NORTHEAST MANURE MANAGEMENT PROJECT

Project Co-operators:
Alberta Environmentally Sustainable Agriculture (AESA)
Northeast Conservation Connection
County of Two Hills
Alberta Agriculture, Food & Rural Development
Highland Feeders Limited

Manure management has become an issue for today's livestock producer as we become more aware of our role as environmental stewards. One part of the solution of manure management being promoted is composting. Composting is described as a natural stabilization of manure using endemic aerobic bacteria and an external carbon source (straw). The Olds College Composting Technology Center has researched composting, developed standards and procedures and promote it as a viable and potentially cost-effective method of handling feedlot manure since it reduces the volume of manure, controls odour, weeds and pathogens.
The goal of our manure management project was to raise awareness of methods of reducing manure volume, reducing odour and promoting manure as a nutrient source with the ability to viably transfer these processes to the cow-calf producer. To reduce manure volume we evaluated the composting process, variations of composting and a bacterial product promoted to enhance the composting process (BTM). To encourage a change in management economics are an integral part of the evaluation, thus economic evaluation was an important aspect of our project. The partners involved in the project include Highland Feeders, County of Two Hills, Northeast Conservation Connection and Alberta Agriculture. This project was funded largely by the Alberta Environmentally Sustainable Agriculture Program (AESA).

It is important to mention that this is a demonstration project targeted towards providing valuable information to producers, it is not research (no replication or statistical analysis, etc.)

The project was established on April 29 with the construction of five piles of manure, each with the following treatment:

1) COMPOST - pile was turned on June 2, July 6 and August 6.
2) PILED - pile was turned once on July 6.
3) CONTROL - manure placed on a pile and not disturbed.
4) BTMX1 - bacterial product applied to the pile at recommended rate and mixed in.
5) BTMX2 - bacterial product applied at 2X rate to pile and mixed in.

The piles were turned with a front-end loader tractor. The composition of the manure was fairly uniform and it did contain a high straw content.
Each pile was measured by weight at creation (AVG=32MT, dimensions = 3 meters wide, 15 meters long and 2 meters high) and at completion of the project when we spread the piles on September 2. A nutrient analysis of each treatment was done at the start of the project and the end for moisture, nitrogen, phosphorous, potassium, sodium, chloride, copper, zinc, manganese, total carbon and etc.. The germination of weed seeds from each treatment were evaluated. The temperature of each treatment was monitored throughout the project by data logger. odour differentials between treatments and in comparison to raw manure were measured when the manure was spread at project completion. Finally we evaluated the economics of incorporating each of our 5 treatments into an average 100 cow-calf operation and their effects on the costs of manure spreading.

The composting process was very successful at reducing manure mass.

FIGURE 1

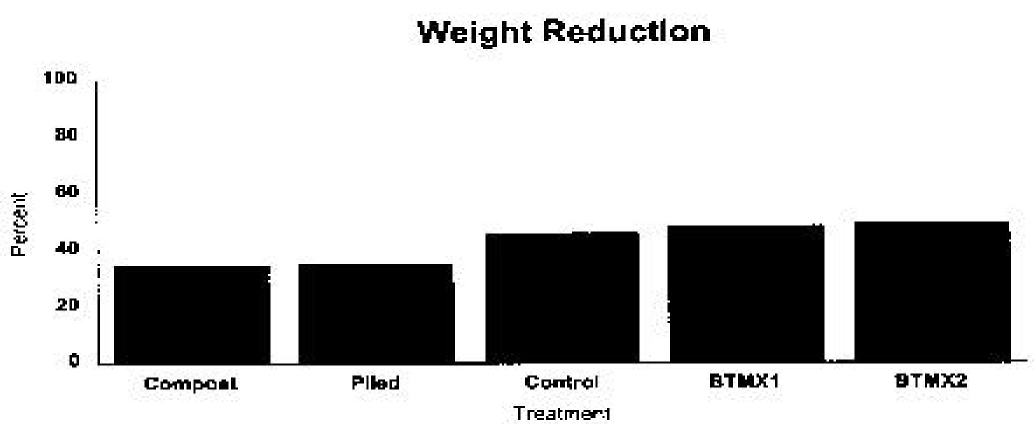
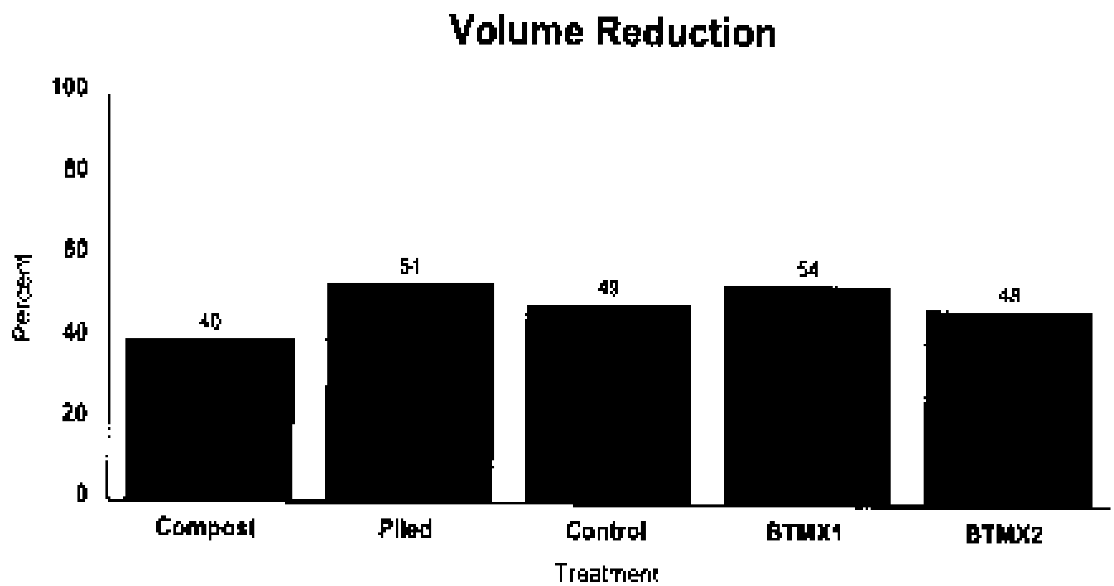


Figure 1 shows the reduction in weight of manure that was achieved as compared to the weight of the original pile. Composting reduced the initial manure pile to 35% as compared to the control pile at 46%. As shown by the control treatment, just moving the manure once, into a pile, reduced the mass of manure in half. The treatments that received the bacterial product promoted to showed no improvement in mass reduction as compared to the control treatment.

Just as important as measuring weight is measuring volume. To reduce the number of loads the manure spreader hauls to the field we must reduce volume along with weight because the spreader box still holds the same amount. The following graph (figure 2) shows the reduction in the volume of the manure piles as a percentage of their original volume.

FIGURE 2



We can see that the volume of all treatments were reduced by approximately 50%, with the volume of the compost treatment reduced the most at about 10% less than the other treatments. By comparing figures 1 and 2 we can conclude that for each treatment volume reduction loosely follows its corresponding reduction in weight.

The nutrient composition of the treatments at the beginning of the project (in essence, raw manure) and at completion are displayed in Figures 3 and 4 respectively.

FIGURE 3

April 29, 1998	lb/MT dry basis				
	Compost	**Piled**	**Control**	**BTMX1**	**BTMX2**
Moisture @ 60C	69%	74%	72%	70%	71%
Nitrogen	43	34	43	35	35
Phosphorous	12	10	13	11	11
Potassium	48	45	47	39	42
Sodium	12	11	11	9	10
Chloride	27	23	25	19	21
Copper	0.06	0.05	0.06	0.05	0.05
Zinc	0.3	0.23	0.31	0.24	0.24
Manganese	0.29	0.24	0.27	0.27	0.25
Total Carbon	1206	1140	1230	1160	1217
E.C.	66	64	64	63	69

FIGURE 4

September 2, 1998	lb/MT dry basis				
	Compost	**Piled**	**Control**	**BTMX1**	**BTMX2**
Moisture @ 60C	23%	44%	47%	68%	45%
Nitrogen	45	63	66	42	42
Phosphorous	18	24	22	15	13
Potassium	53	68	60	38	42
Sodium	12	16	15	8	10
Chloride	23	31	23	19	19
Copper	0.08	0.09	0.07	0.04	0.05
Zinc	0.36	0.49	0.44	0.44	0.29
Manganese	0.53	0.46	0.47	0.44	0.58
Total Carbon	802	1043	1135	990	666
E.C.	54	71	63	39	45

The moisture content of the compost, piled and control treatments show a reduction in relation to the number of times these treatments were turned. Most importantly, it shows that when we haul raw manure, we are hauling a lot of water.

Figure 5 shows the nutrient content of the manure from the piled treatment on a lb/ac basis based upon the average custom application rate utilized in the Northeast, of 4 MT/ac.

FIGURE 5

MANURE APPLICATION RATE 4 MT/ac
(Piled Treatment)

	Nutrients Applied	**Nutrient Requirements of Barley (60bu/ac)**
	lb/ac	**lb/ac**
Nitrogen	50	88
Phosphorous	54	29
Potassium	154	84
Sodium	37	
Chloride	71	
Copper	0.21	
Zinc	1.08	
Manganese	1.02	
Total Carbon	2349	

The application of phosphorous exceeds the requirements of the barley crop, so we can see the need to soil test and apply the manure at rates matched to crop requirements so we do not introduce nutrient imbalances into our soil.

The following figure (figure 6) displays the dollar value of the nutrients contained in the manure. Utilizing the application rate data in figure 5, the dollar value for the application of the manure from the piled treatment at a rate of 4 MT/ac calculates to $52.04/ac worth of nutrients being applied. Expressed on a $/MT basis, the value of the macronutrients in the manure from the piled treatment are worth $13.01/MT.

FIGURE 6

VALUE OF NUTRIENTS

Fertilizer	$/MT	**Manure**	$/MT	@ 4 MT/ac application rate
46-0-0	$250.00	**Nitrogen**	$3.15	$12.60
12-51-0	$400.00	**Phosphorous**	$4.87	$19.48
0-0-60	$170.00	**Potassium**	$4.99	$19.96
			$13.01	**$52.04**

Temperature of the treatments were monitored because there are two important temperature related aspects. First, if the pile achieves a temperature of >63C weed seeds will lose their viability. Second, if the pile achieves a temperature of >55C for 2 days pathogens will be killed. Figure 7 shows the temperature of the compost treatment as compared to the control treatment.

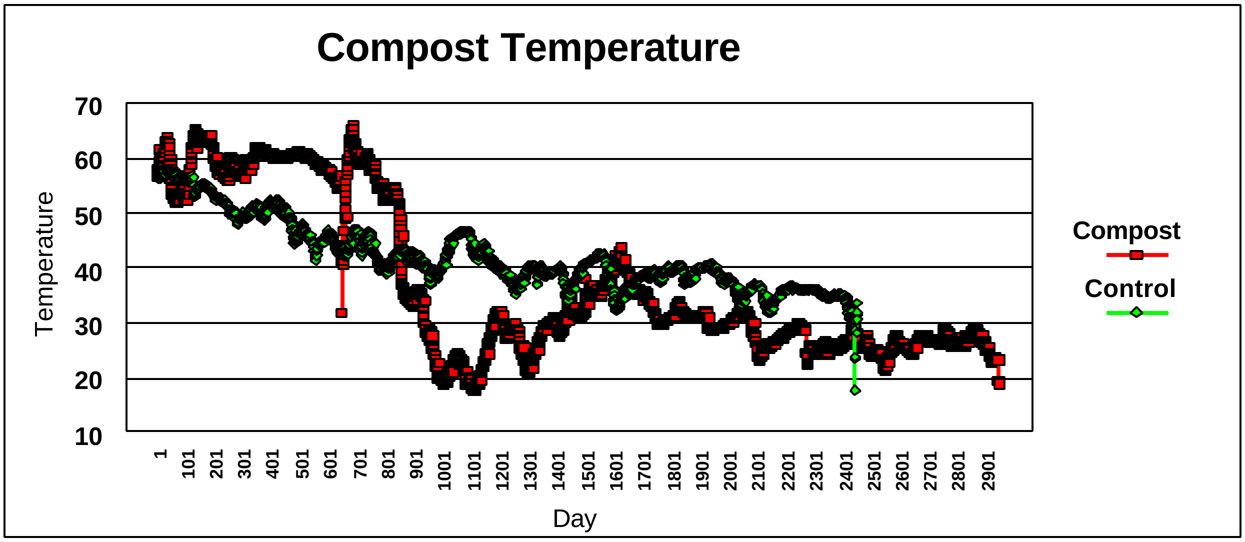


FIGURE 7

The compost pile achieved the temperature requirements to disable weed seeds and pathogens. It is visible on the graph when the compost pile was turned as the temperature of the pile increased at 750, 1550 and 2400 time units.

We attempted to evaluate the effects the different treatments would have on weed seed viability. We were unable to achieve any comparisons because no weeds grew out of any of the treatments. As mentioned previously, if the temperature of the pile reaches >63C weed seeds will become unviable.

The texture of the manure from the compost treatment is worth noting. The compost manure could be described as an almost A peatmoss type of product. With a moisture content of 23% the compost was very dry, loose, uniform and spread very evenly. These characteristics are especially valuable if a producer has to spread manure on forage or crop land that is direct seeded.

Odour differentials between treatments were measured at the time of spreading utilizing the olfactometer from the Alberta Research Council. Unfortunately , the day of spreading was very windy and the olfactometer data was rendered invalid. However, personal observation was that the odour from compost was insignificant, with odour decreasing in relation to the number of times the treatment was turned. In comparison to raw manure, there is a big difference in odour when the manure is turned just once, as exhibited by the control treatment.

The economic evaluation for introducing the concepts of our five treatments into a typical 100 cow-calf operation are based on the following assumptions.

Assumptions

- Loader + 3 spreaders - $200/hr
- AVG truckload - 10.5 MT
- Turnaround time for 2 mile haul - 20 minutes
- Loader tractor - $50/hr
- Loader tractor capacity - 30MT/15 minutes
- Manure production - 5MT/cow
- BTM - $20/liter, 1 liter treats 30MT

The results of our evaluation are as follows.

FIGURE 8

Weight Reduction		Spreading	Piling	BTM	**TOTAL**
100 %	Raw	$3,160			**$3,160**
46 %	Control	$1,460	$210		**$1,670**
36 %	Piled	$1,140	$420		**$1,560**
35 %	Compost	$1,120	$840		**$1,960**
48 %	BTMX1	$1,520	$210	$334	**$2,064**
49 %	BTMX2	$1,560	$210	$668	**$2,438**

Our evaluation has the piled treatment (turning the manure once) as the cheapest alternative followed by the control treatment then compost. All these treatments significantly reduced the cost of hauling manure. The best management practice, which would be the compost treatment, is more costly but has some valuable characteristics associated with it, namely low odour and fine texture. It is difficult to put a value on these characteristics, so it is important for producers to evaluate their situation and requirements when developing a manure management plan for their operation. However, by turning the manure just once (control treatment), we were able to add significant value to the product. The reduction in weight allows us the opportunity to transport the manure to fields further away and apply at recommended rates to match crop requirements. This is a big improvement when compared to spreading raw manure.

It is important to be conscious of where piles of manure are sited. They should be placed in a location to reduce the potential for runoff of nutrients from the pile as well as to prevent an introduction of runoff water into the pile . It would also be a wise practice to not locate manure piles in the same place every year to prevent a possible accumulation of nutrients in the soil.

This project demonstrated that by turning manure once, twice or three times all added significant value to the manure by reducing the volume, reducing odour, and most importantly to the producer, reducing costs. The nutrient analysis displays the value of nutrients this resource contains. The volume reduction allows the producer to properly utilize these nutrients on his land base through sustainable application rates. This project demonstrates that manure management can be a win-win situation for the producer and the environment.