RESEARCH UPDATE: AERATION'S EFFECTS ON PERMANENT PASTURE AND HAY FIELDS

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Topnotch livestock and hay producers are always looking for a way to improve forage productivity and profitability. In Indiana, approximately 320,000 acres of grass hay and 1,000,000 acres of pasture are maintained annually. Unfortunately, maintained does not always mean maintaining proper fertility levels.

So what is one to do if land is purchased or currently owned hayfield or pasture has poor fertility? One approach we are looking at is use of an AerWay® aerator to incorporate phosphorus (P) and potassium fertilizer (K) in a P and K deficient soil. Previous work conducted by researchers at several universities found that the implement did not improve yield, but their research emphasized aeration and not the effects of the implement as a method of fertilizer incorporation. Our hypothesis is that the AerWay® aerator will incorporate needed P and K fertilizer in the root zone of permanent pasture and hay land and will result in improved forage yield.

Current Research

Research is being done at the Southern Indiana Purdue Ag Center, near Dubois, Indiana. Sites we are using include a predominately tall fescue hayfield and pasture that have moderate to low P and K levels. Treatments include a four replicate factorial combination of P or no P fertilizer, K or no K fertilizer, and aeration (A) or no aeration. In spring of 2001, the fields were harvested or grazed, initial soil samples were taken and treatments were applied. Individual plots are fifteen feet by sixty feet. Soil was sampled to an eight-inch depth and subdivided into four two-inch segments to determine effects of the aerator on fertilizer incorporation. Phosphorus was applied at a rate of 275 pounds P_2O_5 per acre in the hayfield and 150 lbs P_2O_5 per acre in the pasture. Potassium was applied at a rate of 470 pounds K_2O per acre in the hayfield and 300 pounds K_2O per acre in the pasture. Nitrogen (N) was applied as ammonium nitrate after incorporation at a rate of 75 pounds N per acre and at a rate of 50 pounds N per acre after each harvest. Plots were harvested twice after the spring harvest, using a 1-meter wide sickle bar mower, and dry matter yields were determined (Table 1). Pre-graze pasture yield was harvested just prior to cow-calf turnout. The pasture research was conducted within one paddock of a three-paddock rotation system. Soil samples were taken in fall of 2001 to determine fertility changes during the summer (Tables 3 and 4). In the fall of 2001 we aerated one-half of each plot a second time to “till” soil for a frost seeding of red clover. Our intention was to see if use of the aerator improved seed to soil contact and if a better red clover stand would result.

Unfortunately, conditions were too wet and seed rotted. In order to compensate for lack of N from a legume component in pasture and hay fields, 50 pounds of N per acre as ammonium nitrate was applied prior to and after the first 2002 harvest.

Table 2 shows data collected from first harvest of 2002, which includes the twice-aerated plots as well as the original treatments. The data collected remains to be statistically analyzed, but it does not appear that the AerWay® aerator has incorporated fertilizer or improved forage yields.

Table 1. 2001 Forage Dry Matter Yield

	2nd Cutting	3rd Cutting	Total
	tons / acre		
AP	0.94	1.43	2.37
A*	0.97	1.21	2.19
P*	1.11	1.22	2.33
APK	1.05	1.44	2.49
C*	1.17	1.25	2.42
PK	1.17	1.34	2.51
K*	1.23	1.23	2.46
AK	1.00	1.51	2.52

*A=Aerated P=Phosphorus K= Potassium C=Control

Table 2. 2002 Forage Dry Matter Yield

	1st Cutting	1st Graze
	tons / acre	
AP	1.57	1.34
A	1.54	1.59
P	1.70	1.69
APK	1.77	1.61
C	1.68	1.47
PK	1.50	1.46
K	1.49	1.68
AK	1.67	1.55
*AAP	1.59	1.47
AA	1.45	1.44
AP	1.57	1.31
AAPK	1.43	1.62
AC	1.47	1.65
APK	1.55	1.48
AK	1.48	1.34
AAK	1.37	1.37

* Those treatments in the lower half of the table received an aeration treatment in the fall of 2001

Table 3. Soil Phosphorus Levels

	Spring 2001	Fall 2001							
		C	A	P	APK	AP	PK	K	AK
Soil Depth	ppm	ppm							
0-2"	20	15	14	45	51	43	49	13	14
2-4"	6	5	5	5	8	6	7	5	5
4-6"	4	2	3	3	3	3	3	2	2
6-8"	2	1	3	2	2	2	2	1	1

Table 4. Soil Potassium Levels

	Spring 2001				Fall 2001			
	2nd Graze	3rd Graze	C Total	A	P	APK	AP
Soil Depth	tons / acre			ppm			
0-2"	0.94	107	1.09	91	2.03	84	92	212	95
2-4"	1.07	61	1.23	55	2.29	52	55	87	57
4-6"	1.62	51	1.17	52	2.79	51	53	58	55
6-8"	0.98	53	1.27	61	2.25	62	61	69	65
	1.39		1.35		2.74				
	1.35		1.38		2.73				
	1.10		1.36		2.46				
	1.24		1.21		2.45				