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UNL's Livestock Environmental Issues Committee includes representation from UNL, Nebraska Department of Environmental Quality, Natural Resources Conservation Service, Natural Resources Districts, Center for Rural Affairs, Nebraska Cattlemen, USDA Ag Research Services, and Nebraska Pork Producers Association.

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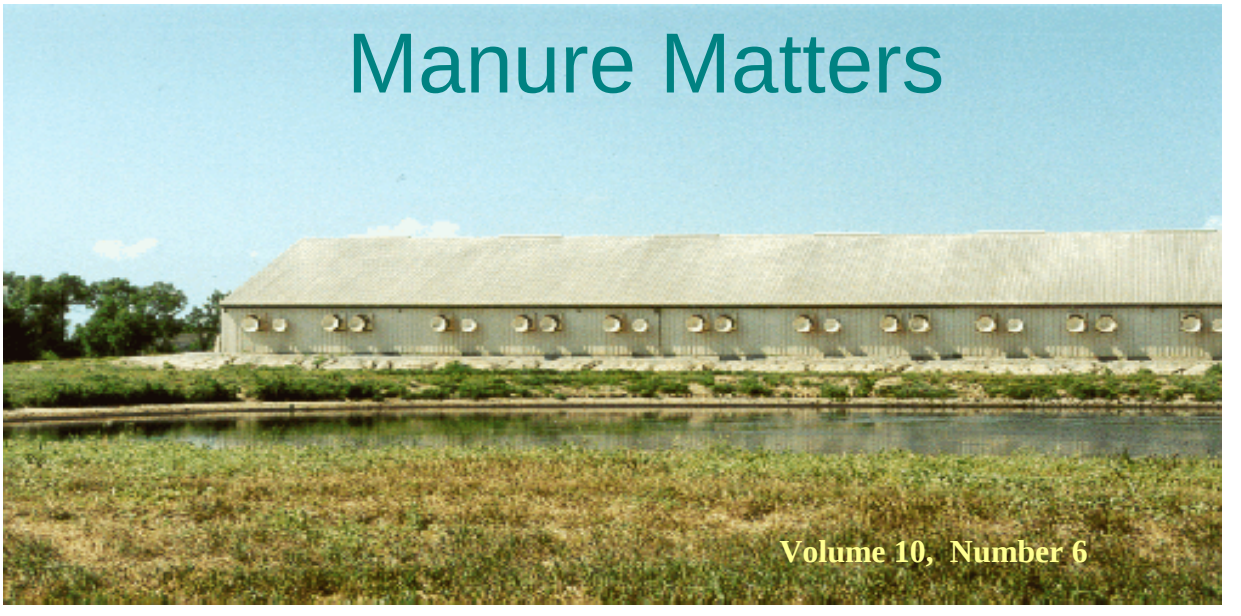

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Phosphorous Runoff Risk During Years following Manure Application

By Charles Wortman

Manure application may result in increased water infiltration and reduced runoff but it can also lead to excessive soil P levels and increased P concentration in runoff. Research was conducted to determine the residual effects of composted manure on runoff loss of water, sediment and phosphorus, and to evaluate soil P tests in prediction of P concentration in runoff. The residual effects of previously applied composted feedlot manure were studied from 2001 to the spring of 2004 at a runoff facility established in 1998 at the UNL Agricultural Research and Development Center. The runoff facility consisted of 21 plots of 36 ft length with a median slope of 5.5%. Low P and high P compost had been applied annually three times in 1998 to 2001 resulting in total phosphate applications of 1500 and 2300 lb/A. Irrigated corn and soybeans were grown in rotation. Bray-1 P in the surface 2" of soil was increased from 16 ppm with no compost applied to 780 ppm with application of high P compost. Runoff loss was more with the no-compost treatment than with compost applied (Table 1). P concentration in runoff, especially bio-available P, increased as the amount of P applied in compost increased. Bio-available P loss in runoff (lb/Ac) was generally more where compost was applied but the effect of higher concentration with the compost treatments was partly offset by the reduced runoff with the compost treatments. The effect of reduced runoff was even more pronounced for total P loss. In fact, total P loss for 2002-4 where no compost was applied was as much as with the high compost treatment. **In interpreting these results, we need to remember that plot length was just 36'; given that runoff and erosion potential are dependent on slope length, the actual losses measured are likely to be considerably less than would occur at a typical field scale with 5.5% slope.**

Runoff P concentration increased as soil test

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P increased. Bray-1, Mehlich-3, and Olsen P soil tests were all found to be useful in predicting mean P concentration in runoff accounting for between 74 and 87% of the variation in bio-available P and 49 to 66% of the variation in total P concentration. Bray-1 was more closely related to runoff P concentration than the other soil tests and the relationships are as follows:

Bio-available P concentration (ppm) = 0.96 + 0.00517 * Bray-1 P, R^2 = 87%;
Total P concentration (ppm) = 4.72 + 0.00630 * Bray-1 P, R^2 = 66%.

The coefficients for these equations are within the ranges of values reported in other studies.

Several conclusions can be drawn.

1. Commonly used soil tests such as Bray-1 are useful in predicting P concentration in runoff.

2. Manure application can significantly improve water infiltration with the result of less runoff and erosion. This partly offsets the effect of the higher soil P level associated with manure application on P loss in runoff.

3. There is considerable risk of P loss in runoff at low to moderate soil P levels (e.g. <25 ppm by Bray-1), especially for total P of which much eventually becomes bio-available after entering surface waters.

4. Doubling soil test P will have much less impact on P concentration in runoff. For example, increasing Bray-1 P from 40 to 80 ppm is estimated to increase the runoff concentration of bio-available P and total P by just 15 and 5%, respectively.

5. P concentration in runoff, and the potential for P loss, increases indefinitely as soil test P increases.

6. P loss in runoff is much more affected by changes in runoff and erosion than by changes in soil test P.

	2001, soybean	2002, corn	2003, soybean	2004 March
	Runoff, gal/Ac			
High P compost	31246	6656	3857	9534
Low P compost	26827	6985	3328	8339
No compost	44231	12413	7837	13985
	Bio-available P concentration in runoff, ppm			
High P compost	9.90	2.55	7.21	3.46
Low P compost	6.49	1.27	3.74	2.78
No compost	2.40	0.39	1.93	0.67
	Bio-available P loss in runoff, lb/Ac			
High P compost	2.58	0.14	0.23	0.28
Low P compost	1.45	0.07	0.10	0.19
No compost	0.89	0.04	0.13	0.08
	Total P concentration in runoff, ppm			
High P compost		5.5	20.7	16.4
Low P compost		3.8	12.0	16.4
No compost		1.5	8.9	14.2
	Total P loss in runoff, lb/Ac			
High P compost		0.31	0.67	1.31
Low P compost		0.22	0.33	1.14
No compost		0.15	0.58	1.66

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