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## Land Requirements for Freestall Dairy Facilities

### Abstract

Existing blueprints were used to estimate land requirements for new dairy facilities. The average land requirement for constructing a new dairy complex with freestall housing and a new parlor is 915 ft<sup>2</sup> per lactating cow. Approximately 52% of the overall land space is used for dairy operations including a milk center, housing, transfer lanes, vehicle roads, a feed center, and a manure processing center. The remaining 48% is green space, areas between buildings or along driveways, and separation distance from main roads and neighboring property.; Dairy Day, 2009, Kansas State University, Manhattan, KS, 2009; Dairy Research, 2009 is known as Dairy Day, 2009

### Keywords

Kansas Agricultural Experiment Station contribution; no. 10-103-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 1021; Dairy Day, 2009; Dairy; Dairy facilities; Land requirements

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# Land Requirements for Freestall Dairy Facilities

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## Summary

Existing blueprints were used to estimate land requirements for new dairy facilities. The average land requirement for constructing a new dairy complex with freestall housing and a new parlor is 915 ft<sup>2</sup> per lactating cow. Approximately 52% of the overall land space is used for dairy operations including a milk center, housing, transfer lanes, vehicle roads, a feed center, and a manure processing center. The remaining 48% is green space, areas between buildings or along driveways, and separation distance from main roads and neighboring property.

## Introduction

New dairies ask engineering firms to develop an overall site layout of proposed facilities. These plans are submitted as part of the water, air, environmental, and zoning permitting requirements to local and state agencies. Permitting may require air modeling to estimate potential gaseous or particulate emissions. Currently, information is not available to estimate land requirements necessary for the overall physical footprint of a dairy before actual design of a dairy. Allocated areas may affect air quality differently. For example, nonpaved feed roads may be the main source of particulate emissions, whereas manure storage structures may be the main source of odorous compounds. The objective of this paper was to establish baseline data to estimate the land area required for the physical structures located on a dairy.

## Experimental Procedures

Thirty sets of site plans were obtained from 8 different North American engineering firms, and useable data were obtained from 28 of the 30 site plans. Each plan was a proposed or recently constructed dairy with freestall housing and a new milk center. Some plans had exercise lots located between the freestall buildings. Exercise lots commonly are found on freestall facilities in western states. Not all of the plans had space allocated for a feed center. Scaled measurements taken from the plans formed a database that was used evaluate space requirements for housing, feed, parlor, and waste management systems.

## Results and Discussion

The dairies represented in the site plans averaged 2,589 lactating cows (range: 246 to 10,000 lactating cows). The average land requirement was 915 ft<sup>2</sup> per lactating cow. The maximum and minimum land area allocated per lactating cow was 1,566 and 358 ft<sup>2</sup>, respectively. The freestall housing area averaged 102 ft<sup>2</sup> per lactating cow, and the special needs space required 29 ft<sup>2</sup> per lactating cow. Roads providing access to the milk center, housing area, and feed center occupied 51 ft<sup>2</sup> per lactating cow. Average space for exercise lots on freestall dairies was 167 ft<sup>2</sup> per lactating cow. Table 1 summarizes the overall requirements for land and housing areas.

Space requirements for the milk center are shown in Table 2. Average space in the milk center was 7 ft<sup>2</sup> per lactating cow. The parlor equipment room averaged 2 ft<sup>2</sup> per lactating cow, and travel lanes to the parlor averaged 7 ft<sup>2</sup> per lactating cow. Significant variation existed between the average, maximum, and minimum space requirements for the travel lanes. Dairies with exer-

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cise lots tended to have greater travel lane space requirements than dairies in northern climates, where facilities tend to be more compact.

Feed center space requirements averaged 86 ft<sup>2</sup> per lactating cow. The feed centers included space for hay storage, commodity buildings, and silage structures. On average, about half of this space was used for silage storage structures.

Nearly all plans showed at least 1 solids storage basin or pad if a mechanical separator was shown along with liquid storage for handling manure, wash water, and runoff. The maximum number of solids storage basins was 4, which is common on flush dairies that use long, narrow trenches for solids separation. The average surface area of the space allowed for solid and liquid storage was 41 and 140 ft<sup>2</sup>, respectively, per lactating cow.

Figure 1 shows facility space and overall space for the different dairies by number of lactating cows. Approximately 52% of the overall land space used for dairy operations consists of dairy operations including the milk center, housing, transfer lanes, vehicle roads, the feed center, and the manure processing center. The remaining 48% is green space, areas between buildings or along driveways, and separation distance from main roads and neighboring property.

**Table 1. Overall requirements for land and housing areas**

Item	Average	Maximum	Minimum	Deviation	Count <sup>1</sup>
Number of cows	2,589	10,000	246	2,041	28
Overall land, ft <sup>2</sup>	915	1,566	371	345	23
Freestall/Housing, ft <sup>2</sup>	102	134	79	15	28
Special needs, ft <sup>2</sup>	29	191	1	44	28
Exercise lots, ft <sup>2</sup>	167	293	68	92	5
Feed lanes and roads, ft <sup>2</sup>	51	156	18	35	18

<sup>1</sup>Number of useable site plans.

**Table 2. Space requirements for the milk center (ft<sup>2</sup>)**

Item	Average	Maximum	Minimum	Deviation	Count <sup>1</sup>
Milk center	7	20	3	3	28
Parlor equipment room	2	9	1	2	28
Lanes to parlor	7	23	1	5	26

<sup>1</sup>Number of useable plans.

# FACILITIES AND ENVIRONMENT

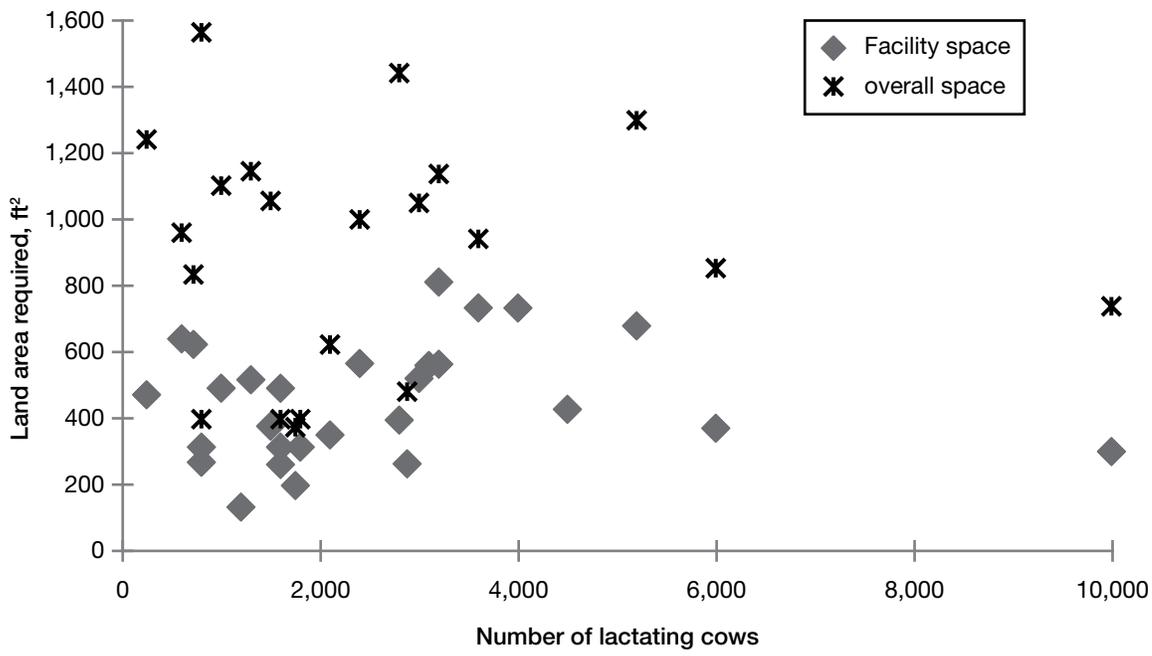


Figure 1. Comparison of land area requirements for facility space and overall space based on number of lactating cows in a dairy.