Manure Injection vs. Surface Application followed by Incorporation: Expected Changes in Profit for NY Dairy Farms

Economic Analysis for the NYFVI funded project titled, On Farm Research Partnership: Evaluation of Manure Injection Equipment Using Yield Monitoring, OAR 11 009, Project Leader, Dr. Quirine Ketterings, Cornell University Nutrient Management Program (SPEAR)

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Introduction

Owners of dairy farm businesses face numerous challenges as they manage manure to meet financial, environmental, and other farm business objectives. Trade-offs and conflicting objectives describe the situation.

Owners of dairy farm businesses in New York State make decisions regarding manure rates, timing, location, and application method while attempting to achieve financial, environmental, underlying production, and other objectives given available land, labor, and other resources, and other constraints. Environmental objectives include those related to CAFO regulations, and those related to producers' desires to control odors. Note that collaborating farm business owners mentioned odor control as an important objective, goal when considering manure management decisions. Decisions can be complex, characterized by conflict among objectives, interactions among factors and others.

Producers seek information regarding agronomic, economic, environmental, dairy herd management and other aspects, as they make decisions regarding optimal rates, methods, etc. Producers are interested in learning about alternatives for purposes of improving decision making and successfully implementing changes while achieving improved results. Producers benefit from better understanding of trade-offs, and of alternatives that best achieve the above objectives. An area of particular interest for reasons outlined by Ketterings et. al. relates to manure application method, specifically manure injection versus surface application followed by incorporation (On Farm Research Partnership: Evaluation of Manure Injection Equipment Using Yield Monitoring Technology. NYFVI funded project OAR 11 009.). Opportunities exist

through on farm research to assist producers with manure management topics. (Ketterings et. al.).

The economic analysis component associated with the Ketterings et. al. work sought to answer the following research question.

What is the expected change in profit associated with the change to manure injection from surface application followed by incorporation?

The target audience for this work consists of dairy producers and their advisors.

Approach

A measure that producers use to make decisions regarding a proposed change to the farm business is the expected change in profit, where profit equals the total value of production minus the costs of resources, inputs used. Expected change in profit equals the expected change in total value of production minus the expected change in costs. To estimate expected changes in profit, analysts use a partial budget approach, a form of marginal analysis.

The partial budget answers the following questions.

- What increases in value of production are expected?
- What decreases in costs are expected?
- What decreases in value of production are expected?
- What increases in costs are expected?

Variable and fixed costs differ among manure application methods. Project team members expected differences in costs to be key factors in the analysis and utilized a manure cost calculator to collect and summarize cost data associated with injection and surface application alternatives (Howland, Betsey and Jason Karszes. 2013. Dairy Activity Analysis Project: Cost of Manure Hauling. MS Excel Workbook. Cornell University).

Producer collaborators helped to define, describe three representative dairy farm sizes for analysis – 500, 1,000 and 2,000 cows -- with corresponding land base, land use, machinery complement and other characteristics. Potter and Bossard, DeGolyer, and Fisher and Russell provided data and helped develop analysis for the 500, 1,000 and 2,000 cow representative dairy farms, respectively. The 500 and 1,000 cow dairy farms employed a haul, transfer, and spread manure management system, while the 2,000 cow dairy utilized a drag hose application system.

Selected assumptions for the analyses follow.

- Average future year, marginal, before tax partial budget analysis for profit
- Late 2013, early 2014 prices, values
- Given the on farm research yield results for corn silage for the collaborating farms, analyses did not reflect an expected change in corn yield for injection versus surface application followed by tillage incorporation

- Given the design of the on farm trials, analyses did not reflect an expected change in fertilizer use
- A leveling pass is required following injection in the spring

Results

Expected changes in profit for each of the three representative farms were negative. (Table 1, 2 and 3). The magnitudes of the expected changes are not large when compared to comparable profit levels for each of the farm sizes examined. Note, too, that producer collaborators are likely willing to accept these changes in performance given that producer collaborators emphasized the importance of odor control objectives when making decisions regarding manure applications. Producers note the advantages of manure injection with respect to odor control versus surface applications.

Using the results from Tables 1, 2, and 3, estimated breakeven, expected changes in corn silage yield (tons/acre) were 0.52, 0.24, and 0.07 for the 500, 1,000 and 2,000 cow representative dairy farms, respectively.

Next Steps

This work with results, discussion and conclusions will be disseminated via a variety of delivery methods including

- the NWNY Dairy, Livestock, and Field Crops Program's monthly newsletter AgFocus, and its website
- other Cornell University fact sheets and publications,
- producer meetings, and others where appropriate.

Table 1. Expected Change in Profit Associated with Proposed Change to Manure Injection from Surface Application Followed by Tillage Incorporation, 500 Cow Representative Dairy Farm, Average Future Year.

Expected Changes in Total Value of Production	$	0
Total(A)		$ 0
Expected Changes in Costs		
Labor		
Incorporation passes avoided		-1,275
Injection task requires more time vs surface spreading		300
Leveling pass needed following injection		416
Injection requires 2 hauler drivers to wait longer		1,100
Fuel		
Incorporation passes avoided		-2,708
Injection task requires more time vs surface app		1,800
Leveling pass needed following injection		419
Repairs		
Incorporation passes avoided		-2,880
Injection task requires more time & more expensive tools vs surface		6,000
Leveling pass needed following injection		
Tractor		78
Equipment, implement		304
Ownership Costs		
Injector implement		5,150
Incorporation passes not needed		-1,228
Additional leveling pass needed		295
Total(B)		$ 7,771
Expected Change in Profit, Total (A) - Total (B) =	-	$ 7,771

Table 2. Expected Change in Profit Associated with Proposed Change to Manure Injection from Surface Application Followed by Tillage Incorporation, 1,000 Cow Representative Dairy Farm, Average Future Year.

Expected Changes in Total Value of Production	$
	0
Total(A)	$0
Expected Changes in Costs	
Labor	
Incorporation passes avoided	-2,115
Leveling pass needed following injection	833
Fuel	
Incorporation passes avoided	-3,825
Injection pass requires more time vs surface	2,864
Leveling pass needed following injection	1,005
Repairs	
Incorporation passes avoided	-2,116
Injection pass requires more time vs surface	6,101
Leveling pass needed following injection	
Tractor	155
Equipment, implement	608
Ownership Costs	
Injector tool, implement and other	5,603
Incorporation passes not needed	-2,456
Additional leveling pass needed	590
Total(B)	$7,245
Expected Change in Profit, Total (A)- Total (B) =	-$7,245

Table 3. Expected Change in Profit Associated with Proposed Change to Manure Injection from Surface Application Followed by Tillage Incorporation, 2,000 Cow Representative Dairy Farm, Average Future Year.

Expected Changes in Total Value of Production	$
	0
Total(A)	$0
Expected Changes in Costs	
Labor	
Incorporation passes avoided	-1,760
Leveling pass needed following injection	1,110
Fuel	
Incorporation passes avoided	-5,100
Injection pass requires more horsepower vs surface	3,360
Leveling pass needed following injection	1,340
Repairs	
Incorporation passes avoided	-1,828
Injection pass requires larger tractor and addt'l tool vs surface	1,600
Leveling pass needed following injection	
Tractor	207
Equipment, implement	810
Ownership Costs	
Associated with the direct injection tool, implement	5,600
Assoc. with incorp. avoided	-3,541
Assoc. with leveling pass	786
Total(B)	$2,584
Expected Change in Profit, Total (A) - Total (B) =	-$2,584