
- Cost- and profit-sharing.
- Green building programs
- Volume-based rates?



Benefits of cycling compost through sod

- Enhance turf establishment
- Waste a resource
- Limit water runoff
- Prevent erosion
- C sequestration
- Protect water quality
- Sustainability



Enterprise budgets for turfgrass sod

Cost	<u>Tifway Bermuda</u>	<u>Zoysiagrass</u>
Operating	----- \$/ac	-----
Labor	339	258
Equipment	856	510
Utilities	171	10
Production Inputs	557	411
Capital Expenses	669	1963
Harvest	254	268
Marketing	480	470

Short hauling distances offset compost costs



Hauling costs:
\$3.30/mile/load
30 yd³/load
1200 lbs compost/yd³
1.0% total P, 50 miles
= \$0.46/lb total P



Compost cost
Manure \$10/yd³
Dillo Dirt \$10/yd³
1200 lbs DD/yd³
1.0 % total P
=\$0.83/lb total P



Sod hauling cost:
\$0.005 yd²/mile
50 miles = \$0.25/yd²
100 miles = \$0.50/yd²

Profit excluding sod hauling cost

<u>Sod source</u>	<u>Expense (\$)</u>		<u>Profit (\$)</u>	
Cain et al.	3535			
Martin & Wells	2391*		1409	
B.T. McDonald		<u>\$0.80/yd²</u>	<u>\$1.00/yd²</u>	<u>\$1.20/yd²</u>
Tifway	3476	(196)	624	1444
Zoysiagrass	3889	(609)	211	1031

* Excludes land and irrigation well costs

- Cain, J.J., J.L. Adrian, P.M. Duffy, and E. Guertal. 2003 Bulletin 653. Alabama Agric. Exper. Sta., Auburn Univ.
- Martin, S.W., and W. Wells. 2001. Mississippi Agric. Exper. Sta., MSU, 22(18):1-5.

A system for cycling composted biosolids through turfgrass sod

- Evaluate volume-based rates and export of compost sources of N and P through sod harvest.
- Quantify effects of composted biosolids on water runoff and quality during turfgrass establishment.

Volume X Concentration

Composted Manure

Nutrient Total Water Ext.

---- mg/kg -----

P 3200 97

N 5400 343

-- % -

OM 12.4

Composted Biosolid

Nutrient Total Water Ext.

----- mg/kg-----

P 9700 1.4

N 22000 294

--- % ---

OC 22.2

Export of compost source of P through turfgrass sod



Control

Dillo Dirt: 0.6 & 1.2-cm depth

Bryan: 0.6 & 1.2-cm depth

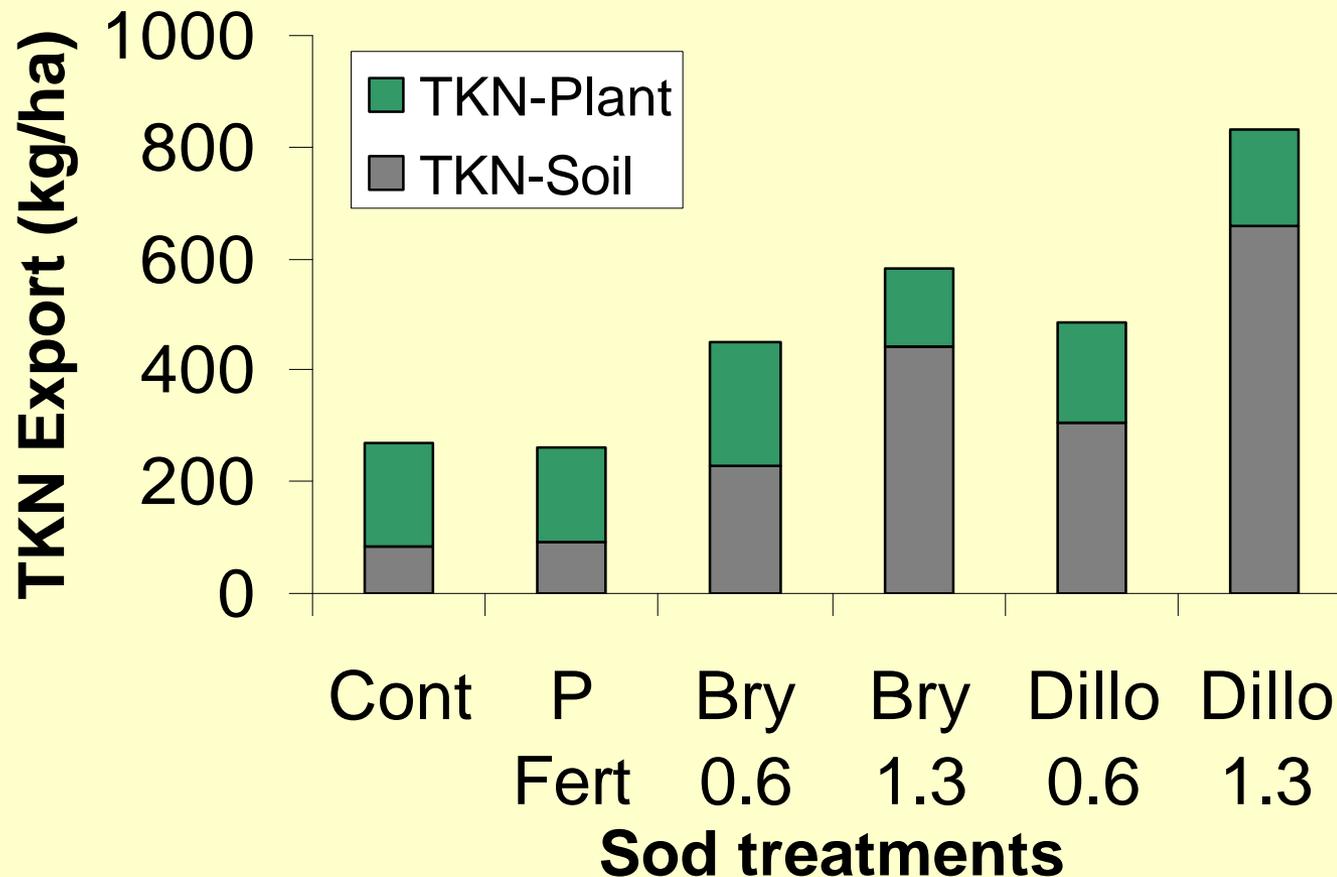
Fertilizer: 50 kg P ha⁻¹

Total P in compost: Dillo Dirt = 9.5 g P kg⁻¹ D.W.

Bryan = 5.8 g P kg⁻¹ D.W.

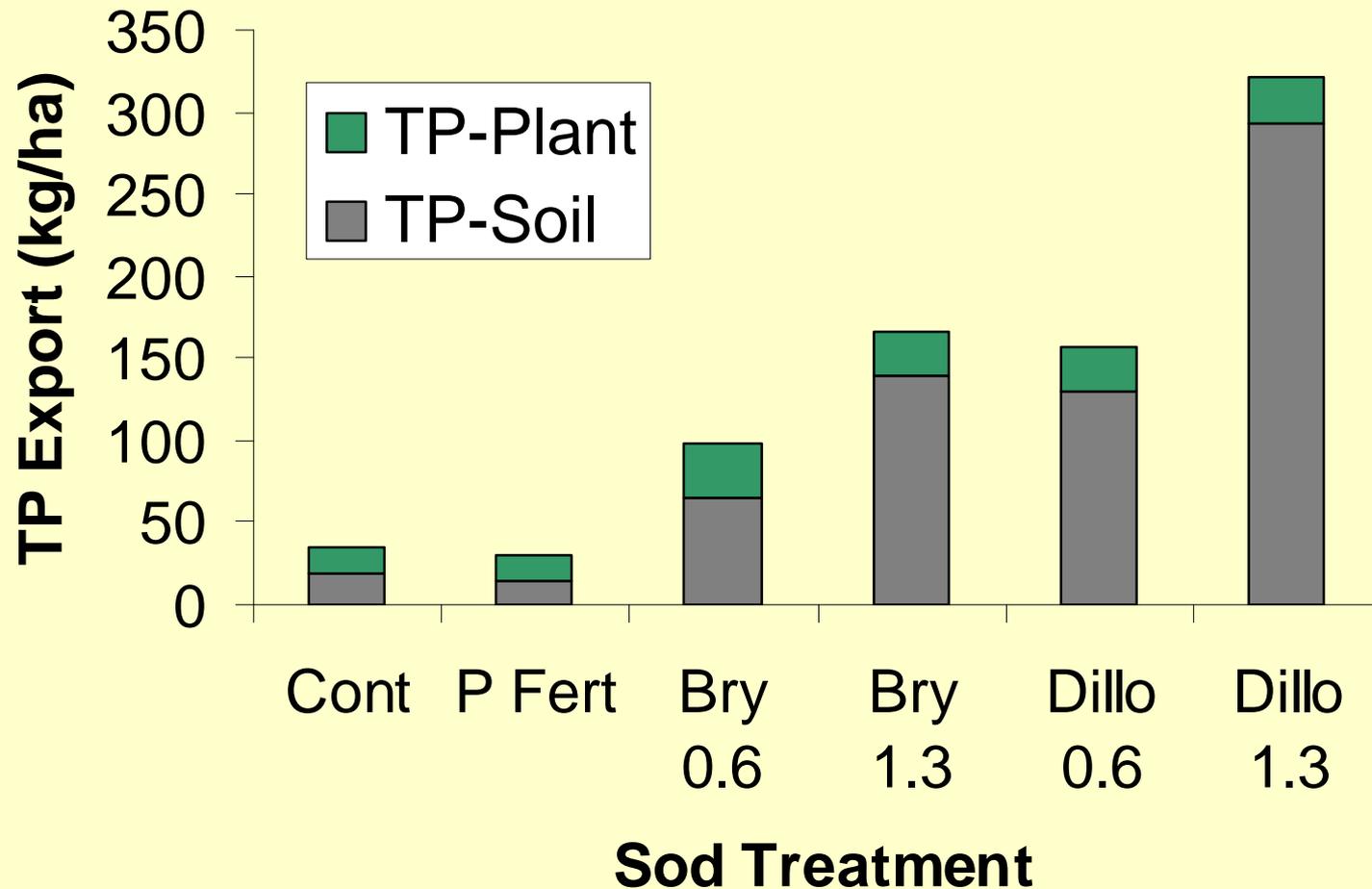
TKN Export through sod

Volume-based rate top-dressed after planting

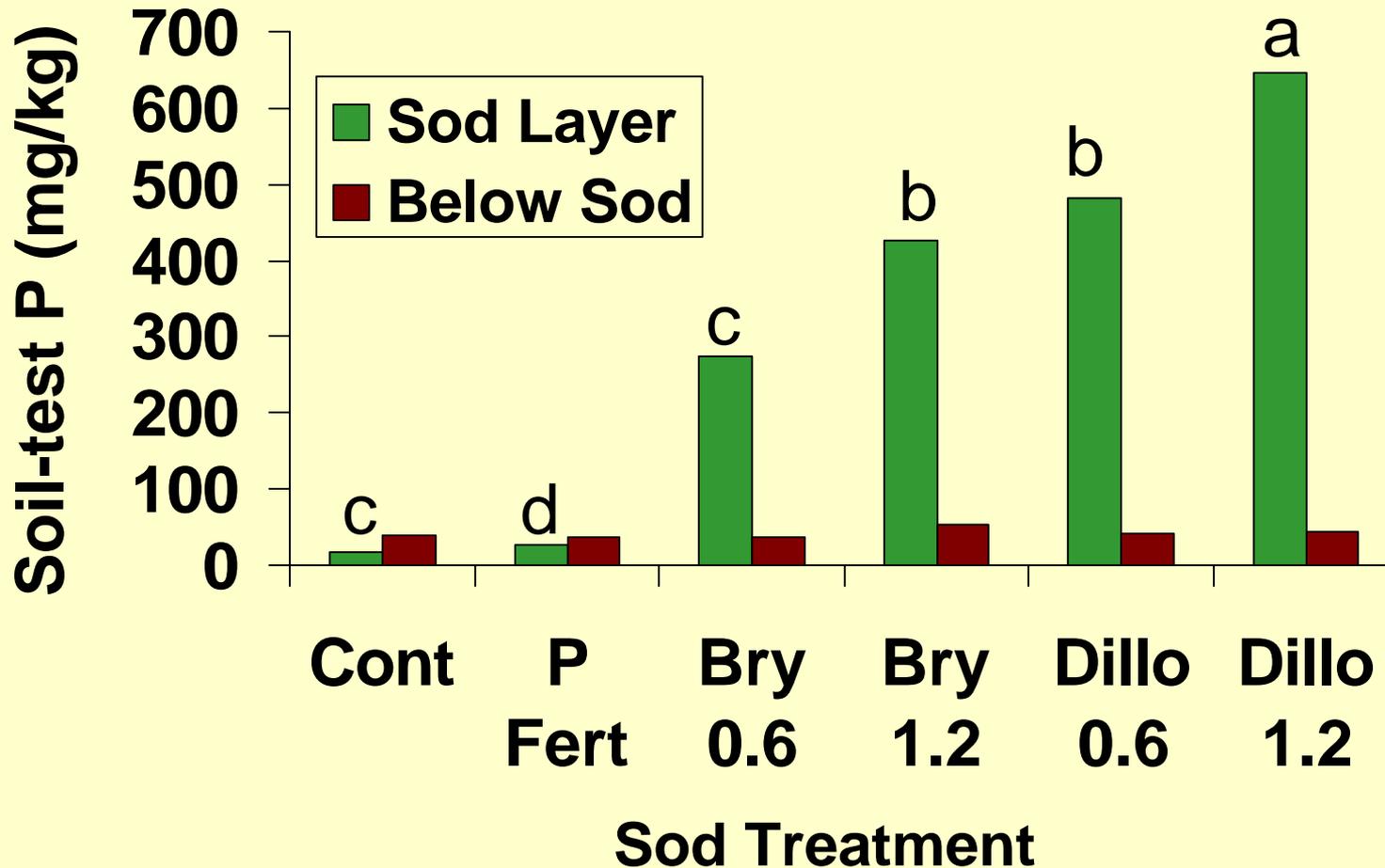


TP export through sod

Volume-based rate top-dressed after planting



Volume-based rate increases soil-test P in sod layer



Compared volume-based rates of municipal compost Between between transplanted sod and sprigged plots 8.5% slope, 8 natural rain events

Sprigged
Bry 12.5%



Sprigged
Dillo 12.5%



Control



Dillo Sod
1.2 cm



Sprigged
Bry 25%

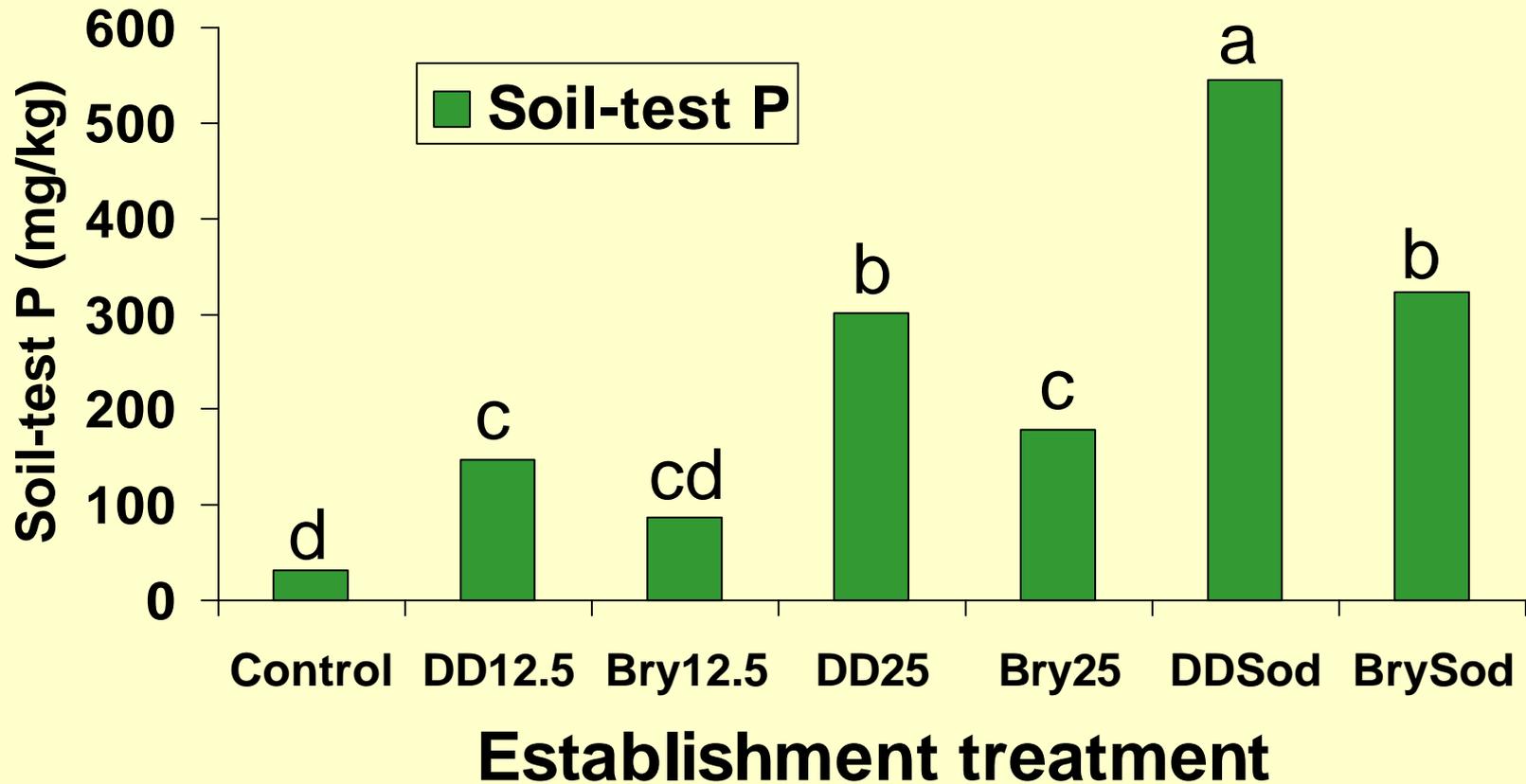


Sprigged
Dillo 0.25%

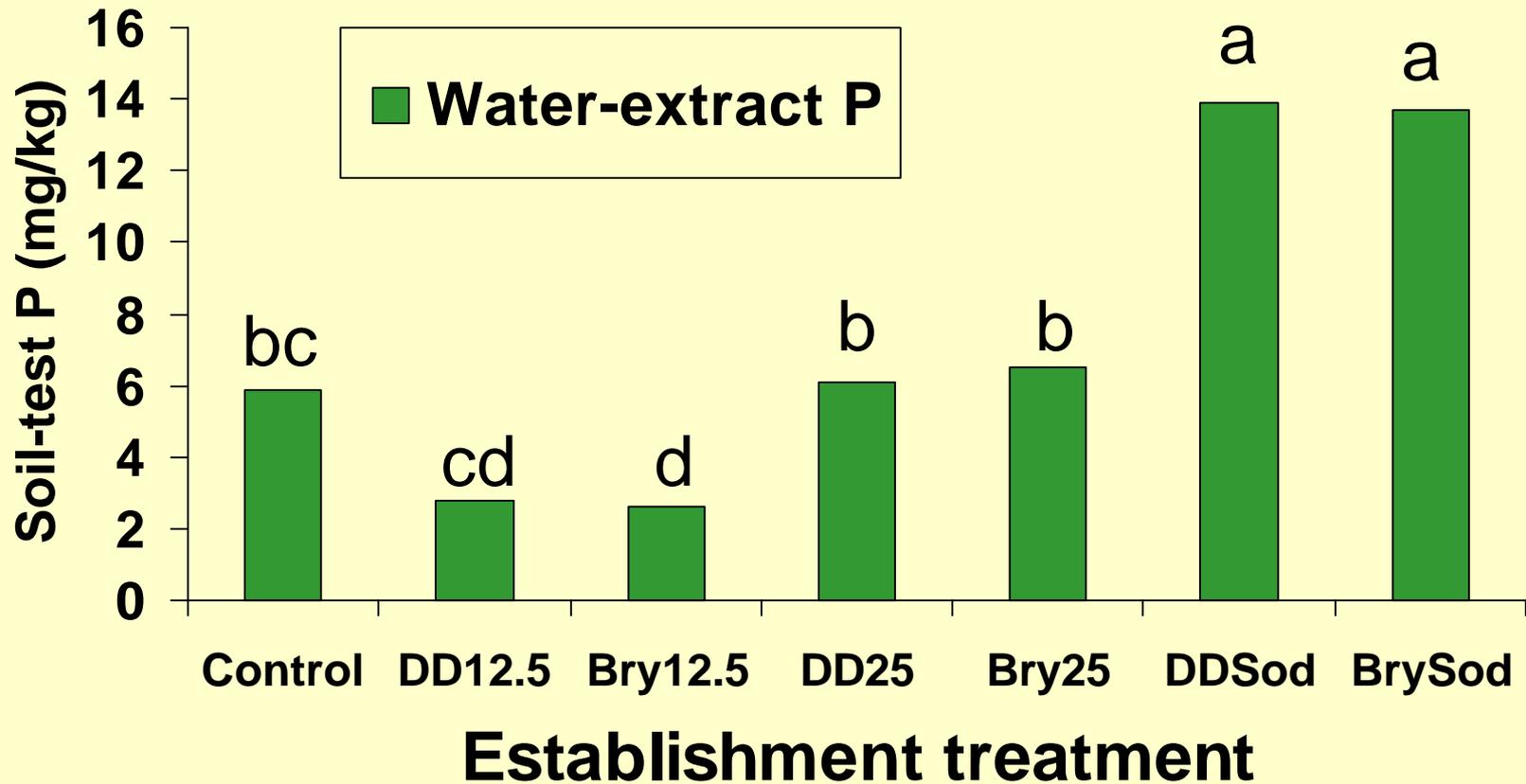


Bryan Sod
1.2-cm

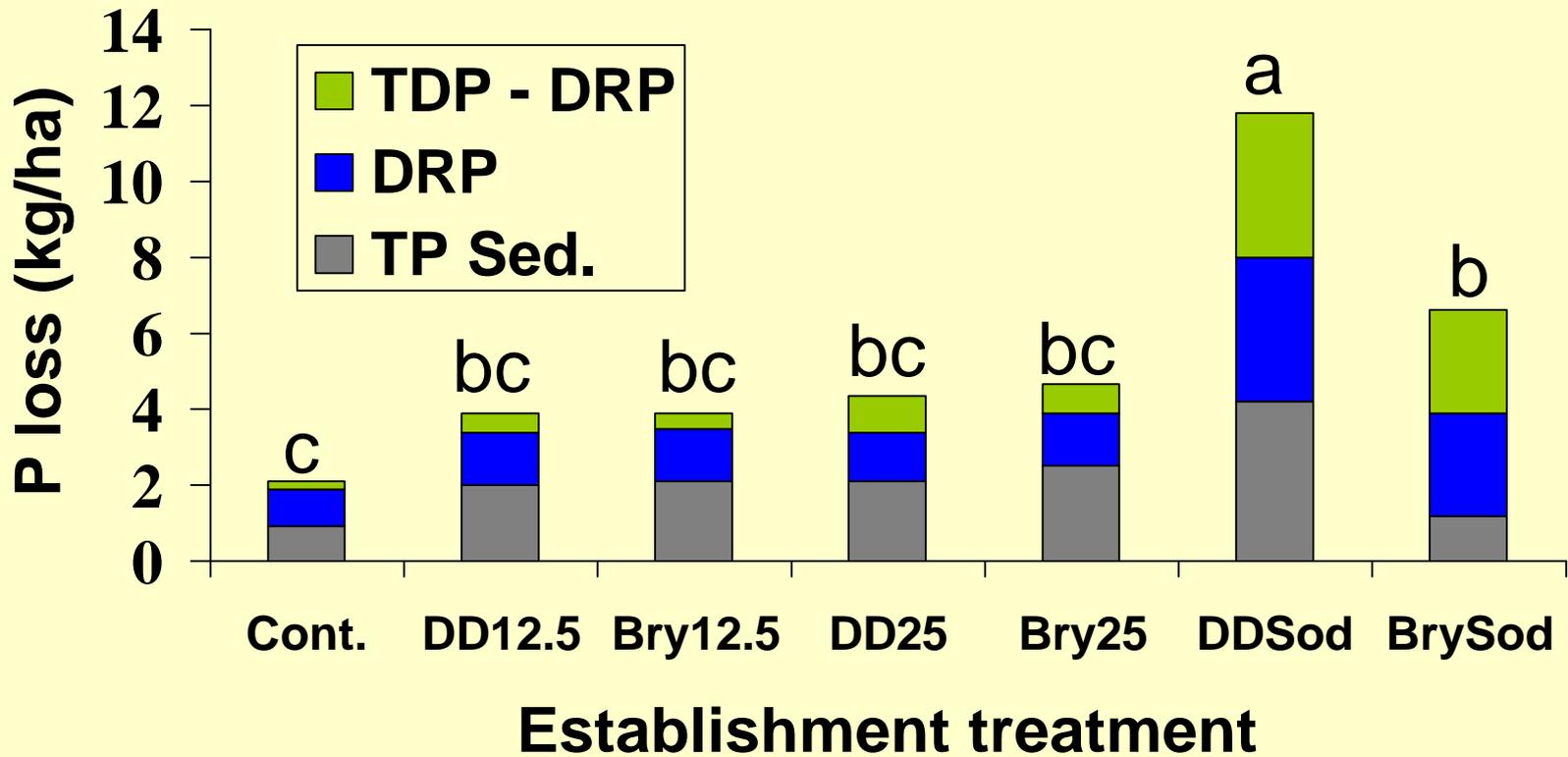
Volume-based rates increase soil-test P within 5-cm depth



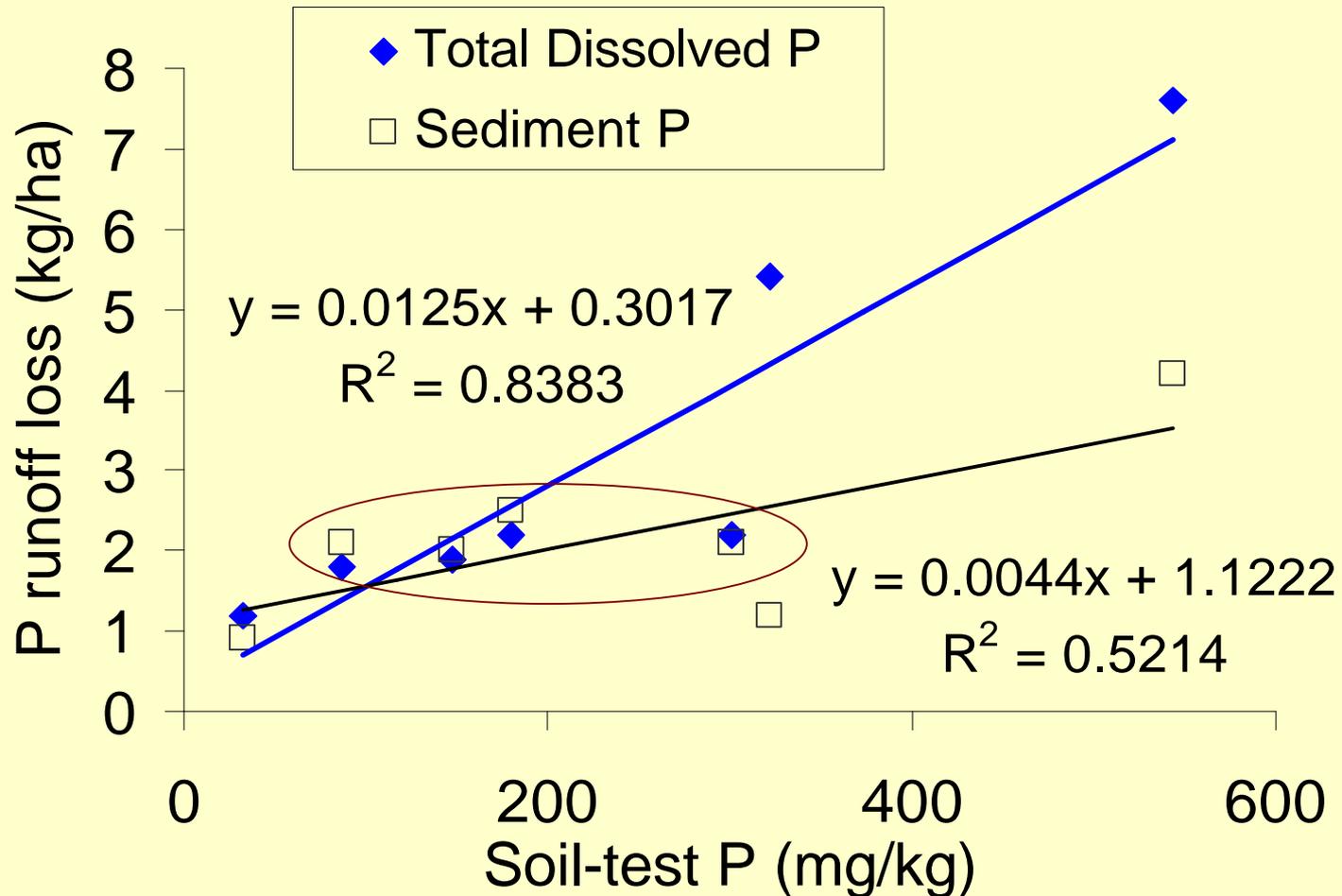
Volume-based rates increase water-extractable P in 5-cm depth



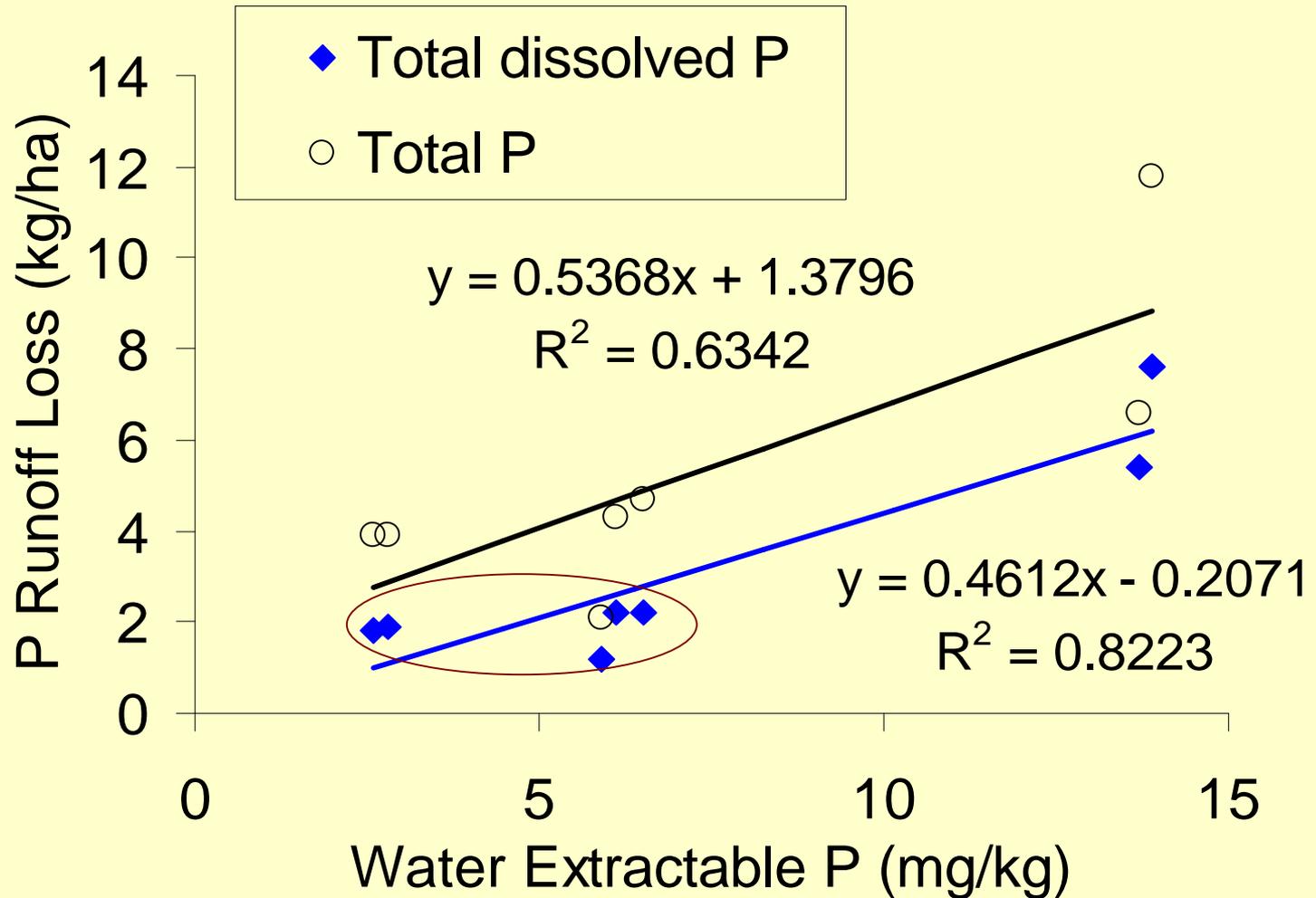
Incorporation of volume-based rate limited runoff loss of dissolved P



Dissolved P loss in runoff was directly related to soil-test P



Dissolved P loss in runoff was directly related to soil WEP



GIS map – sod production sites

Databases

Soils

Elevation

Land use & cover

Hydrologic

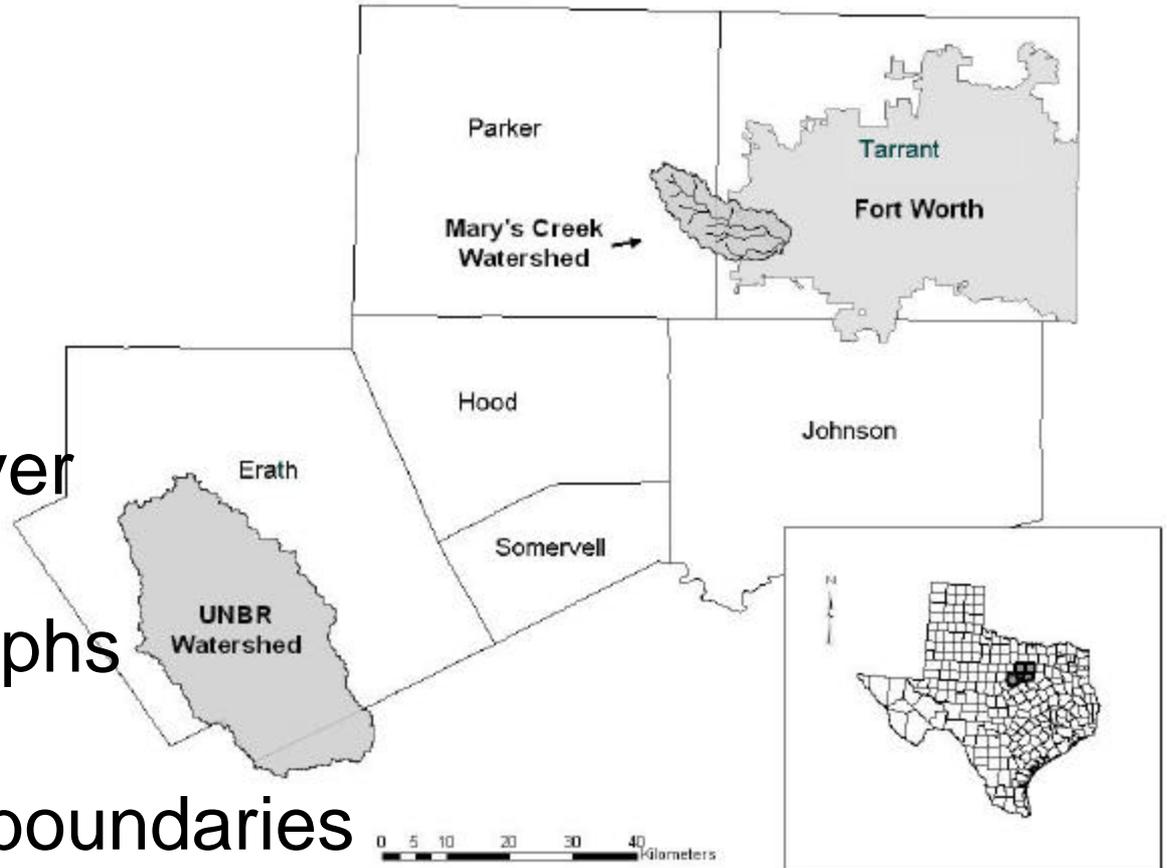
Aerial photographs

Roads

Administrative boundaries

Proximity to compost and markets

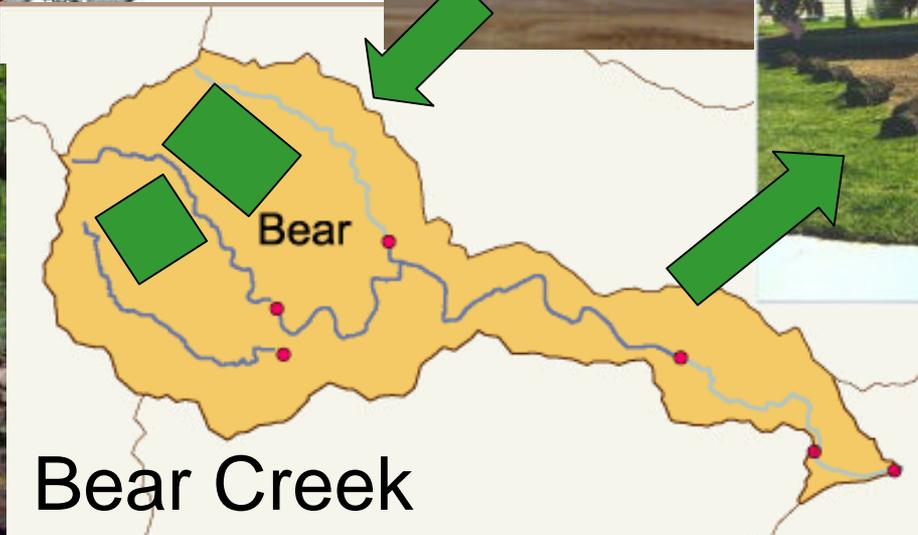
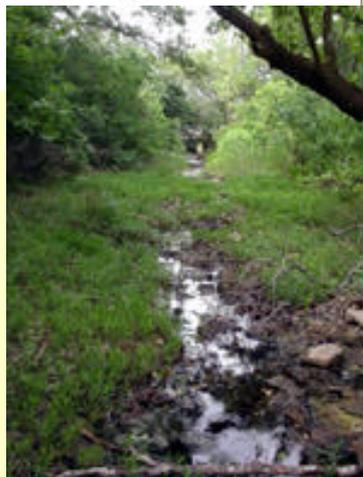
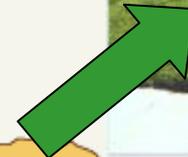
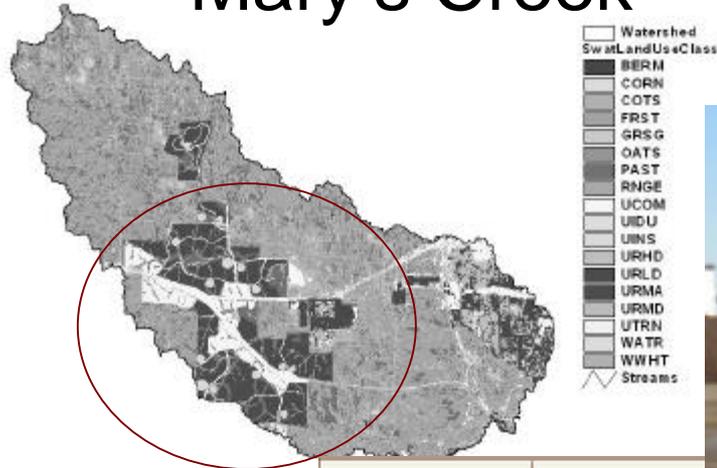
Ground-truthing essential



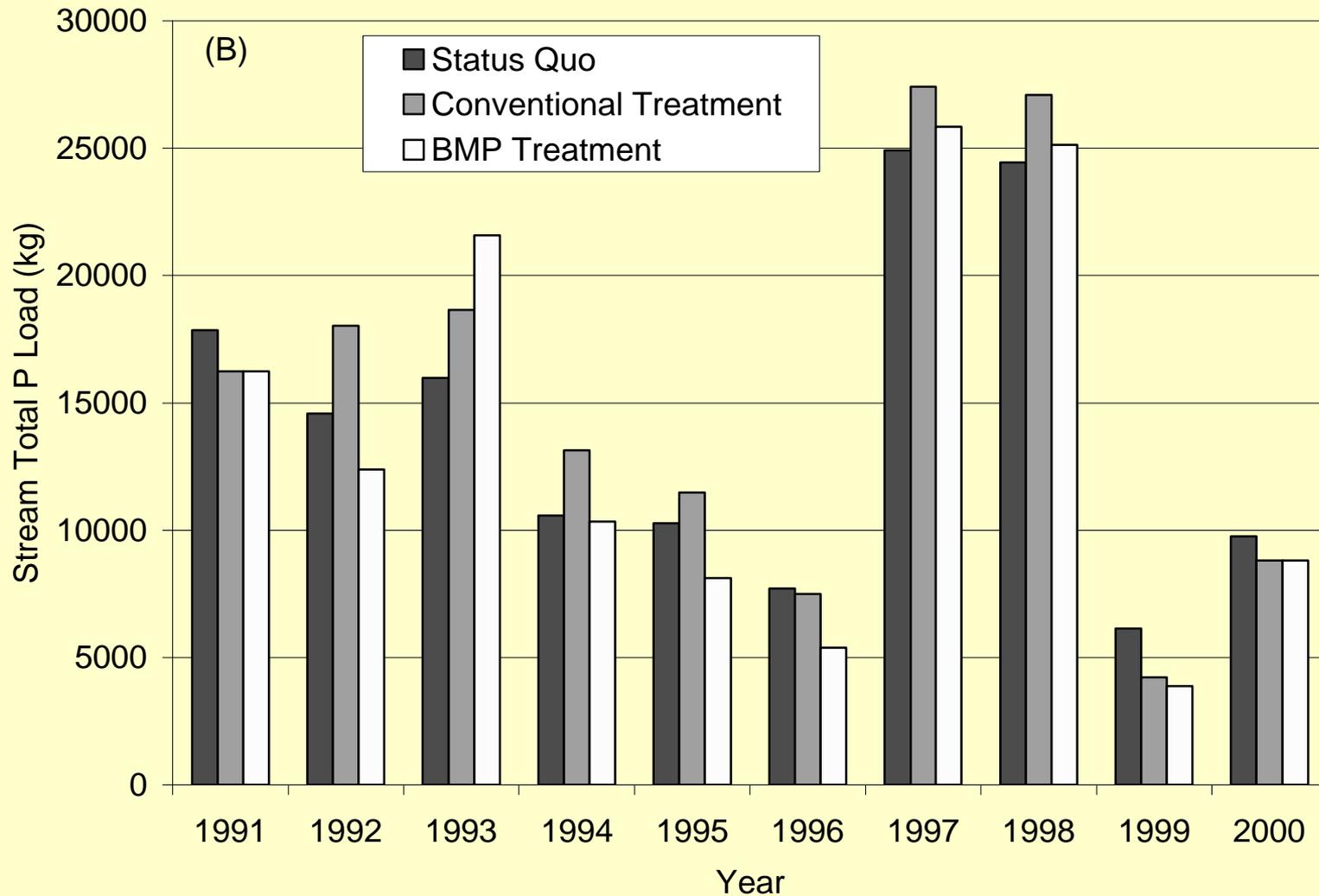
Cycling biosolids through sod produced on agricultural land near cities



Mary's Creek



SWAT simulations of P load in stream



Conclusions

- Agricultural land near cities offers economic niche that minimizes hauling costs.
- Low water-extractable P concentrations in municipal compost.
- Volume-based rates contribute to high soil P concentrations
- Incorporation of compost limits nonpoint-source loss of dissolved P.

Future

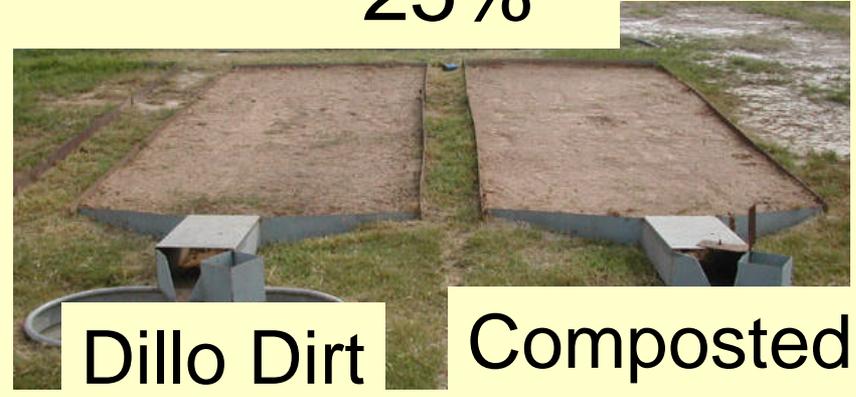
- Identify and map agricultural lands suitable for turfgrass sod production.
- Simulation modeling with and without systems for cycling biosolids through turfgrass sod.
- Economic analyses.
- Outreach and demonstrations.

Volume-based rates – 8.5% slope

Compost-manufactured Topsoil

12.5%

25%



Dillo Dirt

Composted
manure

Dillo Dirt

Composted
manure

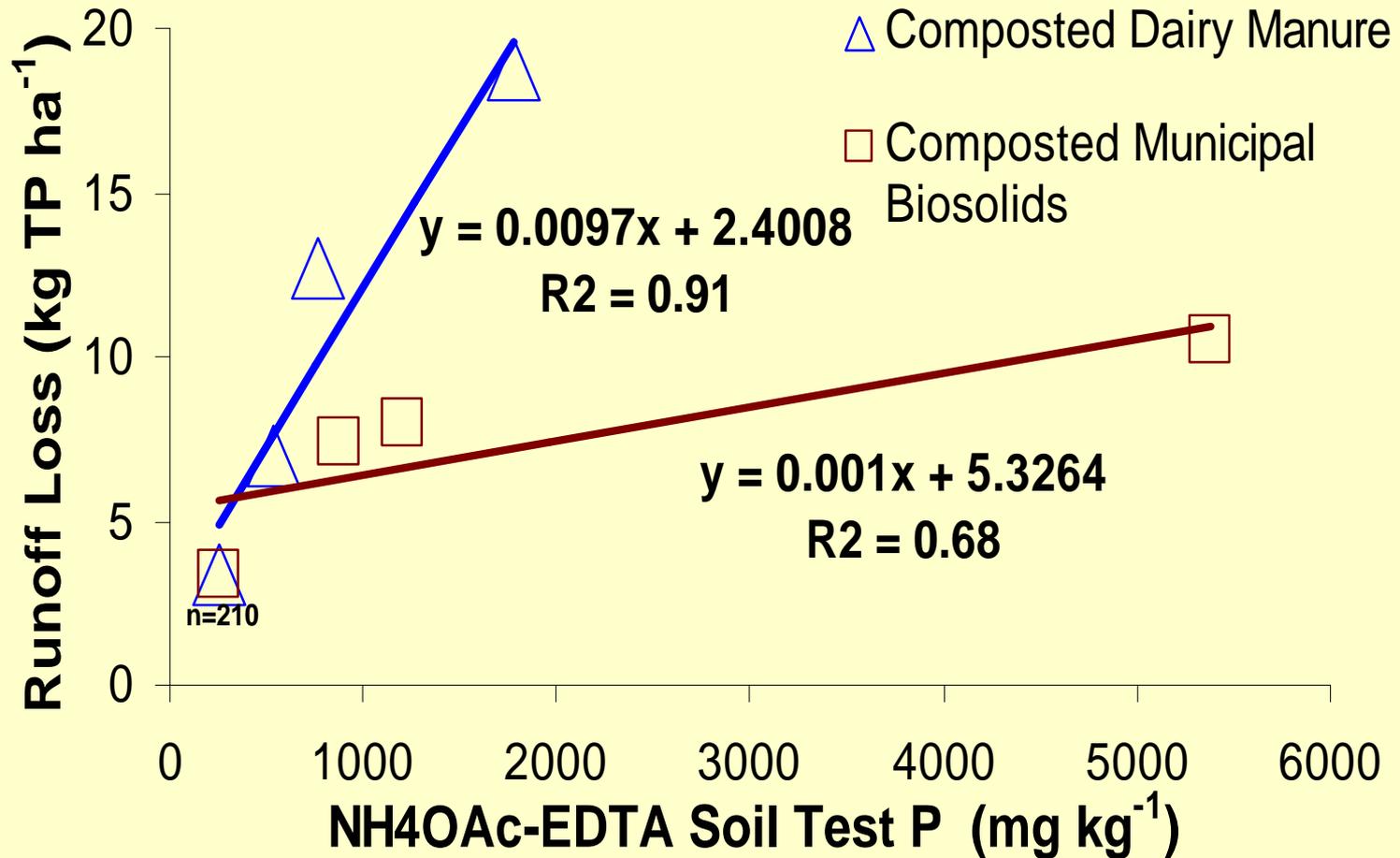
Erosion-control compost (50/50)



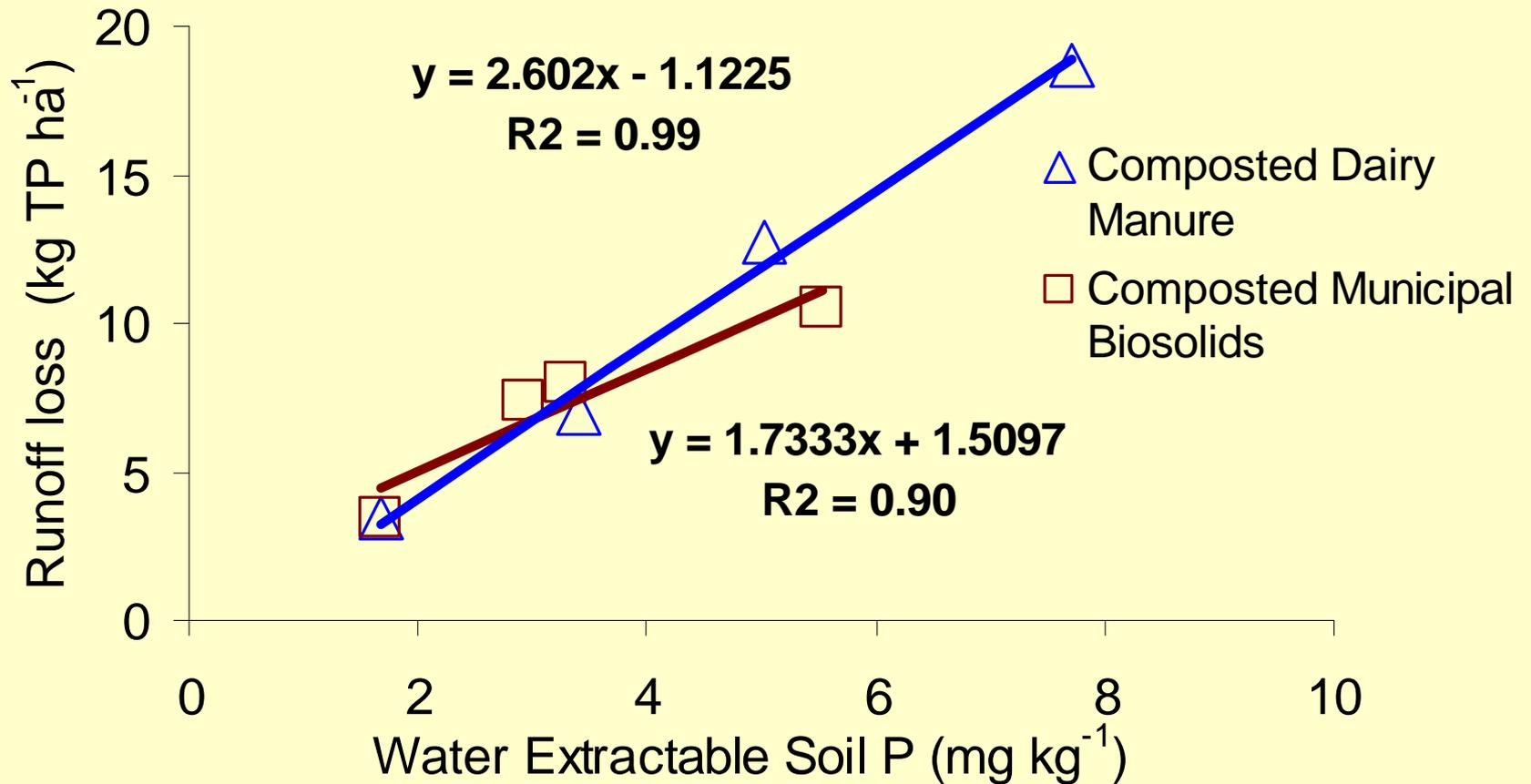
Dillo Dirt

Composted
manure

Volume-based rates



Volume-based rates



Purpose: Systems for cycling composted municipal biosolids

City



Dillo Dirt



Grow Green



Sod produced on agricultural land

Capital expenses

Depreciation	<u>Tifway bermuda</u>	<u>Zoysiagrass</u>
	-----	-----
	\$/ac	
Establishment	38	296
Land	125	325
Equipment	442	379
Interest (9%)	65	957