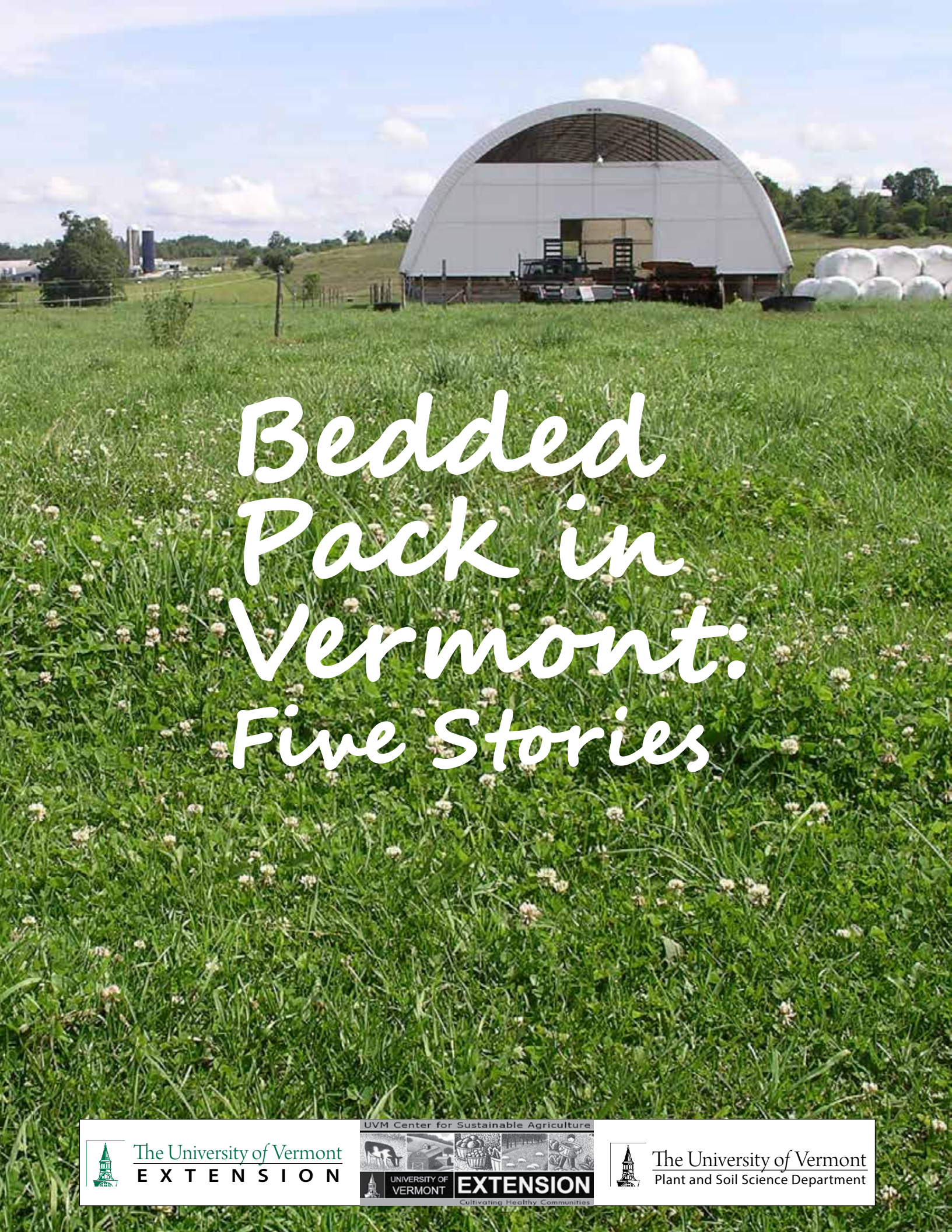

Bedded Pack in Vermont: Five Stories

The University of Vermont EXTENSION

UVM Center for Sustainable Agriculture
UNIVERSITY OF VERMONT EXTENSION
Cultivating Healthy Communities

The University of Vermont
Plant and Soil Science Department

Compost pile of bedded pack materials at Rock Bottom Farm. Sawdust gives it a crumbly texture. (Photo courtesy of J. Brown)

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.

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Cover Picture: *Solar barn housing a bedded pack at Guy Choiniere's farm. (Photo courtesy of J. Colby)*

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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, Kyle Thygesen, Julie Wolcott: You inspire us, and we hope your stories inspire others.

The bedded pack at Guy Choiniere's farm. (Photo courtesy of J. Colby)

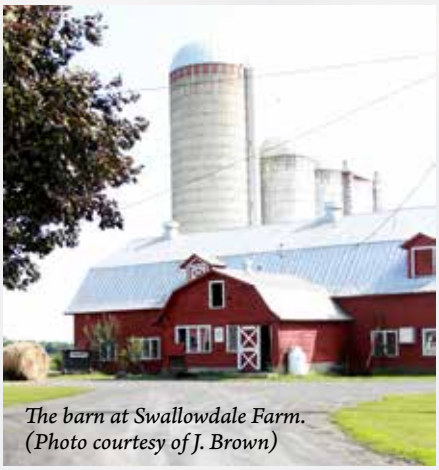
The Stories: Farmers from Addison, Orange, and Franklin Counties opened their farms and records to us. Here are their stories.

Happy, healthy, profitable animals are the central goal of livestock farmers. Bedded pack housing can be a path to that goal.

Simply put, bedded pack refers to accumulated bedding materials and manure under covered housing. The farmer using a bedded pack starts with an initial thick layer of bedding, adding more daily or weekly. The herd is housed on the pack during the dormant season, lounging, loafing, and eating there. The bedded pack ends up being several feet thick by spring. In the winter, it provides a comfortable place for the herd to spend the cold months, storage for manure, and, after composting the pack, a superlative amendment for pastures and hayfields.

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.



The barn at Swallowdale Farm. (Photo courtesy of J. Brown)

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.

Mark and Sarah Russell (Photo courtesy of J. Brown)

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 hasn't been as absorbent as would be ideal. This winter, he'll be using processed hay, which should make a difference in moisture control. 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.

Pack materials compost near the pastures they will soon be fertilizing (Photo courtesy of J. Colby)

The clay soils are benefitting from compost applications. Mark sees the compost as adding much needed water-holding capacity, giving pastures resilience in dry spells.

Amy Huyfer and Earl Ransom in the pack barn at Rock Bottom Farm. (Photo courtesy of J. Brown)

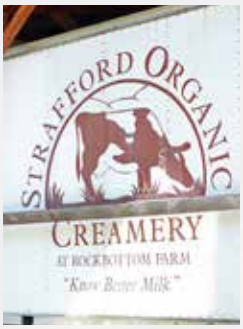
Rock Bottom Farm in Strafford, VT:

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.

The pack has been cleared out of Earl Ransom's barn. (Photo courtesy of J. Brown)



(Photo courtesy of J. Brown)

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: add 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.

Earl Fournier in front of his pack barn. (Photo courtesy of J. Brown)

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 Fournier 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.

Sign in front of the Fournier Farm. (Photo courtesy of J. Brown)

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 waterers. 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 composts 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.

The exterior of Earl Fournier's pack barn. Large overhead doors provide access for equipment as well as ventilation. (Photo courtesy of J. Brown)

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

Choiniere Family Farm in Highgate, VT:

Guy Choiniere built a large solar barn with 7200 square feet of space for a bedded pack. It's an airy building with adjustable sides, and 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.

Part of the barn also provides room for equipment storage and for chicken coops. The chickens often run through the pack, picking apart manure patties 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.

Chickens pick through the pack at Guy Choiniere's farm. (Photo courtesy of J. Colby)

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 the herd.

Guy explains the management of his bedded pack. (Photo courtesy of J. Colby)

Dancing Cow Farm in Bridport, VT:

Steve Getz with one of his herd. His bedded pack is in the background. (Photo courtesy of J. Colby)

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 and the system worked very well. 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 of 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, if he had wanted to. The farm produced Dancing Cow Cheese, though, and the herd size fit the batches of cheese 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 out 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.

The bedded pack at Dancing Cow Farm is in a wood-sided solar barn. Steve points out the clean layer of bedding covering the pack. (Photo courtesy of J. Colby)

Table 1: A snapshot of five Vermont dairy farms using bedded packs. [1]

	Choiniere Farm	Fournier Farm	Dancing Cow Farm	Rock Bottom Farm	Swallowdale Farm
Herd size	115	153	40	95	172
On the pack	90	25	25	47	80
Bedding	Round bales	Large square straw bales	Large square straw bales	Wood chips	Round bales
Base	Wood chips and straw	Sawdust	Mulch hay bales	Wood chips	Wood chips
Bedding rate, daily	27.5 lbs/cow	12 lbs/cow	54 lbs/cow	6 lbs/cow	4 lbs/cow
Barn Facility	Solar, 7200+ sq. ft., built for $105,000 in 2005	Solar, 4000 sq. ft., built for $75,000 in 2006	Solar, 3200 sq. ft., built for $20,000 in 2003	Pole barn modified by building up concrete walls for $6500	Free-stall barn, 9240 sq. ft. Free stalls were removed @ $300
Labor per week (hours)	21	0.75	1	5	7
Annual operating expenses	$40,726*	$9,914	$31,450	$14,761*	$14,935
Cost per cow/day	$5.03	$2.23	$3.49	$3.27	$2.07

**Guy 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.*

[1] More details and an explanation of the assumptions used are included in the final pages of this publication.

The bedded pack

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

In late summer, the pack at the Russell's farm is composting in preparation for clean out. (Photo courtesy of J. Brown)

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 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. 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. Ventilation is extremely helpful in managing moisture for a cleaner pack, and as the Russells have seen, can be found in structures other than solar barns.

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.

Spreading pack materials. (Photo courtesy of J. Colby)

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.

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

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 $5.03. Labor needs varied widely, from a few minutes to a few hours each day.

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.

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. These are shared in Table 2 below.

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

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

Modified from Gilbert, T. September 2009. *Bedded Pack Materials for Bedded-Pack Barns.* Northeast Organic Farming Association of Vermont Dairy & Livestock Technical Assistance Program Newsletter.

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.

Mark Russell stands near his bedded pack to explain the system, and how it is working on his farm. (Photo courtesy of J. Colby)

Building and managing the pack: When you start your pack, you want to put in a good base, at least a foot or so of something absorbent. Wood chips can work well here. Over the course of the season, you should add more bedding 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 important 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.

A cow scratcher on the pack at Guy Choiniere's farm for even more cow comfort. (Photo courtesy of J. Colby)

The pack has been cleared out of Earl Ransom's barn. (Photo courtesy of J. Brown)

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.

All the farmers interviewed preferred to clean out the pack using larger equipment. Several of the farmers hired contractors to move out the pack, paying approximately $1500-2000 to have the materials moved into a spot for composting, piled in windrows. In some cases, the farmers scraped the pack into a windrow in the solar barn for composting 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 compost is through a windrow, a long pile, approximately 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.

Wood bedding materials and compost: a word to the wise

Use of wood-based bedding products may yield a high C:N ratio (parts carbon to parts nitrogen). Compost is ideally in the 20:1 or 30:1 range C:N ratio. Excess carbon slows decomposition 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 sawdust for a lot of his bedding. One of the samples of his bedded pack came back with a 41:1 C:N ratio. This sample was taken from around the waterers, 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.

Earl Ransom examines composting pack materials. The inner portion of the pile is much warmer, and grey matter seen is fungal activity. (Photo courtesy of J. Brown)

Cows coming back for milking at the Fournier Farm. (Photo courtesy of R. Gilker)

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).

(Photo courtesy of J. Brown)

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.

Using a long-tipped thermometer, Guy Choiniere examines the temperature of the bedded pack as it composts in place. (Photo courtesy of J. Colby)

Cows relax by the adjustable walls in Guy Choiniere's barn. (Photo courtesy of J. Colby)

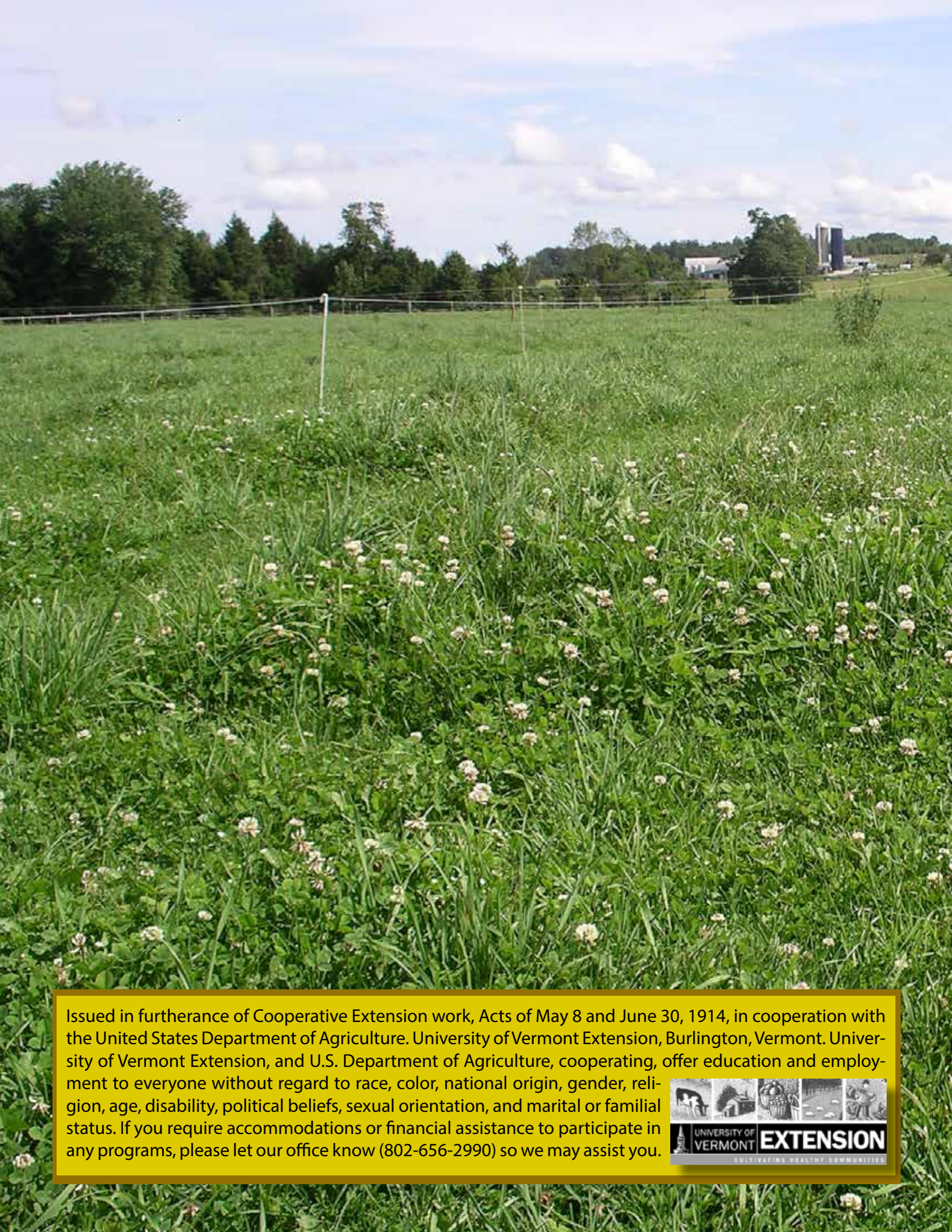
Economic Analysis of Bedded Packs on Five Dairy Farms in Vermont

	TOTAL ANIMALS (mature & young)	ANIMALS ON PACK	DAYS ON PACK	SQ FT PACK PER ANIMAL	CONSTRUCTION COSTS	BUILDING IMPROVEMENTS	ANNUAL OPERATING EXPENSES	ANNUAL OPERATING EXPENSES PER ANIMAL DAYS	TOTAL ANNUAL LABOR (hr)	WEEKLY LABOR TO MAINTAIN (hr)	TOTAL LABOR PER ANIMAL DAY (hr)
Choiniere	115	90	180	80	$105,000		$40,726	$5.03	567	21	0.07
Fournier	153	25	237	160	$75,000		$9,914	$2.23	42	0.75	0.01
Getz	40	25	360	266	$18,750		$31,450	$3.49	69	1	0.01
Ransom	95	47	190	96		$6,500	$14,761	$3.27	206	5	0.02
Ransom 2*	95	47	190	96		$6,500	$19,945	$4.42	206	5	0.05
Russell	172	80	180	116		$300	$14,935	$2.07	210	7	0.03
Mean					$62,500		$22,357	$3.22	219	6.95	0.03
Median					$75,000		$14,848	$2.75	206	5	0.03
Max					$105,000		$40,726	$5.03	567	21	0.07
Min					$18,750		$9,914	$2.07	42	0.75	0.01

*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.
Famers 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 = (Number of animals x Annual days on pack x Hours per day on pack)/24 hours
Square Feet of Pack Per Animal = Square feet of barn (less unused or non-pack space)/number of animals on pack. 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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