



CHAPTER 34

Is Manure Application on Alfalfa a Good Idea? Ontario Experience

Bonnie Ball and Christine Brown

Research scale experiment on 10 August 2009 where alfalfa received nutrients as liquid manure or as inorganic fertilizer after second cut.

Application of manure on alfalfa stands increases the available land area to apply manure, but alfalfa fields have not been traditionally used for manure application in Ontario. Harvested alfalfa stands provide a good window of opportunity to utilize manure nutrients during the summer months, and the risk of off-site movement and water contamination by manure nutrients is lower in dry summers than under the wet conditions in spring and fall. Also, alfalfa may satisfy its high P and K requirements from applied manure, thus preventing soil test levels from declining, a frequent problem in Ontario fields (IPNI, 2011).

However, manure application on alfalfa fields may cause plant damage and reduce stands by smothering or equipment damage such as compaction. This may lead to changes in stand composition to a less desirable mixture. In addition, the manure cannot be completely incorporated into established alfalfa stands, so emission of ammonia cannot be eliminated and therefore the economic value of the N from manure is not utilized by the crop.

Manure not as good as fertilizer?

In a research scale experiment in Ontario, alfalfa and timothy/alfalfa mixed plots were established on loam soil in 2008. Liquid dairy manure was applied using tine or drop

hose applicators following the second cut in 2009 (at a rate of 21 or 44 m³/ha), and following the first cut in 2010 (at a rate of 26 or 51 m³/ha). Treatments also included comparable nutrient additions from a 13-10-35 chemical fertilizer (390 kg/ha in 2009 and 370 kg/ha in 2010) and control treatments with no nutrients applied. Field scale trials were also conducted on multiple farms and years with manure applied after first or second cut at rates ranging from 43 to 67 m³/ha, compared with chemical fertilizer and no nutrient application.

Why did forage sometimes yield less with manure than with fertilizer?

It was noted in the farm trials that wheel track effects were less prominent if the manure was applied within 5 to 6 days after cutting. In the research scale experiment, neither rate nor method of application (rolling tine vs. drop hose) affected yield. Ammonia volatilization in the week after application was 40% less with tine than drop hose after a July 21, 2009 application, but no difference was observed after a June 4, 2010 application. Since the stands contained at least 98% alfalfa (dry weight basis), ammonia losses are unlikely to impact production. Clearly, conserving manure N is less important for alfalfa-based than grass-based forage production.

Effect on stand composition?

Sward composition was not affected by manure vs. fertilizer but there was slightly more weeds with no nutrients applied (2.7% by weight) than with manure (0.4%). The small proportion of timothy (1.5%) in the mixed stand remained unchanged with manure or fertilizer.

Does manure affect alfalfa quality?

When forage is used for dairy rations, the 'MILK' index (based on crude protein, acid detergent fiber and neutral detergent fiber) (Undersander 1993), can be used to indicate feed value. By the second year of the experiment, the MILK index was greater with fertilizer or manure (1024 lbs/ton, average of both) than with no applied nutrients (903 lb/ton). On a per acre basis, MILK was 4828 lb with fertilizer, 4351 lb with manure and 3921 lb with no nutrients applied, from the 2010 second cut. At the field scale, yield combined with quality measured in MILK produced per acre of forage showed an advantage to manure application as compared with no nutrients in both 2006 and 2009 trial averages (Table 1). Also, forage K and P concentrations were greater with manure or chemical fertilizer than with no nutrients in both the field scale and research trials.

Table 1. Effect of manure and chemical fertilizer on grass-alfalfa yield and MILK index based on chemical analysis in field scale trials in Ontario.

Treatment	Yield/cut dry ton/ac	MILK index	
		lb/ton	lb/ac
Zero	1.05	2,827	2,959
Fertilizer	1.09	2,938	3,180
Manure	1.13	2,958	3,352

Disadvantages of manure — wasting nitrogen

Nitrogen amounts applied on the research plots were 26 lb/ac (29 kg/ha) and 53 lb/ac (59 kg/ha) in 2009, and 41 lb/ac (46 kg/ha) and 132 lb/ac (148 kg/ha) in 2010 from the low and high rates of manure, respectively. This is an economic loss, but not an environmental concern as soil inorganic N concentrations were low (determined in September 2009 and August 2010).

Advantages of manure — maintaining soil fertility


The amount of K removed in the forage cut from the fields with manure or fertilizer applications was greater than from forage cut from fields with no nutrients applied. If manure was not applied to every cut, soil test K levels declined substantially, showing the high K removal capacity of alfalfa.



Tool bar equipped with rolling tine and drop hose used to vary method and rate of manure application in the research scale experiment

Only half of the applied manure-P was recovered by the crop after one cut. After two cuts, more P_2O_5 is removed than applied. The draw-down of soil available P was up to 38%. The low manure rate (21 and 26 m^3/ha) added 25 lb P_2O_5/ac (28 kg /ha) and 44 lb K_2O /ac (49 kg /ha) in 2009, and 35 lb P_2O_5/ac (39 kg /ha) and 58 lb K_2O /ac (64 kg /ha) in 2010, and was adequate in terms of production. Within the short time of the measurements, the low manure rate did not accentuate the decline of soil P and K. Manure applied after each cut, accompanied with regular soil testing to monitor nutrient reserves, should maintain soil K and P.

Conclusion

Alfalfa-based forage was relatively unharmed by various low disturbance manure application methods with small or no yield reductions, and stand composition did not change in the short-term (2 years). As compared with no nutrient application, forage quality as MILK was improved and similar to that with chemical fertilizer nutrients. The main disadvantage of manure on alfalfa is low N utilization. The advantages of manure on alfalfa are maintaining available soil P and K, and providing windows of opportunity for applying manure to fields when risk of losses to the environment through runoff and leaching are low. 

References available online at www.farmwest.com

Bonnie Ball Ontario Ministry of Agriculture and Food, Stratford, ON, Canada | bonnie.ball@ontario.ca

Christine Brown Ontario Ministry of Agriculture and Food, Woodstock, ON, Canada