LABOR REQUIREMENTS FOR HANDLING MANURE FROM CONCRETE BASINS

J. P. Harner III[1], T. Strahm[1], D. Key[1], and T. L. Strahm

Summary

Time requirements for loading a manure spreader and traveling to and from the field varied from 20 to 30 min per load. However, standardizing the data showed that 5 to 7 min were required per 1,000 gal (9,000 lb). The preliminary results of the time motion data indicate about 30 min per cow per year are required for handling manure from a concrete storage basin. These results were consistent among the four dairies evaluated, even though differences existed in operating procedures. These results enable dairy producers to assess labor and equipment needs for performing the various operations associated with hauling manure from a concrete storage basin.

(Key Words: Manure, Handling, Labor, Storage.)

Introduction

Time motion studies are useful in determining labor requirement to perform specific tasks in manufacturing processes. These studies have been used in the dairy industry to evaluate the labor requirements for various tasks associated with milking and milk parlor performance. Data may be used to evaluate the impact of changes, increase understanding of labor requirements, or determine detailed operational costs. The objective of this study was to determine the labor requirements for handling manure from concrete basins.

Procedures

The study was conducted at four dairies located in northeast Kansas. The dairies utilized concrete basins for storing manure prior to land application. Manure was scraped and stored in a basin and then applied using a manure spreader. The concrete basins were 3 to 6 ft deep with volumes in proportion to the storage period and herd size. Although all of the dairies utilized sand for bedding freestalls, it was not standardized. The hauling distances from the concrete basin to the field varied. Data were collected utilizing stop watches to time a specific task required during the handling of the manure. The specific tasks recorded were:

Loading time: time from when the spreader stopped at the loading area when one operator was used or when the first bucket began to dump into the spreader if two or more operators were present until the spreader moved away from the loading area.

Travel time to field: time from when the spreader moved away from the loading area until the spreading operations began.

Spreading time: time from when the spreading operation began until the spreading operation was completed.

Travel time from field: time from when the spreading operation was completed until when the next loading time began.

[1]Department of Biological and Agricultural Engineering.

The total time was an equal to the summation of the four events. Radios were used to communicate when certain events occurred. Each dairy had different operation procedures as described below.

Dairy A. Utilized a pay loader and spreader with one person operating all of the equipment.

Dairy B. Utilized a tractor front end loader and spreader with two people or one person operating each piece of equipment

Dairy C. Utilized a skid steerer and three manure spreaders with four people or one person operating each piece of equipment. Data also were collected using a 3,350-gal manure tank wagon with a single operator at this dairy.

Dairy D. Utilized a tractor front end loader and spreader with one person operating both pieces of equipment.

Data were collected for 10 to 15 round trips per dairy. A round trip represented the time required to complete the four sequenced time events. Data from each farm then were entered into a spread sheet and averaged. Manufacturer information related to spreader capacity was obtained and converted to 1,000 gal for comparison among the four dairies. The manure spreaders ranged from 1,820 to 3,300 gal in capacity.

Results and Discussion

Figures 1 through 4 illustrate the results obtained from dairies A through D, respectively. The average time for loading a spreader ranged from 3 to 7 min. Data from Dairy C (Figure 3) indicated that a manure tank could be filled in less than 4 min. A similar amount of time was required to load a spreader. The time required to go from the loading area to the field or back was about 4 min. Dairy B (Figure 2) accomplished this task in less than 2 min, but the distance to the edge of the field was less than 100 yards. Dairy A (Figure 1) had the longest hauling distance and required about 6 min per one-way trip. Spreading generally was accomplished in less than 2 min. Overall, the total time required per load of manure ranged from 13 (Figure 2) to 23 (Figure 1) min. Spreader size did not have an impact on the time requirements per 1,000 gal hauled.

The results were converted to time required per 1,000 gal, because variation exists in the size of manure spreaders. A bushel of spreader capacity was equal to 7 gal (1 bu = 0.8 cubic ft = 64 lb at 80 lb/cubic ft pcf = 7 gal at 9 lb/gal). Between 5 and 7 min were required per 1,000 gal (9,000 lb) removed from the concrete basin. Rate of removal was independent of the number of operators, differences in spreader capacity, loading equipment, and distance to the fields.

A 1,400-lb cow produces around 150 lb of manure (feces + urine) per day. Content of fresh manure averages 87% moisture. Previous work found the manure in most basins averaged less than 80% moisture. Therefore, about 36,000 lb or 4,000 gal enter a basin each year per cow. Using the time motion data collected, about 30 min of labor are required per cow each year when the manure is stored in a concrete basin. For a 100-cow dairy, this represents about 50 hrs of time per year. Time requirements for a small dairy that typically scrapes and hauls are approximately 100 hrs. This was determined based on hauling four times per week at 30 min per trip. No additional labor or time is required for hauling manure stored in a concrete basin when compared to hauling three or more times per week. Based on a cost of $75 per hr for tractor and spreader equipment, the application cost is equal to about $37 per cow if a basin is used and $75 per cow if a daily scrape and haul system is used.

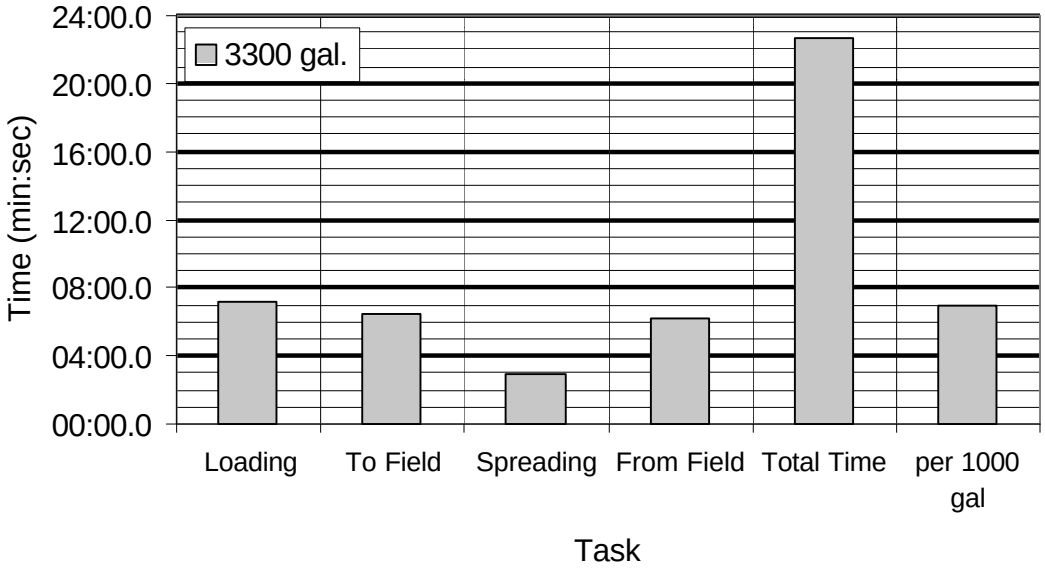

Figure 1. Average Labor Times for Manure Handling Phases Using Multiple Spreaders at Dairy A.

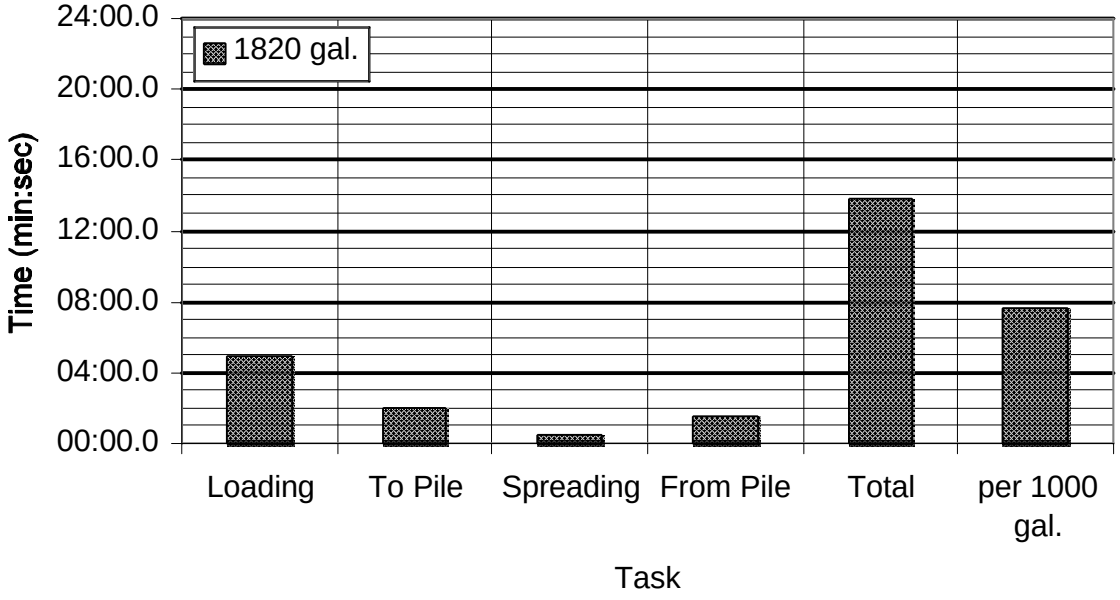

Figure 2. Average Labor Times for Manure Handling Phases at Dairy B.

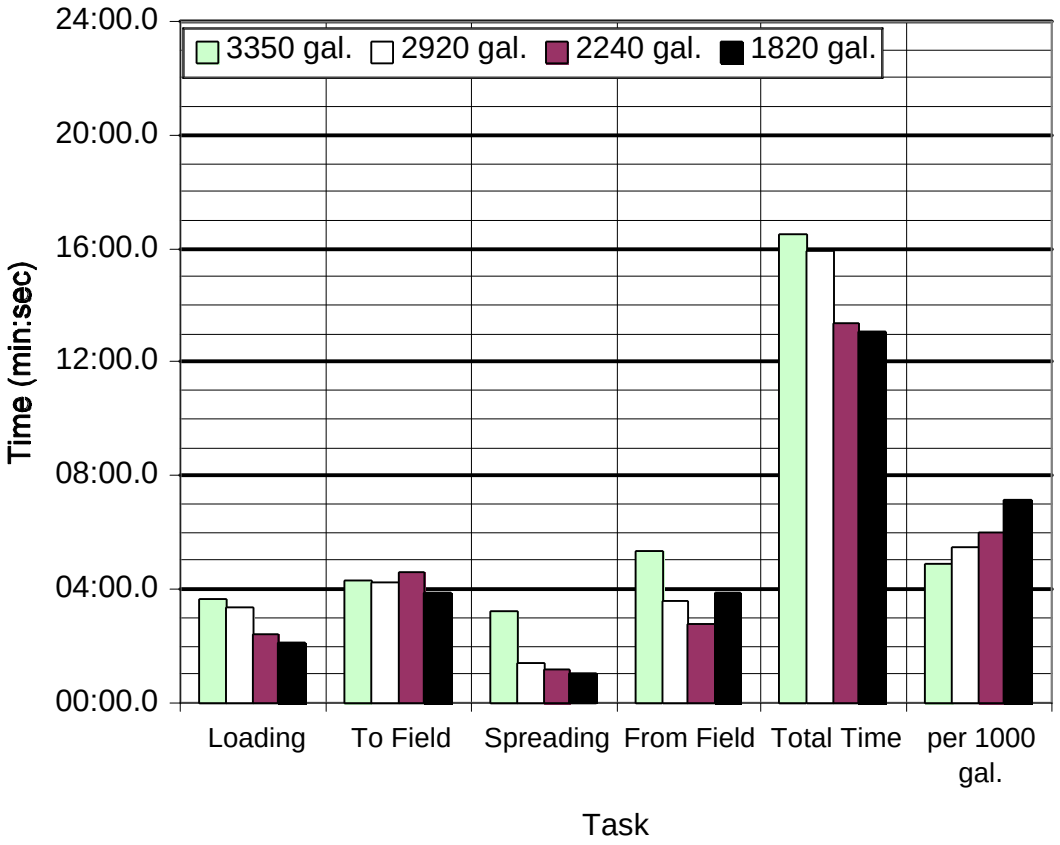

Figure 3. Average Labor Times for Manure Handling Phases Using Multiple Spreaders at Dairy C.

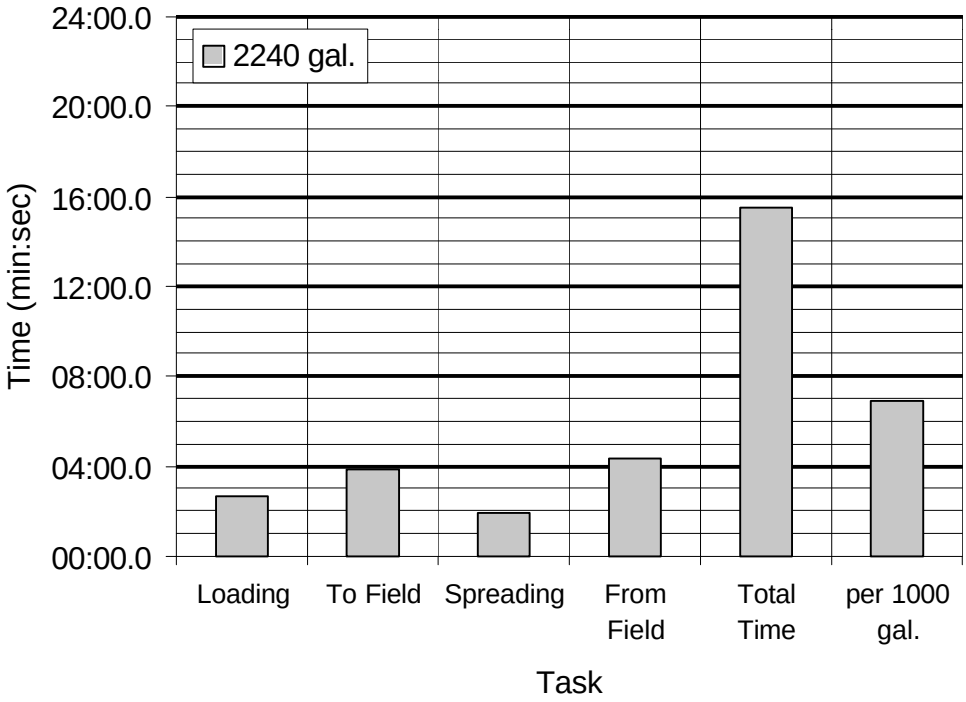

Figure 4. Average Labor Times for Manure Handling Phases at Dairy D.