TITLE 35. OKLAHOMA DEPARTMENT OF AGRICULTURE, FOOD, AND FORESTRY
CHAPTER 17. WATER QUALITY

SUBCHAPTER 11. EUCHA-SPAVINAW MANAGEMENT ACT [NEW]

35:17-11-1. Purpose

The purpose of these rules is to implement the provisions of the Eucha-Spavinaw Management Act and these rules shall apply to all persons utilizing poultry waste for land application purposes in the Eucha-Spavinaw Watershed. In no case shall the provisions of these rules be construed to apply to any persons applying poultry waste for land application purposes in any watershed other than the Eucha-Spavinaw Watershed.

35:17-11-2. [RESERVED]

35:17-11-3. Phosphorus index

(a) The Eucha-Spavinaw phosphorus index for the land application of poultry waste shall be determined pursuant to the criteria and formulas contained in Appendix A of this Subchapter.

(b) Poultry waste shall not be applied to any land application site having a Soil Test Phosphorus (STP) level of 300 mg/kg (milligrams per kilogram) or greater, as determined by the Mehlich-III extractant, ICP analysis method.

(c) Soil samples for analysis of Soil Test Phosphorus shall be collected from zero inches to four inches in depth, or to the actual depth of the soil if less than four inches.

(d) Poultry waste samples for determination of soluble phosphorus shall be analyzed pursuant to the method found on page 74 of "Methods of Phosphorous Analysis for Soils, Sediments, Residuals, and Waters," SERA-IEG 17 Southern Cooperative Series Bulletin No. 396.

(e) Where the index refers to best management practices (BMPs), eligible practices shall adhere to United States Department of Agriculture Natural Resources Conservation Service Conservation Practice Standards for Water Quality.

(f) The Eucha-Spavinaw phosphorus index shall also include the following maximum application rates:

(1) The maximum amount of poultry waste that may be applied under any condition during the fall application season is two tons per acre.

(2) The maximum amount of poultry waste that may be applied during any season to fescue or other cool season grasses is two tons per acre.

(3) The maximum amount of poultry waste that may be applied during the spring and summer seasons to Bermuda fields with greater than fifty percent Bermuda mix is three tons per acre.

(4) The maximum application limits shall supersede even if the calculated ESPI PI would otherwise allow greater application rates.

(g) Under no circumstances shall poultry waste application rates exceed Nitrogen requirements for the crop.

(h) Land application of poultry waste shall be based on the Eucha-Spavinaw phosphorus index but shall also be limited by

other applicable statutes or rules where those statutes or rules are more stringent.

APPENDIX A. EUCHA-SPAVINAW PHOSPHORUS INDEX [NEW]

The Phosphorus Index Concept

The original Phosphorus Index (PI) was developed to assist field staff working with landusers to identify sensitive areas and recommend management alternatives to reduce risk of P losses (Lemunyon and Gilbert, 1993). Parameters which influence P availability, retention, management, movement, and uptake are included in the PI. The PI has been developed as a risk assessment tool for P runoff potential from individual fields within a watershed. This assessment is based on soil and field characteristics as well as management practices within each field. Fields having low or high P runoff potential may be identified through the use of the PI and may be prioritized for nutrient application and soil management practices. The PI is designed to assess the relative risks of P loss, not a quantity of P lost in runoff. This document is intended to provide background information for a version of the P Index developed specifically for the Eucha-Spavinaw watershed.

Most states (44) have developed a PI for specific conditions and management practices within each state. Some states have begun to incorporate runoff data to determine weightings for certain parameters. One of the first states to use actual runoff data was Arkansas in the development of a PI for Pastures (DeLaune et al., 2001). Most recent versions of the PI use a multiplicative matrix rather than an additive matrix. The first component considers factors that account for the amount of P on site or being added to the site (P source potential). The second component considers factors that affect P movement and potential off-site transport (P transport potential). The sum of each individual matrix is then multiplied to obtain the P Index.

Calculating the Eucha-Spavinaw Phosphorus Index

The Eucha-Spavinaw PI (ESPI) is based on the Arkansas PI for Pastures. Eight site characteristics are included in the ESPI; they are grouped into P Source and P Transport categories. The ESPI include the following factors: (1) soil test P, (2) soluble P application rate, (3) soil erosion factor, (4) method of P application, (5) soil runoff class, (6) flooding frequency, (7) timing of P application, and (8) grazing management. Based on the ESPI, fields are assigned a class of low, medium, high, or very high.

The ESPI is calculated by multiplying the values for the P source potential and the P transport potential and BMPs, as

follows;

ESPI = (P Source Potential * P Transport Potential * BMPs)/1.8*100 ***(eq.1)***

Calculating Phosphorus Source Potential

Three sources of P are considered in determining the P Source Potential: soil test P (Mehlich III), soluble manure P, and particulate P soil erosion factor (Table 1).

P Source = 0.4 * lb/ac soluble manure P as poultry litter + 0.0007 * lb/ac soil test P + RUSLE2 value * lb/ac soil test P ***(eq. 2)***

Soil Test P. Soil test P should be determined by collecting a representative soil sample from the field and sending the sample to the appropriate soil testing laboratory. Soil test P should be determined using the Mehlich III procedure (Mehlich, 1984). The value reported by the testing laboratory (lb P/ac) is entered into *eq. 2*.

Soluble Manure P. The soluble manure P applied is determined by collecting and analyzing the manure which is applied to the field. Soluble P in the manure should be determined using the method described by Self-Davis and Moore (2000). The amount of soluble P applied to a field is entered into *eq. 2*.

Particulate P Soil Erosion Factor. The erosion factor is calculated by multiplying the annual erosion rate (as calculated by RULSE2) by soil test P and dividing by a conversion factor (1000 ton soil/ac).

Calculating Phosphorus Transport Potential

Five factors of P transport are considered in determining the P Transport Potential: soil runoff class, flooding frequency, method of application, timing of application, and grazing management (Table 2).

P Transport = runoff class + flooding frequency + application method + application timing + grazing management ***(eq. 3)***

Soil Runoff Class. The soil runoff class is determined using slope gradient and the runoff curve number of the soil (Tables 3

and 4).
Flooding Frequency. The flooding frequency for each soil series is found in the Soil Survey for each particular county. Fields are grouped into land that is never flooded (none), occasionally flooded, or frequently flooded.
Application Method. Application method refers to how the farm manager will apply the manure to a field. The categories include: incorporated, surface applied, or surface applied on frozen or snow covered ground.
Application timing. Timing of application was determined by evaluating historical runoff data as well as seasonal crop growth specific to the Eucha-Spavinaw watershed. Times frames are (with increasing risk for runoff): July-September, April-June, October-March.
Grazing Management. Grazing management is subdivided into three management scenarios: pastures which are hayed only, hayed and grazed, and grazed only. A pasture under intensive grazing would be expected to have a higher risk for P runoff than a pasture with no grazing due to compaction and additional P inputs from cattle.

Best Management Practices (BMPs)

A farmer is given credit for the use of BMPs which may reduce the ESPI, such as fencing around streams to prevent cattle access. These include those BMPS which are not accounted for in the ESPI (i.e. alum is accounted for in the P source factor, therefore it is not listed as an additional BMP). Each BMP is given a weighting factor of 0.9. The final P Index value is multiplied by each BMP that may be utilized within a watershed.

ESPI with BMPS = ESPI * 0.9 for each BMP

Example: System with 2 BMPS

ESPI = Initial ESPI * 0.9 * 0.9

More research is needed to determine the effectiveness of each BMP and to identify potential BMPs.

Interpretation and Recommendations of the ESPI

Once the ESPI is calculated using eq. 1, fields are assigned a class of low, medium, high, or very high. Each class is associated with a site interpretation and nutrient application recommendation (Table 5). ESPI values range from 0 to >100 and

are unitless, which follow an initiative by other Indexes used in the Northeastern and Mid-Atlantic Regions to ensure that Indexes are consistent across state boundaries. Consistent with other Indexes, the ESPI is designed to assess the relative risks of P loss, not a quantity of P lost in runoff.

Table 1 – Phosphorus Source Potential Characteristics and Calculations

Site Characteristic	**Description**	**Loss value**
Soil Test P (lb/ac)	The amount of Plant available P in the soil, as measured by soil test.	
Loss rating value	**0.0007 x Mehlich III Soil Test P Value**	**LRV**
Soluble manure P rate (lb/ac)	The amount of soluble P applied per acre, lbs. SRP/acre.	
Loss rating value	**0.4 x lbs. soluble P applied as poultry litter**	**LRV**
Particulate P Soil erosion factor (tons/ac/yr)	The amount of soil erosion as calculated by RUSLE2 x STP. RUSLE (Ton A^{-1}) * STP (lb A^{-1}) / 1000 Ton A^{-1}	
Loss rating value	**RUSLE2 value x Mehlich III Soil Test P Value**	**LRV**
P source value = (Loss rating value for soil test P + Loss rating value for soluble manure P + Loss rating value for particulate P from soil erosion factor)		

Table 2 - Phosphorus Transport Potential Characteristics and Calculations

Site Characteristic	**Description**					**Loss Value**
Soil runoff class	Negligible	Low	Moderate	High	Very High	
Loss rating value	**0.1**	**0.2**	**0.3**	**0.5**	**1.0**	**LRV**
Flooding frequency	None		Occasional		Frequent	
Loss rating value	**0**		**0.1**		**2.0**	**LRV**
Application method	Incorporated		Surface applied		Surface applied on frozen ground or snow	
Loss rating	**0.1**		**0.2**		**0.5**	**LRV**

value				
Application timing	July-Oct	April-June	Nov-March	
Loss rating value	**0.1**	**0.4**	**0.5**	**LRV**
Grazing Management	Hayed only	Grazed and hayed	Grazed only	
Loss rating value	**0.1**	**0.2**	**0.3**	**LRV**
P Transport = (runoff class + flooding frequency + application method + application timing + grazing management)				

Table 3 - Partial listing of runoff curve numbers.

Cover type	Hydrologic Condition	Soil Hydrologic Group			
		A	**B**	**C**	**D**
	Poor	68	79	86	89
Pasture	**Fair**	49	69	79	84
	Good	39	61	74	80
Hayland not grazed		30	58	71	78

Table 4 -Runoff class based on field slope and runoff curve number.

Slope %	Runoff Curve Number							
	<50	**50-60**	**60-65**	**66-70**	**71-75**	**76-80**	**81-85**	**>85**
<1	**N**	**N**	**N**	**N**	**N**	**L**	**L**	**M**
1.1-3	**N**	**N**	**N**	**L**	**L**	**L**	**M**	**M**
3.1-8	**N**	**N**	**L**	**L**	**M**	**M**	**H**	**H**
8.1-15	**L**	**L**	**L**	**M**	**M**	**H**	**H**	**VH**
>15	**L**	**L**	**M**	**M**	**H**	**H**	**VH**	**VH**
N=Negligible, L=Low, M=Moderate, H=High, VH=Very High								

Table 5. ESPI Interpretation and Nutrient Application

Recommendations

P Index Scale	Site Interpretations and Recommendations
< 33	**Low** potential for P movement from site. Apply nutrients based on ESPI calculation. Caution against long-term P buildup.
34 to 55	**Medium** potential for P movement from site. Evaluate the Index and determine any areas that could cause long-term concerns. Add conservation practices or reduce P application to maintain the risk at **55** or below. Apply nutrients based on ESPI calculation.
56 to 100	**High** potential for P movement from site. Evaluate the Index and determine elevation cause. Add appropriate conservation practices and/or reduce P application. The immediate planning target is a PI value of **55** or less. If this target cannot be achieved with realistic conservation practices and/or reduced P rates in the short term, then a progressive plan needs to be developed with a long-term goal of a PI less than **55**. Apply nutrients to meet ***crop phosphorus needs*** according to NRCS Nutrient Management standard (590). ***Application rates based on crop phosphorus needs are generally less than 1 ton/ac. Since accurate, uniform applications at these low rates are rarely obtainable with conventional equipment, no litter (nutrient) application is recommended.***
>100	**Very High** potential for P movement from site. ***No litter (nutrient) application.*** Add conservation practices to decrease this value to below **100** in the short term and develop a progressive conservation plan that would reduce the PI to a lower risk category, with a long-tem goal of a PI less than **55.**

Example 1

The following site characteristics from farm A are:

a) Soil test P = 300 lb/ac
b) Soluble Manure P = 500 mg P/kg manure or 1 lb soluble P per ton of manure.
   Application rate is 2 tons manure/ac
   2 tons manure/ac * 1 lb soluble P/ ton = 2 lb soluble manure P/ac
c) Soil erosion factor = RUSLE2 value is 0.10 ton/ac/yr
d) Manure is surface applied
e) Soil runoff class is Low (CN=74, Slope = 2%)
f) No flooding occurs
g) Application timing is May
h) Grazing management is grazed and hayed

Calculating P Source Potential

Soil test P (300 lb P/ac * 0.0007)	=	0.21
Soluble manure P rate (2 lb soluble P/ac * 0.4)	=	0.8
Soil Erosion Factor (0.10 ton/ac/yr * 300 lb/ac)/1000	=	0.03
	=	**1.04**

Calculating P Transport Potential

Low runoff class	=	0.2
No flooding	=	0
Surface applied	=	0.2
Applied in May	=	0.4
Pasture is grazed and hayed	=	0.2
		1.0

ESPI = 0.92 * 1.1/(1.8*100) = 58

ESPI is 58, which is in the high risk category and nutrient applications are to be based on crop P needs. Since application rates based on phosphorus needs generally equate to <1 ton/ac and such application rates are not accurate, no litter is applied.

However, the ESPI for the same field could be re-calculated if a change in management was made, such as litter application rate. The application rate could be adjusted to 1.5 tons/ac. Calculating the ESPI for the field above with an application rate goal of 1.5 tons/ac would result in an ESPI of 47, which is in the medium risk category. Therefore, a litter application rate of 1.5 tons/ac would be allowed.

Background References:

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