

Phosphorus Runoff Losses from Alfalfa and Grasses

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Background

- Phosphorus in runoff from cropland can contribute to water quality problems.
- Wendt and Corey found high soluble P losses in runoff from alfalfa in fall after foliage was killed by frost.

Background

- In Wisconsin, over 2.5 million acres of alfalfa freeze at the end of the year.
- P from frozen vegetation could contribute to P losses in runoff.

Objective

- Determine the extent of P losses from alfalfa and grasses after freezing or drying.

Methods

- Laboratory freezing/drying followed by water extraction of P
- Simulated freezing with paraquat
- Simulated rainfall and runoff collection
- Natural freezing and runoff-overwinter collection



Lab freezing and drying effects on P extracted from alfalfa

Treatment	P extracted*	
	mg P / kg (ppm)	% of Total
Fresh	27	0.6
Frozen	400	9.5
Frz.-thaw (24 hr.)	602	14.3
Dry	979	23.3

* Ave. of 4 fields with soil P range (35-179 ppm)

Soil test P effect on P extracted from alfalfa after freezing

Field	Soil test P (ppm)	P extracted (mg P/kg)		Total Plant P (mg P / kg)
		Fresh	Frozen	
1	35	13	159	3760
2	63	6	160	3570
3	95	13	440	4200
4	179	74	839	5300





Freezing, drying, and paraquat effects on P extracted from alfalfa and grasses

Plant	Treatment	P extracted	
		(mg P / kg)	(% of total)
Alfalfa (2950 mg P/kg)	Freeze	109	3.5
	Dry	787	25.2
	Paraquat	707	22.6
Grass (3750 mg P/kg)	Freeze	778	20.7
	Dry	1172	31.2
	Paraquat	1482	39.4

Soil test P = 83 ppm (alfalfa); 203 ppm (grass)



Soluble and total P in runoff from alfalfa after simulated rainfall

	Runoff			
	Soluble P		Total P	
	Conc. (ppm)	Load (g P/ha)	Conc. (ppm)	Load (g P/ha)
Control	0.09	10	0.20	22
Removed	0.20	77	1.34	513
Paraquat + 3d	0.40	85	1.45	310
Paraquat + 3d*	0.41	68	1.50	249
Paraquat + 10d	0.29	100	1.80	613

*0.5 inch water applied before simulated rain

Soluble and total P in runoff from grasses after simulated rainfall

Treatment	Soluble P		Total P	
	Conc. (ppm)	Load (g P/ha)	Conc. (ppm)	Load (g P/ha)
Control	0.09	2	0.71	16
Paraquat + 3d	1.10	13	1.42	17



Alfalfa treatment effects on overwinter P losses in natural runoff

Treatment	P load (g/ha)		Volume (L)	Sed. (kg/ha)
	Soluble	Total		
Cut to grd.	99	146	187	127
Cut to 6-8 in.	71	107	118	--
Not Cut (18 in)	37	56	104	15

Runoff collected 10/26/01 - 5/4/02.

Summary

- Freezing and drying increases soluble P loss from plants
- Total and soluble P in alfalfa increases with increasing soil test P
- P losses from grasses after freezing are as great as from alfalfa

Summary

- Paraquat treatment increased soluble P losses in runoff from a simulated rain
- Overwinter natural runoff in one year did not show increased P losses due to alfalfa
- Climatic conditions (timing & extent of freezing drying and precipitation) influence potential for P loss in natural runoff