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Transportation Distance Effects on Application Costs in Two Different Liquid Manure Transport and Application Systems

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Introduction

- Liquid swine manure management in Upper Midwestern United States
- Below building pits
- Outside slurry tanks
- Mostly Fall applied after Corn or Soybean harvest, with some Spring application

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Introduction

- Liquid swine manure management in Upper Midwestern United States
- Phosphorus Index
- Soil and manure sampling
- Amount of manure produced
- Crop nutrient up-take
- Method of application

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Manure Application Methods

- Drag-Line Applicators (DLA)
- Tank Wagon Applicators (TWA)
- TWA plus Tanker-trucks
- Irrigation, mostly center-pivot
- Each method has benefits and constraints

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Literature Review

- Rotz et al. (2008) developed the Integrated Farm System Model (IFSM)
- Harrigan et al. (1996) developed DAFOSYM
- Koelsch et al. (2007) developed a DSS
- Leibold and Olsen (2007) evaluated swine manure application using a spreadsheet-based analysis
- Hadrich et al. (2010) developed a manure transport and land application decision support tool - Manure$HAUL

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Objectives

- Both spreadsheet calculators as well as the whole farm simulation models developed so far have not compared the costs of transporting and applying manure for the TWA or the DLA systems.
- The objective of this work was to evaluate the impact of distance on the cost of owning and operating manure application equipment in a commercial manure business under either method of TWAs or DLAs.

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Materials and Methods

- Employee hourly wages = US $20 per hour
- Fuel costs = US $0.79 per liter
- Area covered per year = 3,462 hectares
- Fifteen (15) year usable life on tractors, pumps, and tank wagons
- Usable life on main line and the drag line was 10 and 5 years, respectively

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Materials and Methods

- Ag Decision Maker Spreadsheet A3-29 (Edwards, 2015)
- Manure application rates analyzed were 37,416, 46,770, and 56,124 liters per hectare
- Distance from the manure storage site to the manure application site analyzed were 1.6, 3.2, 4.8, 6.4, and 8.0 kilometers

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Results and Discussion

Fixed Costs

- Includes depreciation, interest (opportunity cost), taxes, insurance, and housing and maintenance facilities.
- Increase incrementally for the DLA system with investment ranging from $1,240,000 to $2,041,000.
- Constant for the TWA system with investment of $1,885,000.

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Results and Discussion

Variable Costs

- Includes labor, fuel, and repair costs
- Costs calculated on hours to apply/hectare
- Includes loading, travel and application time
- TWA assumptions: road speed – 32 km/hr., field speed - 8 km/hr.
- Variable Costs per liter increase with distance and decrease with higher application rates

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Results and Discussion

Labor and Fuel

- Labor costs for DLA system based on 750 hours @ $20/hr.
- Fuel costs for DLA system based on 375 hours (down time for resetting pipe)
- Labor and Fuel for the TWA system was based on hours of operation

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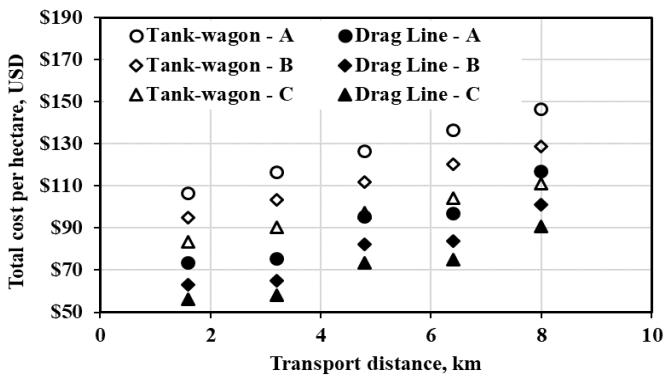

- Total cost per hectare v/s distance

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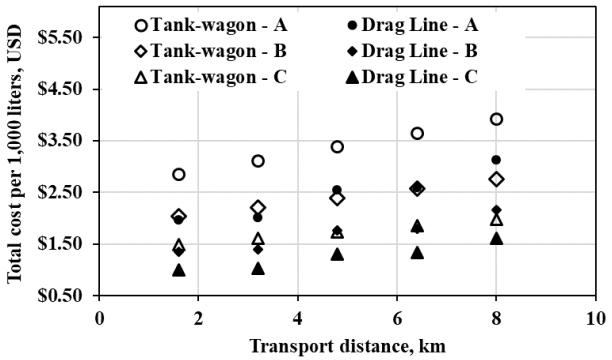

- Total cost per 1,000 liters v/s distance

Conclusions

- The cost analysis presented in this paper considers only the application costs based on five different transport distances and three different application rates. It does not include any additional operating costs such as parts truck, employee trucks, manure sampling costs, manure management plan costs, record keeping, accounting, and other incidental overhead costs. As such, the analysis presented should not be considered a complete representation of total operating costs.

Conclusions

- Increase in transport distance caused the variable cost to increase for both transport methods leading to increase in total operating costs, although the increase was stair-stepped in case of DLA system mainly due to addition of booster pump, fuel, and an employee at 3.2 km and 6.4 km transport distance.

Conclusions

- Increase in application rate caused the TWA system cost to drop more than the DLA system at any given distance. This was mainly due to the variable cost being higher to apply manure with TWA system. Overall, the total operating costs were lower for the DLA system when compared to the TWA system for the three corresponding manure application rates.