EVALUATION OF DIFFERENT SYSTEMS FOR CALF HOUSING

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Abstract: Calf housing can vary, according to the calf age, such as individual hutches from birth to weaning, or group pens with respect to age and size of the animal. Every calf housing system has its own advantages and disadvantages, of which several are influenced by specific local weather conditions. The individual raising pen has the advantage of individual feeding and of reducing epidemiological risks. Oppositely, the group pens facilitate the interaction of animals and set up the environment to learn and understand group behavior. This paper presents the advantages and disadvantages of various constructive systems for the housing of calves.

Keywords: Common pens, individual pens

INTRODUCTION

The newborn calf represents the highest genetic potential for milk production on a well-managed farm. Therefore, the care given in raising this animal should be consistent with its high value (Penn State, 2015). The way calves are housed is the most variable part of a calf raising facility. There are many ways to house young dairy calves - hutches, pens, groups, greenhouses etc. Almost as many ways to house calves as there are farms. Calf housing is unique to most farms - responding to the unique features of the farm, including topography, land available, buildings on the farm, number of cows and calves, presence of water, fields, etc. Housing calves is also dynamic. It needs to change with changes in herd size, calving schedules, weaning schedules, etc. According to the USDA NAHMS National Dairy Heifer Evaluation Project (NDHEP), the types of housing used by producers in the U.S. for preweaned calves are presented in Table 1.

Table 1
Type of calves housing in U.S

<table>
<thead>
<tr>
<th>Type of housing</th>
<th>Winter (%)</th>
<th>Summer (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual hutches</td>
<td>30.5</td>
<td>32.4</td>
</tr>
<tr>
<td>Group (super) hutches</td>
<td>2.2</td>
<td>2.8</td>
</tr>
<tr>
<td>Individual pens in the cow barn</td>
<td>14.6</td>
<td>13.6</td>
</tr>
<tr>
<td>Group pens in the cow barn</td>
<td>21.8</td>
<td>18.0</td>
</tr>
<tr>
<td>Tied in the cow barn</td>
<td>15.9</td>
<td>13.5</td>
</tr>
<tr>
<td>Individual pens in another barn (not cow barn)</td>
<td>20.5</td>
<td>19.1</td>
</tr>
<tr>
<td>Group pens in another barn (not cow barn)</td>
<td>12.8</td>
<td>14.0</td>
</tr>
<tr>
<td>Tied in another barn (not cow barn)</td>
<td>4.7</td>
<td>4.4</td>
</tr>
<tr>
<td>No building (loose lot or pasture)</td>
<td>1.2</td>
<td>5.6</td>
</tr>
</tbody>
</table>

Individual hutches are the most popular method for housing calves (in the U.S. and in the world) as shown in Table 1. Although they are a more expensive method, individual hutches provide added benefits which are very important to a young calf’s success. Ventilation is very important because it reduces the risk of airborne pathogens traveling
from one calf to another and also reduces the toxic odor which can cause stress on the calf and weaken their immune system. Individual hutches also provide isolation for each animal. Calves have a weak immune system and can pass contagious diseases very easily. Well maintained individual hutches can also provide the best calf comfort. It is crucial that the hutches are always dry. This promotes the best environment to discourage infectious bacteria from growing in the hutch (Verwey, 2009).

In Romania, the standards for calf protection are regulated in Order no. 72/15 August 2005 on the sanitary veterinary norm establishing minimal standards for calf protection, the official transposition of the Council Directive 91/629/CEE (Council Directive, 2005). Several significant issues mentioned in the order are: housing should be protected so that every animal can lie down, stand up and grow with no difficulty; the flooring should be smooth, plane and stable, with a clean and properly drained bedding area; the calf individual housing is allowed up to the age of 8 weeks, except for the case when the calf is isolated at the recommendation of the veterinary; housing should be well ventilated and provided with additional heating and cooling systems.

In choosing a calf housing system, the following aspects should be considered: initial capital, operating, and maintenance and repair cost for the rearing facility; climate factors, maintenance systems and labor efficiency. Emphasis should be put on providing a housing with a warm floor for the rest area, and a clean bedding protecting animals from the exposure to aggressive environment factors. For a calf housing system to be successful, there are important fundamentals that need to be incorporated into the design related to ventilation, comfort, pen size and calves per pen, labor efficiency, and cost effectiveness (Broadwater, 2010; Dairy Australia, 2014; Sirbu and Tanasescu, 2015; Marusciac et al., 1982; Sirbu and Tanasescu, 2005; Nordlund, 2014).

Due to the variations in material and structural life between housing options, it is best to determine the total annual cost for each housing system being considered. Difficulty can exist in calculating the exact total annual cost since some of the alternative housing systems offered to the producer are relatively new and the life of the systems are not well established. However, it is well known that plastic cladding only lasts a few years while corrugated aluminum cladding will last 30 years or more (Curt and Gooch, 2009).

The purpose of the present paper lies in comparing the advantages and disadvantages of rising calves in various constructive systems, related to farm size and level of modernizing.

**Material and Method**

The research took into consideration the most frequently used calf housing systems and was based on both bibliographical and a practical study on site. Within a farm, several types of housing can be met, dependent upon the calf age, such as individual hutches from birth to weaning, or group pens with respect to age and size of the animal.

Calves can be raised:
- indoor (within an insulated or non-insulated barn) in: individual pens or group pens;
- outdoor/outside in: individual hutches or group (super) hutches (igloo type).

Housing facilities can be made of: polyethylene, glass fiber, zinc plated steel, plywood panels, PVC panels, or a mixture of mentioned materials. The housing systems can be purchased from companies specialized in their manufacturing and selling, or can be built by farmers, mainly from timber (or plywood), and can be relocated if equipped with
wheels. Polyethylene pens are more advantageous, as the material is lightweight, good insulator, easy to clean, making it recommendable for both individual or group pens. Similar to plastic, timber also has good insulating properties, but it absorbs humidity and bacteria as it is an organic and porous material. The materials used for pens should prevent the interior greenhouse effect, that is they should reflect the solar radiation that could heat up the inside of the pen.

**Outdoor housing.** Housing dairy calves in outdoor hutches is today the most spread system in the world. The use of outdoor hutches from birth to weaning (at maximum 8 weeks from birth) offers the best growing rates and resistance to diseases. As the calf immune system is in development, housing in individual hutches assures a limited exposure to bacteria and a reduced risk of disease. After weaning, animals can be moved in super hutches (also called Igloos), where they grow in groups.

Individual hutches are small-sized structures with the front part fully open, usually with a width of 1.20-1.50 m, a length of 2.00-2.40 m at 1.05-1.20 m high. In warm climate areas, very small sized hutches are used (1.2x1.2 m), as their costs are more accessible. Moreover, they are provided with an outdoor paddock made of wire mesh or welded pipe. The paddock area has commonly the same width and length, of 1.20 m to 2.40 m, built in front of the hutch. The most common and successful calf hutches are made from plywood, fiberglass, or other solid materials. During winter, it is important that the sidewalls and back of the hutch be completely air tight to prevent drafts from blowing through the hutch. During the hot summer, hutches with small ventilation panels that open in the back appear to be more comfortable for the calf. If a back opening is provided, it is critical that it be closed tightly during the winter. Hutches should be placed upon a dry and draining material and a geotextile material placed below bedding will prevent plugging of porous base. Ideally, hutches should be built towards the south to allow winter sun penetrate the hutch. The hutch should be well bedded with straw, shavings, or other suitable material. Hay and grain should be placed just inside the front section of the hutch to keep these materials dry. A rack to hold a small bucket is best for grain feeding, and provides for easy feeding, cleaning, and sanitizing. A second bucket rack located outside the hutch, usually on the pen fence, can be used for liquid feeding. Locating the feeding area to the front and outside the hutch helps reduce bedding maintenance.

Figures 1 and 2 present hutches for outdoor calf raising.

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Fig. 1. Individual hutches for outdoor/outside calves rising
Super hutches (igloo type) are designed for groups of animals, allowed to choose between the warm and protected environment and an external area for motion. Similar to individual hutches, super hutches are provided with an external paddock for motion and sunlighting.

**Indoor housing (within a barn).** Calves can also be raised in solid walled pens, inside a building, to protect animals from wind, rain and snow. New buildings can be erected for this purpose or older ones can be used: hay storage barns or other types. However, the most important aspect to be considered lies in the proper ventilation to prevent humidity and water condense. Individual pens can also be placed in thermally insulated indoor housing, with a controlled microclimate or in non-insulated and not warmed indoor housing. Individual pens have side and rear closing panels to avoid the contact among the calves. In some cases (in non-insulated housing), cover can be used for the cold season, even if pens are built inside the housing. Kohlman recommends a height for side panels of minimum 120 cm to limit disease transmission among calves in nose-to-nose contact. Side panels can be extended by minimum 30 cm (Figure 3) with respect to the front panel to reduce or even remove the nose-to-nose contact among the calves (Kohlman, 2009). The front and rear panels are made from wire mesh for a good air circulation. To avoid, the displacement of the material in the bedding area, the rear panel is closed at the height of 50 cm, the remaining 70 cm being built with wire mesh. The front panel is provided with feed rack and milk/water buckets. Pen dimensions vary from 90x150 cm to 120x240 cm on different farms. The more popular pen size is 120x180 cm.
A group pen of about 3.50x3.50 m (Figure 4), placed in the neighborhood of individual pens, provides for a fast accommodation of weaned calves. The erection of solid panels (at calf level) in the rest area diminishes drafts. Continuously available fresh water and a feed bunk should be located on one side or corner of the pen to separate the dirtier feeding and watering areas from the bedding area. For most feeding and management systems, it is important that all calves be able to eat from the feed bunk at the same time. Therefore, allow 45 cm of feed bunk per calf, with dividers or stanchions to minimize pushing and crowding by the more aggressive animals. Hay may be fed in the feed bunk or from a separate hay rack, depending on personal choice. If lockups are not provided along the feed bunk, at least one self-locking stanchion should be conveniently located for animal restraint (Penn State, 2015). To avoid overcrowding and food related competition, limited groups of 3 to 5 calves are recommended to be housed.

RESULTS AND DISCUSSION

In so far outdoor housing for calves is concerned, the following aspects need to be kept in mind: they can be purchased from the market or built by the farm; they need to be placed on a surface that is properly drained; they should be exposed to the sun, respectively the south in cold climate conditions; they should be relocated after each batch of calves to reduce to the minimum the possible diseased spreading.

The most significant advantages of housing calves in individual hutches are:
- pens can be relocated in clean places so that the initial placement can regrow until a new calf is moved in; they provide optimal natural ventilation; the calf has well defined areas for bedding and feeding; pens are easy to clean, disinfect and transport; the lack of nose-to-nose contact of the calves minimizes disease spreading; small initial investment compared to the building of a barn; possibility to easily monitor calf development and to identify ill animals; pens do not deform, are opaque and provide an optimal climate all along the year.

The disadvantages of outdoor individual hutches are: labor efficiency diminishes as food and water need to be transported along considerable distances; outside feeding, mainly in cold season; need of additional shading, during hot summers; paddock area directly exposed to weather (rain, snow); caretakers are obliged to work outdoor, irrespective of weather conditions.

As for calf housing in super hutches, it has the following beneficial aspects: monitoring and common treatment of batches according to category; better natural ventilation; easiness to clean and relocate (if made from plastic material); sufficient light; raising animals in groups favors a speedier development and higher feeding consumption.

However, super hutches are also disadvantageous because group housing favors disease spreading. Pens with motion paddocks separated by wire mesh panels permit the development of social contacts among calves, and avoid loneliness due stress. Paddocks give the possibility to move and to stay in the sun, reduce disease incidence and facilitate permanent monitoring and supervision. Calves can also be housed in individual and group pens located in naturally and artificially ventilated barns. Naturally ventilated barns have a longitudinal rooflight panel near the roof ridge, made with lightweight translucent plates and air exhaust openings on both sides. Though with inconvenient service conditions during the warm season, natural ventilation has the benefit of minimal investment costs and practically no energy consumption. Mechanically ventilated housing is beneficial because: they are stable during operation, independent of weather status; they can be
controlled, adjustment and even automation; they can entrain carbon dioxide and other heavy impurities gathered at the lower part of the spaces and remove them in the atmosphere.

The mechanical ventilation system shall be avoided whenever possible, in spite of its advantages, because it consumes much electrical energy when driving fans. Moreover, they do not always provide the microclimate conditions required, enabling disease spreading. The main advantage of indoor hutch housing of calves lies in the protection to wind, sun, rain and snow, of both working staff and animals. The detriment is related to high initial costs per unit surface, because of the building works, as follows:

- the bearing structure is made from metal cross frames, columns and wooden beams, belts, etc.; the walls are made with lightweight concrete up to the height of 1.20 m above the ground, or brick masonry, prefabricated sandwich type panels of folded sheet in two layers and mineral wool insulation, etc, followed by an adjustable curtain built to protect against wind and admit air, up to the roof; thermo-insulating covers (steel sheet and polyurethane foam); individual concrete and reinforced concrete foundations, or concrete continuous foundations, to avoid moisture or soil water infiltration and housing water removal require high performance hydro-insulation materials; concrete flooring, etc.; access gates from steel and aluminium profiles; interior and exterior finishes.

Individual housing has special benefits in so far disease protection is concerned, such as: lower risk for respiratory diseases; careful monitoring of each animal; easy monitoring and recording of collected data on calves. In common housing facilities, the risk of growing ill increases because of the contact among animals and individual monitoring is more difficult. As for cleanliness and hygiene, individual shelters are less exposed to manure and wastes, but the staff in charge of the farm has to provide for the cleanliness of the stall. In common shelters, however, mechanical means could be used for sanitation purposes, obviously taking care of an optimal level of hygiene to control diseases and contamination.

**CONCLUSIONS**

Raising calves in individual hutches gives the possibility of motion, individual feeding and good ventilation. Hutches should be placed so as the visual contact among animals is possible, should be oriented to the south and be erected on 15 cm thick draining material. For common shelters, the risk of falling ill increases because animals come into direct contact, individual monitoring is much more difficult, but the interaction among animals is improved. As for cleanliness and hygiene, individual stalls are less exposed to manure and wastes, but the staff in charge of the farm has to provide for the cleanliness of the stall. In common stalls, however, mechanical means could be used for sanitation purposes, obviously taking care of an optimal level of hygiene to control diseases and contamination. Irrespective of the housing system selected, animals need enough space for mobility, laying, spreading legs and growing with no difficulty. Both maintenance systems (with indoor or outdoor hutches) can be efficient only as long as the housing is kept clean, dry, well ventilated with no draft conditions and allowing for a minimum contact among the calves.

**REFERENCES**


