Bedded Pack in Vermont: Five stories

The University of Vermont
Plant and Soil Science Department
The University of Vermont EXTENSION
Dedication:
To Jonathan Rutter, whose joy, intellect, and energy infused grazing farmers throughout the northeast.

Thanks to the farmers who invested their time and patience in this project. Brent Beidler, Guy Choiniere, Earl Fournier, Steve Getz, Earl Ransom, Mark Russell, Julie Wolcott: You inspire us, and we hope your stories inspire others.

Compost pile at Rock Bottom Farm. Sawdust gives it a crumbly texture.
(Photograph courtesy of J. Colby)

This publication was developed from the stories of the farmers and the efforts of a dedicated project team. Team members include: Josh Bakelaar, Linda Berlin, Mark Cannella, Jennifer Colby, Tom Gilbert, Rachel Gilker, Allen Matthews, and Deborah Neher.
Economic analyses were conducted by Mark Cannella.
Laboratory and statistical analyses were carried out by Josh Bakelaar and Deborah Neher.

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Cover Picture: Comfortable cows relax on the pack. (Photo courtesy of J. Colby)
Dear Reader,

Happy, profitable animals are the central goal. Bedded pack housing uses a covered area to house animals on accumulated bedding materials, and it can be a path to that goal.

A bedded pack provides a comfortable place for the herd to spend the winter months, storage for manure, and, after composting the pack, a superlative amendment for pastures and hayfields. It’s a management tool to keep the herd healthy, and an alternative way to store manure. Dairy herds on bedded pack have lower incidences of mastitis and other health issues, and the system may require less labor and fuel inputs than a conventional housing and manure storage system. And favoring the long-term benefits to fields and pastures, the pack makes great compost to fertilize pastures and hayfields; using composted bedding from a pack system can provide healthy organic matter and biological activity that may improve soil quality and resiliency to drought and pest damage.

This publication will explore bedded packs in a few ways. We’ll look at how five grass-based dairy farmers use packs; each farmer has a different management style and faces different challenges. We’ll cover basic management needs for building and using a bedded pack. And along the way, we’ll review the numbers – what it costs and why, and what composted bedded pack can mean for pasture fertility.

This building helps produce food for life under the soil.

--Guy Choiniere

Comfortable cows relax on the pack. (Photo courtesy of J. Colby)
The Stories:

Farmers from Addison, Orange, and Franklin Counties opened their farms and records to us. Here are their stories:
**Swallowdale Farm in Orwell, VT:** Mark Russell has a free stall barn with 9240 square feet for the milking herd of approximately 85. The high roof of the existing structure provides plenty of clearance for the accumulation of the bedded pack. Shortly after moving to the farm, Mark invested his own sweat equity to clear out free stalls and make the barn into a structure for bedded pack.

One challenge Mark is trying to address is that the cows currently go on and off the pack all along one of the long sides of the pack. The access area is not effective as bedding, and it means that approximately 25% of the bedded pack is underutilized because of the traffic on it. By limiting the access points to the pack, less pack area will be affected by cow traffic.

The primary bedding material Mark uses is hay, with some straw. This isn’t always as absorbent as would be ideal, but it is working out alright for now. One option to improve the pack would be to mix in other materials, such as sawdust, more straw, wood chips, or even cardboard, paper or chaff. If these materials are unavailable, moisture absorption of the hay might improve by chopping it before using it as bedding. From year to year, Mark’s bedding options change as prices fluctuate and different materials become more and less locally available.

**Rock Bottom Farm in Strafford, VT:**
Earl Ransom converted part of a pole barn to make it work for bedded pack housing. There wasn’t much space, though, and Earl added bedding more frequently than he would have otherwise to compensate for the crowding. Now he’s building a new 30’ x 60’ pole barn, a simple structure with one main wall and a concrete floor. This new barn will hold another bedded pack for the dry cows and heifers, reducing the numbers on the main pack.

For several years, the primary bedding Earl used was wood chips, which Earl made from planks or sometimes got ready-made from the utility company or other sources. At the start,
wood was readily available, and relatively inexpensive. Earl bought a used chipper to use on the farm. In four years, the price of planks went from $10 per bundle to $25, and the chipper broke. In a stroke of good fortune, at the same time his chipper broke, a local business began selling sawdust at $13/yard. Earl switched to sawdust and noticed a change in the pack.

When he was using the wood chips, moisture in the pack was a problem. The wood chips have varying amounts of moisture, often around 60%, and wood chips are not very absorbent. The chips do allow liquid to drain to the bottom of the pack. To reduce pack moisture, Earl tried to aerate the pack. In some cases, mixing the top 12-18” reduced moisture at the surface and was effective at lowering the amount of bedding needed. It is not the best answer though, as in some cases it just brought the wet wood chips and moisture up to the surface. He ended up scraping the top 6” to get the pies in, dragging deeper once per week. Other methods recommended to reduce pack moisture were: adding other materials such as sawdust or smaller wood chips, use more seasoned wood chips, and improve barn ventilation.

Since Earl switched to using sawdust, he’s seen that the materials compost better and the cows stay cleaner. He found it harder to clean the pack out, but he is able to mix the materials more while they are still in the barn, double digging down 2-3 feet, in a process similar to the way one would double dig a garden. The daily aeration helps the compost process and reduces the amount of bedding needed. The sawdust that comes up to the surface is dark brown, but dry, providing more moisture absorbance.

When we visited Earl’s pastures, paddocks that had received composted bedded pack materials were noticeably greener than their neighbors, which had not received any compost or amendments. The comparison was striking walking through the adjacent paddocks, as soil quality on those hilly paddocks was originally a challenge for Earl, limiting forage production. With the addition of nutrients and organic matter, the paddocks were a visual reminder of the benefits of compost.

**Fournier Farm in Swanton, VT:** The Fournier Farm has a 2500 square foot solar barn for its heifers; about 25 heifers spend their winters on the pack. Earl likes the pack system, and would use it for the rest of the herd if he had the space. Right now, though, he has a working free-stall barn, and the rest of the herd is housed there.

The pack works well for Earl. The heifers have plenty of space. Most of the bedding for the pack is chopped straw, with sawdust around the wa-
Given the materials used, good ventilation, and the stocking rate, there’s about 10% moisture content in the pack, well within the ideal of 5-20% moisture, even with the waterers on the pack.

Earl moves the pack out and composes it, spreading the compost at up to 1.5 tons/acre on pastures and hayfields. His pastures are on level land, with reasonably good fertility. Over the years, they typically receive either compost or liquid manure from the manure pit. Nevertheless, he’s observed more resilience from pastures that have received compost than from pastures receiving only liquid manure.

Choiniere Farm in Highgate, VT:
Guy built a large solar barn with 7200 square feet of space for a bedded pack. Part of the barn also provides room for equipment storage and for chicken coops. On the pack is an automatic cow scratcher that rotates when a cow comes up and pushes against it, adding to the comfort of the herd. The chickens often run through the pack, picking apart manure patties much as they would in the pasture. The co-housing may aid in the development of the pack as well as providing egg production for added farm income.

One winter, Guy had as many as 90 cows on the pack, making it quite crowded. With the greater stocking rate, labor and bedding needs went up significantly, taking an extra hour or more a day for chores, and fifty percent more bedding materials to keep the herd clean and dry. The information shared in this publication reflects this experience. When there are 75 or fewer cows in the herd, the pack works as originally planned.

Using an average amount of bedding made up of mostly hay with some dry shavings, the pack in Guy’s barn has about 10-20% moisture. There is extremely good ventilation through the large doors on either end of the barn and through adjustable sidewalls. The herd is fed on the pack from hay bales in rings. The waterers are on the edges of the pack, which seems to work out well when the herd size is smaller. If it’s necessary to reduce pack moisture content, the waterers could be moved off the pack entirely, and the hay could be chopped to reduce particle size.

The pack provides 800 tons of materials to compost for application to pastures and hayfields. Guy hires in help to move the pack out to the field, where it is piled in windrows to compost. A year or so later, he
spreads it onto fields and pastures that need amendments. Very invested in soil biological qualities, Guy appreciates the composted pack for its biological enhancement of the soil as well as the comfortable housing the pack provides for the herd.

**Dancing Cow Farm in Bridport, VT:** Steve Getz built a 3200 square foot solar barn for his herd of 28. He built it relatively inexpensively, using wood-sided walls to cut down on costs. Ventilation for the solar barn and pack was extremely good, through large doors on either end of the barn. As this goes to press, Steve has sold his herd and he’s not farming, but the barn is there for another herd and bedded pack.

When Steve began a bedded pack, he used a base 20 bales of mulch hay. Then he put down straw bales from Canada. He used approximately 1 ½ straw bales (650 lbs per bale) daily, first bringing them out with a tractor and then spreading it by hand. The herd used the barn throughout the winter, and they also had access to the barnyard for water. If the ground was well frozen, hay was supplied on a nearby pasture as well. With only about 25 Jerseys using the pack, the stocking rate was low and the pack’s moisture content was as well, at 5-10%. Steve was using about twice as much bedding as needed, and he could have increased the herd size as well, if he had wanted to. The farm produced Dancing Cow Cheese, though, and the herd size fit the batches they made each day. Balancing herd size and barn size can be a challenge in both directions of the scale.

In the spring or summer, Steve hired a contractor to clean out the pack, paying about $2000 for the materials to be put into windrows in the field. Once the materials composted, Steve applied them at 4-5 tons/acre to hayfields low in nutrients. When the compost was sampled, it seemed that the straw didn’t break down as well as would be desired, leaving a C:N ratio of 18:1, somewhat higher than the anticipated 10-12:1. Because of the high moisture content of the composting pack, it would benefit from smaller windrows affording more aeration, or turning in the first 4-6 weeks of the composting process. Applying compost with a high carbon to nitrogen ratio can lead to microorganisms binding up nitrogen in the soil, causing nitrogen deficiencies for crops.
Table 1: A snapshot of five Vermont dairy farms using bedded packs. ¹

<table>
<thead>
<tr>
<th></th>
<th>Choiniere Farm</th>
<th>Fournier Farm</th>
<th>Dancing Cow Farm</th>
<th>Rock Bottom Farm</th>
<th>Swallowdale Farm</th>
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<tbody>
<tr>
<td>Herd size</td>
<td>115</td>
<td>153</td>
<td>40</td>
<td>95</td>
<td>172</td>
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<tr>
<td>On the pack</td>
<td>90</td>
<td>25</td>
<td>28</td>
<td>47</td>
<td>80</td>
</tr>
<tr>
<td>Bedding</td>
<td>Round bales</td>
<td>Large square straw bales</td>
<td>Large square straw bales</td>
<td>Wood chips</td>
<td>Round bales</td>
</tr>
<tr>
<td>Base</td>
<td>Wood chips and straw</td>
<td>Sawdust</td>
<td>Mulch hay bales</td>
<td>Wood chips</td>
<td>Wood chips</td>
</tr>
<tr>
<td>Bedding rate, daily</td>
<td>27.5 lbs/cow</td>
<td>12 lbs/cow</td>
<td>54 lbs/cow</td>
<td>6 lbs/cow</td>
<td>4 lbs/cow</td>
</tr>
<tr>
<td>Barn Facility</td>
<td>Solar, 7200+ sq. ft., built for $105,000 in 2005</td>
<td>Solar, 4000 sq. ft., built for $75,000 in 2006</td>
<td>Solar, 3200 sq. ft., built for $20,000 in 2003</td>
<td>Pole barn modified by building up concrete walls for $6500</td>
<td>Free-stall barn, 9240 sq. ft. Free stalls were removed @ $300</td>
</tr>
<tr>
<td>Labor per week (hours)</td>
<td>21</td>
<td>0.75</td>
<td>1</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Annual operating expenses</td>
<td>$40,726*</td>
<td>$9,914</td>
<td>$31,450</td>
<td>$14,761*</td>
<td>$14,935</td>
</tr>
<tr>
<td>Cost per cow/day</td>
<td>$5.03</td>
<td>$2.23</td>
<td>$7.28</td>
<td>$3.27</td>
<td>$2.07</td>
</tr>
</tbody>
</table>

¹Guy Choiniere’s costs for this year reflect the crowded herd. Guy estimates that a typical year’s cost to manage the bedded pack are around $10,000, or $1.33 per cow. Earl Ransom’s costs are calculated based on his use of wood chips. The switch to sawdust is captured in the section on financial analysis.

The bedded pack

If you don’t have a bedded pack and you’re thinking about getting one, here are some of the considerations:

Where are you going to put it? Installing a bedded pack can mean adapting an existing structure or building a new one. The facility needs to have 80-150 square feet for each cow to be housed, depending on the size of the animals (assuming cows here, but this system works for a variety of animals including sheep, goats and pigs). For smaller Jerseys, only 65 square feet per cow are necessary, but for Holsteins, 100 square feet per cow is recommended. If you squeeze too many animals onto the pack, you are sure to regret it. Labor and bedding needs go up astronomically. When Guy

¹ More details and an explanation of the assumptions used are included in the final pages of this publication.
Choiniere housed ten extra cows on his pack, he found himself spending one to one-and-a-half extra hours and another round bale every day to keep the animals and pack reasonably clean and dry.

**Do I have enough vertical space?** Sidewalls are typically concrete, but could be wood. As the pack builds up, a great deal of pressure is exerted outward, so choosing the most appropriate sidewalls can affect the life of the facility. Expect at least 4-5’ of accumulated bedding over the course of housing. Clearance overhead, particularly in doorways, should be high enough to ride a tractor through—with the added bedding present. Ventilation is key for the pack and barn to perform well. Costs to build a solar barn for bedded pack housing range from $700-1700 per animal, depending on wall types, doors, and other features. Many solar barns have sides that can be adjusted or large doors on either end for cross ventilation. This ventilation is extremely helpful in managing moisture for a cleaner pack.

**What are you going to use for bedding?** This is really the biggest question and the main obstacle and biggest ongoing expense farmers face in using bedded pack housing. The materials you use are subject to availability. Finding a source for bedding can be difficult, and as discussed above, sources and bedding types can change from year to year.

Bedding costs are much higher for a bedded pack than for any other housing, using four times as much bedding as a typical freestall barn. For the five farmers described here, the average cost of housing per cow per day was $3.98, with a range of $2.07 to $7.28. Labor needs varied widely, from a few minutes to a few hours each day.

The variations were mostly because of the difference in herd size and packs. The high costs and time spent were when a farmer was forced to house too many animals in too small a space, or when a farmer added more bedding than was truly needed. For the more typical bedded packs, we found that farmers were spending about an hour each day managing them, and about $2-3 per cow per day. Details about costs are in Table 1 and also in the financial analysis section at the end of this publication.

**Reducing pack moisture: Ideally, pack moisture content will be at about 5-20%.**

1. Good pack materials. Using adequate amounts of blended bedding materials that absorb moisture will aid in reducing pack moisture. If you drop to your knees and your pants get wet, then you need to add more bedding.
2. Good ventilation. Having cross ventilation will reduce pack moisture.
3. Aeration. Turning the pack can work moisture into the pack for better absorption.
4. Keep the waterer off the pack. Locate waterers off the pack, or along the sides. Sawdust and other absorbent materials may be useful around the waterer.
5. Start with a good base. A foot or more of materials is helpful. Wood chips and other absorbing materials are useful in the base.
To build your pack, you may use hay, wood chips, shavings, sawdust, or straw. Any of these materials can be useful, although you may appreciate the qualities of some more than others. See Table 2 for a side-by-side comparison. For example, hay doesn’t work as well as straw, and processed straw is even easier to work with. If you use wood chips, make sure they are well cut, and not jagged edged. There are a lot of options, and you don’t have to stick with just one product. In fact, one of the best choices is to use a mix of different products. Sawdust and wood chips, for example, or hay and sawdust can be used together. This will take advantage of the absorptive properties of sawdust and the loft of hay or wood chips. One farmer added chopped corn stalks to sawdust and noticed the 50/50 mix stretched his bedding, composted better, and made a firmer easier surface for his cows to walk upon.
Using a mix of bedding types improves the compost, with each product bringing its own advantages and disadvantages. See Table 2 for a comparison of different bedding materials.

No matter what type of bedding you decide to use, it’s important not cut corners on the amount and frequency of application, in order to achieve the best results.

**Building and managing the pack:** When you start your pack, you want to put in a good base, at least

![Earl Ransom walks through the pastures. (Photo courtesy of J. Brown)](image)

Table 2: Bedding materials for bedded packs. Recommendations are for 10-30 lbs/cow/day.

<table>
<thead>
<tr>
<th>Material</th>
<th>Pros</th>
<th>Cons</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Softwood Sawdust</td>
<td>Low bacterial growth</td>
<td>Increasingly costly</td>
<td>Dry sawdust preferable (15% MC if possible)</td>
</tr>
<tr>
<td></td>
<td>Locally available</td>
<td>Poor air circulation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Easily aerated for composting</td>
<td>Small particle size can cause teat irritation</td>
<td></td>
</tr>
<tr>
<td>Hardwood Sawdust</td>
<td>Easily aerated for composting</td>
<td>High bacterial growth</td>
<td>Dry sawdust preferable (15% MC if possible)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Less locally available</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Small particle size can cause teat irritation</td>
<td></td>
</tr>
<tr>
<td>Whole Straw</td>
<td>Excellent cow comfort</td>
<td>Expensive</td>
<td>Organic producers must use organic straw</td>
</tr>
<tr>
<td></td>
<td>Improved pack structure for aeration</td>
<td>Difficult to aerate for compost bedded pack system</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good structure for windrow composting</td>
<td>Limited moisture absorption</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Large particle size may reduce bacterial growth and mastitis</td>
<td>Can make removal challenging</td>
<td></td>
</tr>
<tr>
<td>Chopped Straw</td>
<td>Improved moisture absorption over whole straw</td>
<td>Requires chopping</td>
<td>Organic producers must use organic straw</td>
</tr>
<tr>
<td></td>
<td>Potentially suitable for aerating during composting</td>
<td>May be more irritating to teat ends than whole straw</td>
<td>Desirable chop length is 3-4”</td>
</tr>
<tr>
<td></td>
<td>Moderate structure for windrow composting</td>
<td>May stick to udder more</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chopping process can be combined with spreading on pack</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood Chips</td>
<td>Easily aerated for composting</td>
<td>Not very absorbent</td>
<td>Need to cut clean edges on chips</td>
</tr>
<tr>
<td></td>
<td>Locally available</td>
<td>Rough cut ends may hurt teats</td>
<td>May be most cost effective to get a chipper</td>
</tr>
<tr>
<td></td>
<td>May be relatively inexpensive</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a foot or so of something absor-
bent. Wood chips can work well
here. Over the course of the sea-
son, you should add more bed-
ding at least once or twice per
week, but optimally, daily. If
manure is sticking to the sides
of the animals, then bedding
is needed. The more crowded
the barn, the more frequently
you’ll want to add bedding.

One aspect to maximizing
cow comfort is ensuring that
the bedding is relatively firm.
The type of bedding used and
moisture content are impor-
tant in creating a firm pack for
herd traffic. Keeping the pack
at low moisture content is important here. If you
are using primarily hay or straw, adding some
wood chips can also firm up the pack.

Cleaning out the pack: Typically, the pack is
cleaned out once each year, after the herd comes
off it. In some cases, the pack may be cleaned
out once in the winter, perhaps during a January
thaw. This may be necessary if the height of the
pack limits head room.

Wood bedding materials and compost: a word to the wise

Use of wood-based bedding products
may yield a high C:N ratio (parts car-on to parts nitrogen). Compost is
ideally in the 20:1 or 30:1 range C:N
ratio. Excess carbon slows decomposi-
tion and traps nitrogen. Using a blend
of pack materials and then proper
mixing of the composting materials
can help make sure the C:N ratio is
in range.

Example: One farmer was using saw-
dust for a lot of his bedding. One of
the samples of his bedded pack came
back with a 41:1 C:N ratio. This sam-
pel was taken from around the wa-
terers, where he puts down sawdust.
Other samples had 19:1-21:1 ratios.
Good blending will ensure that the
pack is well suited to compost.

All the farmers interviewed pre-
ferred to clean out the pack using
larger equipment. Several of
the farmers hired contractors to
move out the pack, paying ap-
proximately $1500-2000 to have
the materials moved into a spot
for composting, piled in wind-
rows. In some cases, the farmers
scraped the pack into a windrow
in the solar barn for compost-
ing through the growing season,
moving it out in the fall when
the herd would be coming onto
the pack again.

Composting the pack: One of the
benefits of the pack is in creating
compost that can be used as an
amendment for fields or pastures. The best and
most frequently used strategy to create that com-
post is through a windrow, a long pile, approxi-
mately 6-7’ high and 12-14’ wide.

The pile may be composted passively or aerated.
Many farmers were interested in turning their
compost, but had reservations about how often
and when, in addition to being limited in the time
available to do so. The recipe for aeration under a
tight schedule is to turn the pile 2-3 times over the first 6 weeks, and then to leave it until it is complete. When possible, temperature monitoring and frequent turning can be used to make composting more efficient and effective.

The pack improves the farm, not just the herd: Compost is one of the best amendments to apply to pastures and fields for the many potential benefits to soil quality: nutrient content, enhanced water holding capacity, soil biological activity, and many more.

We sampled pastures receiving composted bedded pack and compared them to pastures receiving either no other amendments or liquid manure. Under bedded pack materials, pastures showed signs of improved soil biological activity, greater nutrient cycling, and potentially higher forage production (Bakelaar J., 2012. Effects of season extension pasture management in Vermont. University of Vermont).

To pack or not to pack:

All of the farmers we’ve talked to are really glad to have bedded packs for their herds. Those who use the packs for only part of their herds would gladly convert existing structures to bedded pack housing if it were feasible.

However, bedded pack housing is not feasible for all existing barns or farms. Bedding costs are much higher than for typical housing systems, and in some places, there is not much suitable bedding available.

Sometimes, it is possible to address these challenges, and if so, we’d be happy to help.

If you are considering a bedded pack for your farm, we hope this publication has been useful, and invite you to contact us for more information specific to your situation.
### Description of Financial Calculations

The figures presented in this report were developed from information collected from a written survey and farmer interviews. Farmers provided information that was specific to the installation or maintenance of the bedded pack system. These figures were not collected from comprehensive farm financial statements or tax records.

Several assumptions were made to facilitate comparison between the 5 farms in this study. Both cash and non-cash expenses are included in the analysis.

- **Animal Days** = \( \frac{(\text{Number of animals x Annual days on pack x Hours per day on pack})}{24 \text{ hours}} \)
- **Square Feet of Pack Per Animal** = \( \frac{\text{Square feet of barn (less unused or non-pack space)}/\text{number of animals on pack}}{\text{Distinction between animals' size was not made. For example, Jerseys are significantly smaller than Holsteins, and space requirements are typically lower. This was not reflected in the calculations.}} \)
- **Pro-rated Annual Building Expense (Option A)** = Initial Building Expense / 20 year lifespan
- **Pro-rated Annual Building Expense (Option B)** = Building Improvements / 5 year lifespan
- **Annual Operating Expenses** = (Pro-rated building expense + base build up cost + bedding cost + machinery cost + clean out cost + spreading cost)
- **Total Annual Labor (hrs)** = Base build up time + (weekly bedding time x weeks in use) + clean out time
- **Hourly Machinery Cost** = $75 per hour for machine and operator

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<table>
<thead>
<tr>
<th></th>
<th>TOTAL ANIMALS (mature &amp; young)</th>
<th>ANIMALS ON PACK</th>
<th>DAYS ON PACK</th>
<th>SQ FT PACK PER ANIMAL</th>
<th>CONSTRUCTION COSTS</th>
<th>BUILDING IMPROVEMENTS</th>
<th>ANNUAL OPERATING EXPENSES</th>
<th>ANNUAL OPERATING EXPENSES PER ANIMAL DAYS</th>
<th>TOTAL ANNUAL LABOR (hr)</th>
<th>WEEKLY LABOR TO MAINTAIN (hr)</th>
<th>TOTAL LABOR PER ANIMAL DAY (hr)</th>
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<tbody>
<tr>
<td>Choiniere</td>
<td>115</td>
<td>90</td>
<td>180</td>
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<td>$105,000</td>
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<td>$40,726</td>
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<td>0.07</td>
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<td>Fournier</td>
<td>153</td>
<td>25</td>
<td>237</td>
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<td>$9,914</td>
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<td>Ransom 2*</td>
<td>95</td>
<td>47</td>
<td>190</td>
<td>96</td>
<td></td>
<td>$6,500</td>
<td>$19,945</td>
<td>$4.42</td>
<td>206</td>
<td>5</td>
<td>0.05</td>
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<tr>
<td>Russell</td>
<td>172</td>
<td>80</td>
<td>180</td>
<td>116</td>
<td></td>
<td>$300</td>
<td>$14,935</td>
<td>$2.07</td>
<td>210</td>
<td>7</td>
<td>0.03</td>
</tr>
</tbody>
</table>

*After the initial analysis, Earl Ransom switched from a wood chip pack to a sawdust pack. The Ransom 2 figures account for increased cash expenses to utilize this new bedding source, but the figures do not reflect a proposed reduction in farm labor from the change.

Note: The mean, median, minimum and maximum calculations do not include Ransom 2 data.

### Description of Financial Calculations

The figures presented in this report were developed from information collected from a written survey and farmer interviews. Farmers provided information that was specific to the installation or maintenance of the bedded pack system. These figures were not collected from comprehensive farm financial statements or tax records.

Several assumptions were made to facilitate comparison between the 5 farms in this study. Both cash and non-cash expenses are included in the analysis.

- **Animal Days** = \( \frac{(\text{Number of animals x Annual days on pack x Hours per day on pack})}{24 \text{ hours}} \)
- **Square Feet of Pack Per Animal** = \( \frac{\text{Square feet of barn (less unused or non-pack space)}/\text{number of animals on pack}}{\text{Distinction between animals' size was not made. For example, Jerseys are significantly smaller than Holsteins, and space requirements are typically lower. This was not reflected in the calculations.}} \)
- **Pro-rated Annual Building Expense (Option A)** = Initial Building Expense / 20 year lifespan
- **Pro-rated Annual Building Expense (Option B)** = Building Improvements / 5 year lifespan
- **Annual Operating Expenses** = (Pro-rated building expense + base build up cost + bedding cost + machinery cost + clean out cost + spreading cost)
- **Total Annual Labor (hrs)** = Base build up time + (weekly bedding time x weeks in use) + clean out time
- **Hourly Machinery Cost** = $75 per hour for machine and operator