

Forage Production and Economic Risk from Dairy Manure Applications to Alfalfa

Jay Daliparth¹, Stephen Herbert¹, and L. Joe Moffitt

¹Department of Plant and Soil Sciences

and

²Department of Resource Economics

Dairy manure management has become an important concern due to its potential for nitrate pollution. Alternatives such as application of manure on alfalfa have become an important option for dairy farmers. However, some dairy farmers are reluctant to spread manure on established alfalfa as they are concerned with affecting stand longevity and purity. Nevertheless, since dairy manure applications on alfalfa can potentially increase the total area available for manure spreading and decrease manure application to corn, there is need for both an environmental and economic risk evaluation of this practice. The research objective of this study was to evaluate the effect of dairy manure applications on yield and weed incidence in established alfalfa and to provide an economic assessment of this management.

Research Approach

Experiments were started in June 1990 on an one-year-old stand of alfalfa at the University of Massachusetts Agronomy Research Farm and a two-year-old stand of alfalfa in a Cooperating dairy Farmer's field in western Massachusetts. The soil at the Deerfield site was an Occum fine sandy loam and the Sunderland site was an Agawam fine sandy loam. Treatments consisted of a control (zero N), low and high manure rates (100 and 300 lb N/ac/yr from approximately 5,000 and 15,000 gal liquid manure/ac, respectively). Low and high N fertilizer (100 and 300 lb N/ac/yr from NH_4NO_3 , respectively) were included as fertilizer check treatments. Liquid dairy manure was applied to alfalfa by surface spreading immediately after the 1st cutting in each of three years. Alfalfa was harvested 3 times a year, and total herbage yield was recorded. After the harvest of each alfalfa cutting, random subsamples were collected and separated into alfalfa and broadleaf and grass weeds. Percentage of total weeds in the herbage was calculated on dry weight basis. The economic risks involved with this alternative manure management practice were assessed.

Effect on Herbage Yield and Weeds.

Our research study showed that application of liquid dairy manure at 100 lb N/ac (approximately 5,000 gal. manure/ac) neither decreased nor increased alfalfa herbage yield (Table 1). Results from manure applications to alfalfa showed similar trends at both the Deerfield site and the Farmer's field, indicating that dairy manure at low rates (5,000 gal. manure/ac) can be applied to alfalfa without any adverse effect on herbage yield. The results also showed that the low rates of manure application to alfalfa had no significant effect on weed incidence compared to percent weed populations in alfalfa receiving no nitrogen except at the Deerfield site. At this site high rates of manure application (15,000 gal. manure/ac) increased weed incidence during a year with low precipitation. This rise in weed incidence may have been due to increased competition between weeds and alfalfa for soil moisture or to a stimulative effect of N supply on weeds. A significant increase in weed population was observed in all treatments at both locations after the July harvest in the dry year.

Table 1. Total herbage yield as affected by application of manure at the Deerfield site

Treatments	Year										
	July†	1990-91			Total	July	1991-92			1992	
		Aug.	May	Aug.			May	Total	July	Aug.	
	tons/ac										
No nitrogen	1.8	1.3	3.1	6.3	2.0	1.5	2.4	5.9	1.4	1.0	
Low manure	1.9	1.4	3.2	6.4	1.9	1.6	2.3	5.9	1.6	1.1	
High manure	1.9	1.5	3.1	6.6	1.6	1.5	2.0	5.1	1.3	1.1	
LSD (0.05)	NS	NS	NS	NS	0.2	NS	NS	0.4	NS	NS	

† Month of cutting.

Economic Risk

The differences in alfalfa herbage yield with conventional production versus manure application to alfalfa would be regarded as negligible by most farmers and are probably not of economic significance even to those farmers with greatest aversion to risk. Hence we conclude, manure can be applied to the land area planted to alfalfa with a low probability of economic risk, and this strategy could prevent excess manure applications on other fields.

Nitrate Leaching

These research studies showed that application of manure to alfalfa at the low rate did not increase nitrate concentrations in the soil water compared to treatments receiving no nitrogen. Water samples were collected by placing suction cup samplers at 1', 2', 3' and 4 foot depths. The average nitrate concentrations under low manure rate during the study period (1990 to 1992) were 2.5 ppm at the Agronomy Research Farm and 6.3 ppm at farmer's field. These concentrations below EPA recommended critical level (10 ppm) for drinking water. An increase in nitrate concentrations in soil water was observed under high rates of manure application. Another important observation from this study was that nitrate concentrations varied in different seasons. Nitrate concentrations were significantly lower during spring compared to summer or fall. Monitoring nitrate leaching during fall is important in New England due to increased precipitation and low evapotranspiration rates during this period. Application of low rates of manure to alfalfa will increase the total land area available for manure spreading on dairy farms, thereby reducing over-application of manure on corn fields and nitrate leaching.