AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

February 1968 A. E. Ext. 486

ESTIMATED CONSTRUCTION COSTS FOR FREE STALL DAIRY SYSTEMS

George L. Casler

Department of Agricultural Economics
New York State College of Agriculture
A Statutory College of the State University
Cornell University, Ithaca, New York

ESTIMATED CONSTRUCTION COSTS FOR FREE STALL DAIRY SYSTEMS

About 90 percent of the dairy cows in New York are housed in stanchion-type barns. Since 1961, over 700 free stall housing systems have been installed; some are completely new and others are conversions from stanchion barns. A recent New York study indicates that the labor requirements in free stall systems are substantially lower than in stanchion barns (4, 5, 6).* Thus, the major reason for changing to a free stall system is to lower the labor requirement or, conversely, increase output per man. An additional factor is that free stall housing usually is combined with high-silage feeding which is compatible with increased corn silage. On many soils, corn silage provides more nutrients per acre than other forage crops, thereby supporting a larger herd on the same acreage. Thus a free stall system provides the opportunity (but not a guarantee) for the farm operator to increase his net income.

Many New York dairymen are faced with the decision of whether they should change from a stanchion-type barn to a free stall-milking parlor-high silage system. For most dairymen, such a change is a major decision requiring large investment and frequently an increase in size of business. To make a wise decision, a farmer must compare the investment required with the benefits he expects to receive. A farmer can determine the investment required by obtaining bids from dealers and contractors for the items required by the system he is planning. Many farmers, however, would like to make tentative budgets of investment required and expected benefits before asking for bids.

This publication is intended to help farmers make preliminary investment estimates for free stall dairy systems.

Items Required

A change to a free stall-milking parlor-high silage system will require investment in some or all of the following items:

A. Livestock handling facilities:

1. Barn (feeding, resting, and isolation and maternity areas)
2. Milking parlor and equipment
3. Milkhouse
4. Bulk tank
5. Silos
6. Feeding equipment
7. Parlor-milkhouse waste disposal system
8. Manure handling equipment
9. Water supply
10. Heifer raising facilities

B. Cattle

C. Land

D. Field Equipment

---

* Numbers in parenthesis refer to references listed at the end of this publication.

Items Associated With the Free Stall System

Cattle, land, and field equipment are not a part of the free stall housing-milking-feeding complex. But in most cases, a change to a free stall system is accompanied by an increase in herd size which may require more land and field equipment. These items are often partially overlooked by farmers planning free stall systems.

Cattle will be acquired by either raising additional heifers prior to the increase in herd size or by purchases. Most farmers will buy at least part of the needed animals. In addition, they may need to purchase more than the normal number of replacements in the early years of free stall operation because of culling of cows that don't fit the system and because the replacement program is not yet adjusted to the larger herd size.

A shift from hay crops or grain crops to corn silage will provide additional roughage for a larger herd. On dairy farms presently growing only roughage crops, a shift to more corn silage will provide roughage for only a relatively small increase in herd size. Therefore, in most major expansions additional cropland will be purchased or rented.

With additional cropland and/or more corn silage a farmer's present set of field equipment is likely to be inadequate. He may need additional equipment such as a larger tractor, larger forage harvester, larger silage blower, four-row corn planter and self-unloading wagons.

Cattle, land, and field equipment can add a large amount to the total investment required by a change to a free stall system. A farmer doing realistic planning should include in his investment estimates all such items that will be required.

Effect of the Free Stall System on Net Income

A farmer considering a free stall system should carefully estimate the effect of this investment on the annual net income from his business. Depreciation of the required capital investment should be included as an expense. The free stall investment can be justified economically only if the annual net income from the business can reasonably be expected to increase as a result of the investment. A publication prepared by LaDue (7) can be of help in budgeting the probable effect of a free stall investment on net income.

The Free Stall System

The remainder of this bulletin is devoted to cost estimates for the free stall housing-milking-feeding complex. Cost estimates are based primarily on data included in the "Farm Management Handbook", A.E. Ext. 440, Department of Agricultural Economics, Cornell University, Ithaca, N. Y., October 1966. The building costs in this Handbook were estimated by the Department of Agricultural Engineering at Cornell University. The cost

estimates for silos and equipment were obtained from dealer surveys. Additional sources of cost data were a survey of farmers who have built free stall systems (10) and discussions with building contractors.

Estimates are included here for 100-cow and 200-cow completely new free stall systems (Tables 1 and 2). Costs have been divided into categories that farmers frequently purchase as separate components. These estimates are for systems with uninsulated pole-type structures and concrete stave silos. Floor plans on which these estimates are based are presented in Figures 1 and 2. Costs for other pole-type designs would not be greatly different unless the square feet per cow is substantially changed.

Many other floor plans are possible. Some floor plans that have been used are available in Cornell publications (1, 2, 3, 6, 10).

These floor plans and cost estimates assume an all-silage program for the milking herd on a year-round basis (no hay and no pasture). Thus no hay storage or feeding facilities are included. Silage consumption is assumed to be 18 tons per cow per year. Assuming some double use of silo capacity because of a combination of hay crop and corn silage, silo capacity is budgeted at 13.5 tons per cow (18 tons x 3/4).

Relatively few dairymen with free stall systems are using an all-silage program. The total investment could be reduced by building less silo capacity. In this case, hay feeding facilities would need to be included. In addition, unless the farmer is willing to spend time hauling hay frequently, hay storage space would be needed in the free stall barn.

The estimates do not include manure handling equipment -- that is, no estimate has been included for scraping equipment, manure spreaders, liquid manure storage or for liquid manure handling equipment.

Since costs vary so widely depending on location within the state, quality of construction, and other factors such as site chosen and amount of electrical work required, the cost estimates have been presented as ranges. Still, costs for any particular component or for the complete system could fall outside the ranges given.

The upper side of the ranges imply high quality materials, fully contracted job, and more elaborate equipment. The lower side of the ranges imply possibly lower quality construction, the farmer acting as his own contractor and minimal equipment to fill the need. For example, on heating and hot water for the 100 stall system, the $500 would imply overhead lamps and/or electric heat pads in the floor while the $1,500 implies a furnace for heating.

For a 200-stall system, the estimated investment for the components included here ranges from $435 to $620 with an average of about $530 per cow. The range for a 100-stall system is $535 to $775 with an average of about $650 per cow. Comparable systems for less than 100 stalls likely would average higher than $650 per cow.

Building costs for labor and materials have increased rapidly in recent years. If building costs continue to increase the cost estimates included here will soon be out of date.

Table 1. Estimated Investment for a New Free Stall-Milking Parlor-High Silage System With 100 Stalls 1/

Item	Investment Total	Investment Per Cow
Barn: 75' x 170' (less space for milkhouse and parlor) @ $1.70 to $2.50/sq. ft. 2/	$19,600-$28,900	$196-$289
Parlor-milkhouse building: 30' x 40' @ $4.20 to $6.50/sq. ft. 3/ 7/	5,000- 7,800	50- 78
Parlor equipment: double-3 herringbone 4/	4,300- 6,000	43- 60
Bulk tank: 1,000 gallon	4,200- 4,800	42- 48
Silos: 20' x 60' and 24' x 60'	11,800- 13,500	118- 135
Feeding equipment: 2 unloaders - $3,200-3,700 Conveyor - $500-800 Bunk feeder - $1,000-1,500	4,700- 6,000	47- 60
Plumbing: 5/ 6/	500- 1,000	5- 10
Electrical work: 5/	1,500- 2,500	15- 25
Waste disposal (parlor and milkhouse): 5/	500- 2,500	5- 25
Grading and driveways: 5/	200- 2,000	2- 20
Hot water and parlor-milkhouse heating: 5/	500- 1,500	5- 15
Toilet facilities including disposal: 5/	600- 1,000	6- 10
Total	$53,400-$77,500	$534-$775

1/ These estimates are for an uninsulated pole-type structure and concrete stave silos without roofs. No manure handling equipment is included. No heifer raising facilities are included.

2/ Includes cost of one manure lip.

3/ Parlor stalls are included in parlor equipment.

4/ Does not include electronically controlled grain feeding devices.

5/ Estimates by the author based on Trattel's survey (10) and discussions with building contractors. Estimates for other components are based on Farm Management Handbook data, A.E. Ext. 440.

6/ Does not include well or pump. Drains under the building to carry waste water to the edge of the building are included in the barn and parlor-milkhouse estimates.

7/ Parlor building is large enough for a four-stall herringbone.

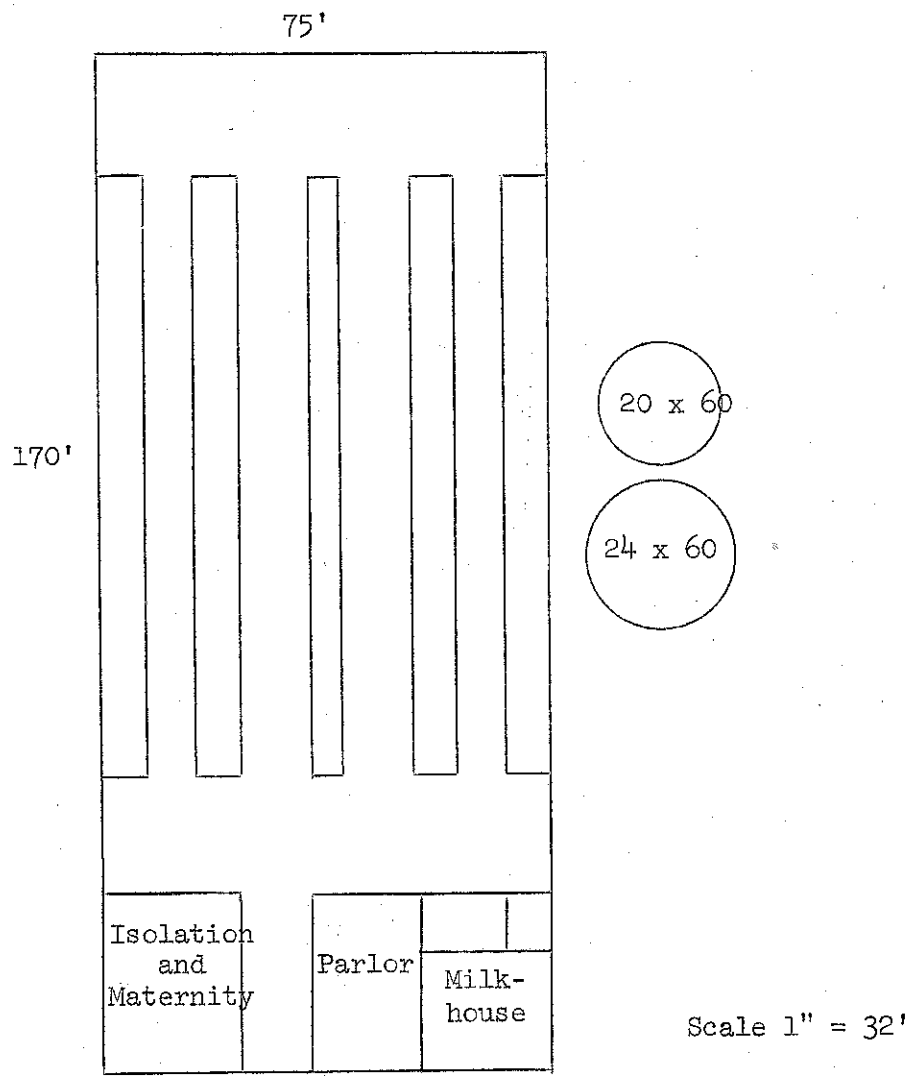

Figure 1. One Possible Floor Plan for a 4-row Free Stall System With 100 Stalls

Table 2. Estimated Investment for a New Free Stall-Milking Parlor-High Silage System With 200 Stalls 1/

Item	Investment Total	Investment Per Cow
Barn: 75' x 260' @ $1.70 to $2.50/sq. ft. 2/	$33,200-$48,800	$166-$244
Parlor-milkhouse building: 36' x 44' @ $4.20 to $6.50/sq. ft. 3/	6,600- 10,200	33- 51
Isolation area: 20' x 36' @ $2.00 to $3.00/sq. ft.	1,400- 2,200	7- 11
Parlor equipment: double-6 herringbone 4/	5,600- 9,000	28- 45
Bulk tank: 2-1,000 gal.	8,400- 9,600	42- 48
Silos: 30' x 60' and 30' x 70'	20,000- 21,800	100- 109
Feeding equipment: 2 unloaders - $4,000-4,400; Conveyors to bunk - $800-1,200; Bunk feeders - $2,000-3,000	6,800- 8,600	34- 43
Plumbing: 5/ 6/	600- 1,200	3- 6
Electrical work: 5/	1,600- 3,000	8- 15
Waste disposal (parlor and milkhouse): 5/	1,000- 4,000	5- 20
Grading and driveways: 5/	400- 3,000	2- 15
Hot water and parlor-milkhouse heating: 5/	600- 1,800	3- 9
Toilet facilities including disposal: 5/	600- 1,000	3- 5
Total	$86,800-$124,200	$434-$621

1/, 2/, 3/, 4/, 5/, 6/ See Table 1 for footnotes.

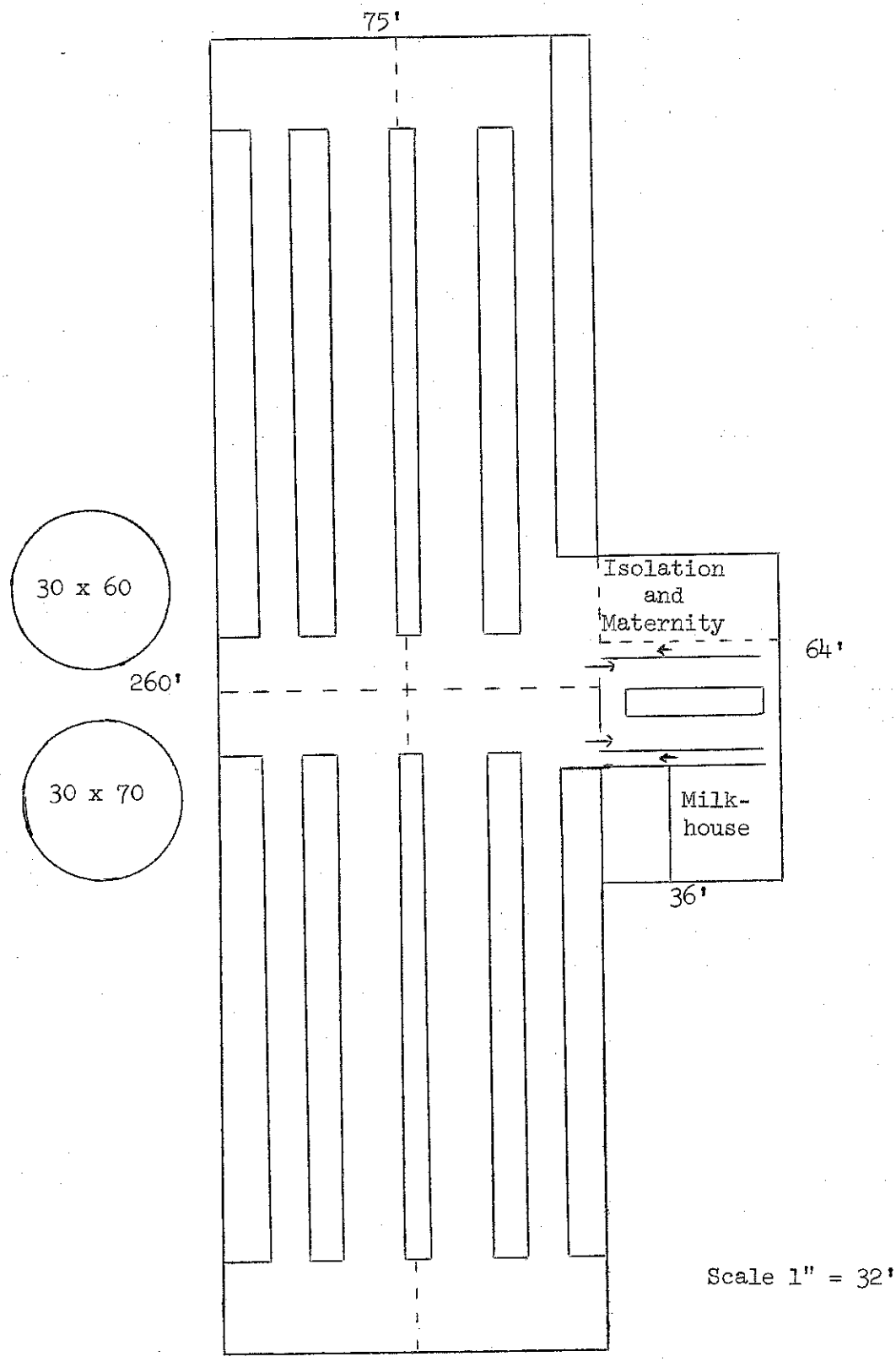

Figure 2. One Possible Floor Plan for a 4-row Free Stall System With 200 Stalls

These estimates should not be interpreted to mean that a particular contractor will or should build comparable systems for these costs. They are intended only to give farmers and others a rough idea of the cost of free stall systems including these components. A farmer could add to these estimates the probable investment in other needed facilities such as a well or manure handling equipment. He could also subtract items that would not be needed for his situation. For example, if he has an adequate bulk tank, he could subtract about $45 per cow from these investment estimates.

Comparison With Costs Obtained From Survey

Seven of the free stall systems surveyed in the fall of 1966 were similar to the 100-cow system discussed here -- that is, they were pole structures and included the same components (10). The seven systems cost $560 to $660 per stall and averaged $620. The average number of stalls was 108. However, these were not 100 percent silage systems. Added tower silo capacity and unloading equipment to enable all-silage feeding would add about $50 to the cost figures above making the total investment about $670 per cow.

Possible Ways to Reduce Investment

1. Use horizontal silos. - Bunker or lined trench silos can usually be constructed for one-half or less the cost of upright concrete stave silos. These silos require more management than tower silos. With good management, cost per ton for storing silage can be lower in a horizontal silo than in a tower silo (8, 9).

2. Put feed bunk outside. - This is being done successfully by dairymen in areas of New York and New England with less severe climatic conditions. However, since the areas around the bunk must be paved the only saving is the roof. Many dairymen have built small roofs over their feed bunks so the net saving, if any, is small.

3. Use self-unloading wagons for feeding equipment. - If this equipment is already owned for silage harvesting, total investment could be lowered by not purchasing automatic bunk feeders and silage transfer augers. Somewhat more labor is usually required if feeding is done with a self-unloading wagon. This equipment is being used successfully by many free stall operators.

4. Use six-row barn design. - Two rows can be added to a four-row barn design by making the barn only 15 feet wider. No extra alleys are needed. This may lower cost per cow substantially. However, with this design cows have 1.5 rather than two feet of bunk space; thus all cows cannot eat at once. Use of this design requires that silage be kept in the feed bunk at all times so that all cows do not need to eat simultaneously.

5. Run 10 percent more cows than stalls. - Since all cows do not want to use the resting area at the same time, it is argued by some people that investment per cow can be reduced by having more cows than

stalls. Some farmers appear to have successfully done this; others who have tried it report that it can't be done. In some areas, sanitarians do not allow this practice. Unless the barn design is changed, the bunk space per cow would be less than two feet per cow and might create feeding problems.

6. Alter the floor plan slightly to include more cows in the same floor space. - For example, in the 100 stall barn layout (Figure 1), 10 more stalls could be added by extending the two outside rows of stalls to the end of the barn. Another 10 could be added by extending these two rows toward the parlor end of the barn. If both these changes were made, they would preclude scraping manure out the side of the barn and entrance to or exit from the free stall area from the side of the barn. Also, 100 stalls could be placed in a barn with a length less than 170 feet if this kind of floor plan modification was made. In either modification these added stalls would result in less than two feet of bunk space per cow. But a few extra dollars for stalls would reduce the cost per cow substantially.

7. Make use of existing facilities. - Stanchion barns have been converted to well-designed free stall systems; they also have been converted to very undesirable free stall systems. Farmers with sound stanchion barns should seriously consider conversion rather than completely new structures. Some conversions have provided acceptable free stall systems at substantial cost savings. However, since many of the items such as the parlor, milkhouse, feeding equipment, silos, and unloaders will be needed even with remodeling, farmers are likely to overestimate the potential cost saving. Because remodeling costs vary so widely among barns and because it is harder to get a firm estimate on remodeling than on new construction, farmers are advised to do some very careful calculating before deciding to remodel rather than build new.

An additional consideration is that if a new barn is built, the old dairy barn is available for heifers and dry cows. With a large increase in herd size, added heifer space may be an important consideration. While an old stanchion barn may not provide the most desirable heifer facility, limited remodeling may make it a low-cost, acceptable structure.

Summary

This bulletin is intended to serve as a rough guide to the investment required for building free stall dairy systems. As such, it can provide a useful starting point for farmers who are considering investment in a free stall system. Final decisions should be based on actual contractor's bids for the required items rather than on the data presented here.

REFERENCES

1. Irish, W. W. and A. R. Grout, "Loose Housing for Dairy Cows", Agr. Eng. Ext. Bul. 357, Cornell University, Ithaca, N. Y.

2. Irish, W. W., "Free Stall Resting Barns", Agr. Eng. Ext. Bul. 356, Cornell University, Ithaca, N. Y.

3. LaDue, Eddy L., "Planning Aid for Designing Free Stall Systems", A.E. Ext. 471, Department of Agricultural Economics, Cornell University, Ithaca, N.Y., July 1967.

4. LaDue, Eddy L., "Free Stall Barn, Herringbone Parlor, High Silage Feeding Dairy Chore Systems - Comparison and Analysis", A.E. Res. 188, Department of Agricultural Economics, Cornell University, Ithaca, N. Y., January 1966.

5. LaDue, Eddy L., "Free Stall Barn, Herringbone Parlor, High Silage Feeding Dairy Chore Systems - Financial Considerations", A.E. Res. 189, Department of Agricultural Economics, Cornell University, Ithaca, N. Y., January 1966.

6. LaDue, Eddy L., "Free Stall Barn, Herringbone Parlor, High Silage Feeding Dairy Chore Systems - Buildings and Arrangements", A.E. Res. 190, Department of Agricultural Economics, Cornell University, Ithaca, N. Y., January 1966.

7. LaDue, Eddy L., "Free Stall Barn, Herringbone Parlor, High Silage Feeding Dairy Chore Systems - Planning the Change", A.E. Ext. 434, Department of Agricultural Economics, Cornell University, Ithaca, N. Y., May 1966.

8. Snyder, Darwin P., "Construction and Management Considerations of Horizontal Silos", A.E. Res. 226, Department of Agricultural Economics, Cornell University, Ithaca, N. Y., August 1967.

9. Snyder, Darwin P., "Economic Considerations of Horizontal Silos", A.E. Res. 227, Department of Agricultural Economics, Cornell University, Ithaca, N. Y., August 1967.

10. Trattel, George, "Costs and Performance Characteristics of Free Stall Housing Systems", A.E. Res. 243, Department of Agricultural Economics, Cornell University, November 1967.