

Horse Manure Management

Mary Keena, Paige Brummund and Rachel Wald

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NDSU

EXTENSION

Outline

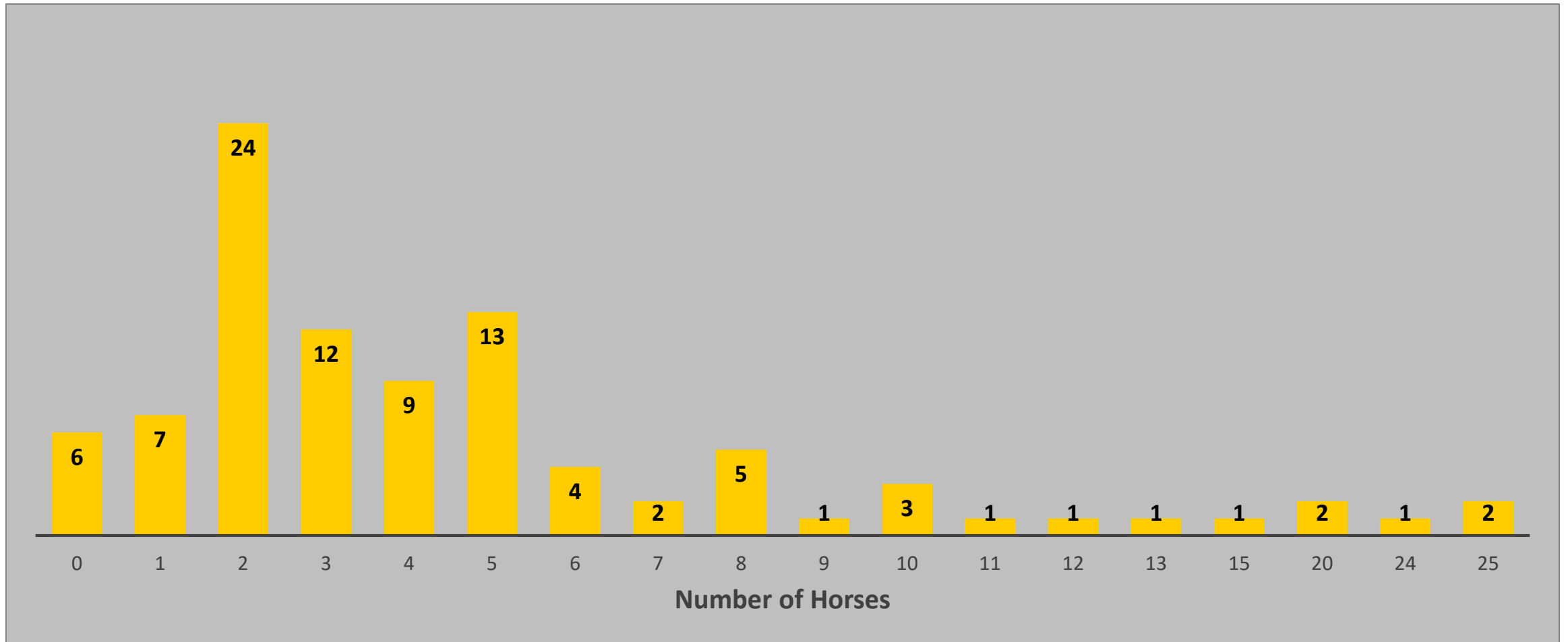
- Production and volume
- Stacking area site selection
- Composting
- Manure weed management
- Manure parasite management
- Working with a custom manure hauler
- At-home spreading options

Who's Here?

- Germany
- Australia
- Argentina
- Peru



Number of Horses/Participant



Why Manage Manure?

- Manure contains valuable nutrients plants need. If the nutrients are not used they become a pollutant and are wasted.
- **Improper manure storage and land application**
 - Excess soil nutrients
 - Surface runoff
 - Leachate
 - Water-contaminated with manure



Harmful algal bloom. Photo courtesy: NDDEQ.

Other Manure Management Considerations

- Flies
- Bacteria and Pathogens
- Rodents
- Odors
- Internal parasites
- Weed seeds

Production (lbs.) – Michigan State Univ. Ext.

Manure produced for 1 horse per month:

- 1000 lbs. horse = 50 lbs. manure & urine/day
- 50 lbs. manure x 30 d = 1500 lbs. manure/month/horse
 - (1 lb. manure:0.3 lbs. wood shavings if horse is stalled)
- 1500 lbs. manure + 450 lbs. shavings = **1950 lbs. total/horse/month**
 - 2000 lbs. = 1 ton x 12 months = 24,000 lbs. or 12 tons manure/year

https://www.canr.msu.edu/news/managing_horse_manure

Production (volume) – Michigan State Univ. Ext.

Manure volume (cu. ft.) for 1 horse per month:

- 1000 lbs. horse = 0.8 cubic feet manure & urine/day
- 0.8 cubic ft. x 30 d = 24 cu. ft. manure/month/horse
 - 2.5 cu. ft. avg. shavings per 0.8 cu. ft. of manure removed from a box stall
 - 2.5 cu. ft. avg. shavings x 30 d = 75 cu. ft. shavings
- 24 cu. ft. manure + 75 cu. ft. shavings = **99 total cu. ft./horse/month**

Manure Stacking/Stockpiling Guidelines - ND

- Short-term Manure Stockpiles
 - Manure may **not** be stockpiled for **more than** nine months at short-term stockpile locations.
 - The same location cannot be used from year to year.
- Permanent Manure Stockpiles
 - Manure stockpiles **for more than** nine months must be stored at a permanent stockpile location.
 - Involves soil investigation and regulatory oversight.

Stockpiling Site Selection

- **Sandy soils have rapid permeability** that allows nitrate to move quickly through the soil to ground water (leaching), while **loamy or clayey soils have slower permeability** that helps retain nitrate in the soil profile.
- Depth to ground water and location of surface water

Stockpiling Site Selection

Manure stockpiles may not be located:

- In gravel pits, or any other excavations;
- Along streams or lakes;
- Within a flood plain; or,
- Within 50 feet of a private water supply well or 100 feet of a public water supply well

Can be covered with plastic to reduce odors and flies

- Anchor securely!

Benefits of Composting Manure



↓ Nutrient Loss
↑ Nutrient Stability

Flies

- Flies breed when spring temperatures rise above 65-degrees F.
- Flies deposit their eggs in the top few inches of moist manure, and these eggs can **hatch in as little as seven days** under optimal temperature and moisture conditions.



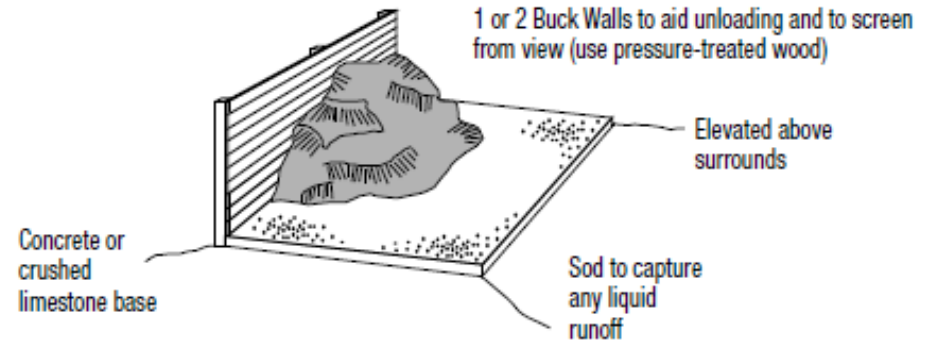
Composting

- Mixture of organic residues
 - Piled
 - Mixed
 - Moistened
 - Thermophilic decomposition
- Results
 - Crumbly, low odor, stable nutrient-rich soil amendment that lacks weed seeds, pathogens, and has decreased 50-65% in volume.

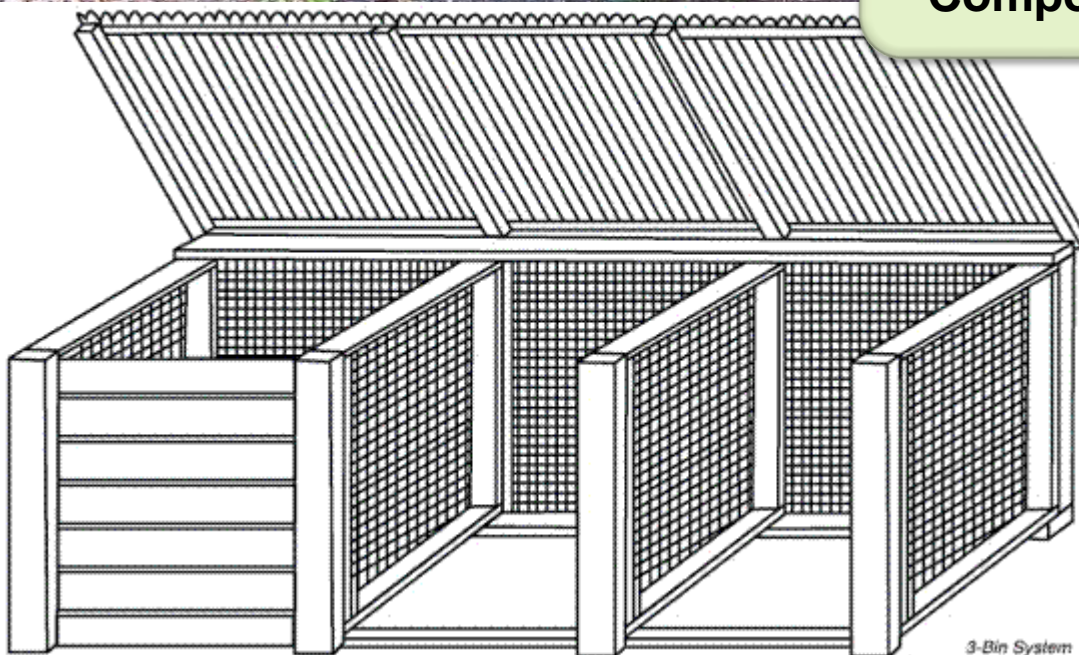




Figure 6. Simple manure stockpile pad with backstop, which is suitable for a small stable. Use a tarp or other cover to minimize leachate production from precipitation.



**Storage
&
Composting**



3-Bin System



Photo courtesy: Managing Small-Acreage Horse Farms – Oregon State and Google Image

Community Compost Project



Green Mountain Technologies
In-vessel composting



Basics of Composting

- Moisture
 - 40-65% of pore space
 - “wet rag test”
- Temperature
 - Ideal = 131° F for 15 days
 - Kills pathogens
 - Kills weed seeds



Basics of Composting



Mixing Tools

- Payloader
- Front-end loader
- Skid-steer
- Turner
 - Eco-mixer for smaller scale operations
- Pitchfork

Basics of Composting

- Mixing
 - Helps maintain temperature
 - $> 5\%$ of pore space = O_2
 - 10 days to 2 weeks
- When is it done?
 - Temperature no longer spikes after turning
 - As little as 6 weeks or up to 6 months
 - Depends...

Basics of Composting

- **Now what?**
 - Let your pile cure until it reaches ambient temperature
- **Nutrient considerations**
 - Stable source of N
 - ~20% available vs. 50% in fresh manure
- **Spread at agronomic rates as fertilizer.**

Reducing Weed Problems

- Weeds lower nutritional value of pasture
 - Some can be harmful to health
- Properly Compost Manure

TABLE 1. Estimated amount of time required to kill 90 percent of seeds at various temperatures.

Weed	Temperature (F)			
	140°	122°	115°	108°
Annual sowthistle	<1.0	2.1	13.3	46.5
Barnyardgrass	<1.0	5.4	12.6	Unaffected
London rocket	<1.0	4.0	21.4	83.1
Common purslane	1.3	18.8	Unaffected	Unaffected
Black nightshade	2.9	62.0	196.6	340.6
Tumble pigweed	1.1	107.0	268.5	Unaffected

Source: *Time and Temperature Requirements for Weed Seed Thermal Death*, by N. Dahlquist et al., 2007

Control of Weed Seeds that Germinate

- Mechanical (Mowing)
 - Mow before weeds produce seed head
- Cultural (Overseeding)
 - Out compete weeds by maintaining a dense stand of grass
- Chemical (Herbicides)
 - First identify weeds to select appropriate chemical
 - Always read and follow label directions
 - Apply at correct time (growth stage of weed) and rate to kill

Incorporation of Manure into Garden

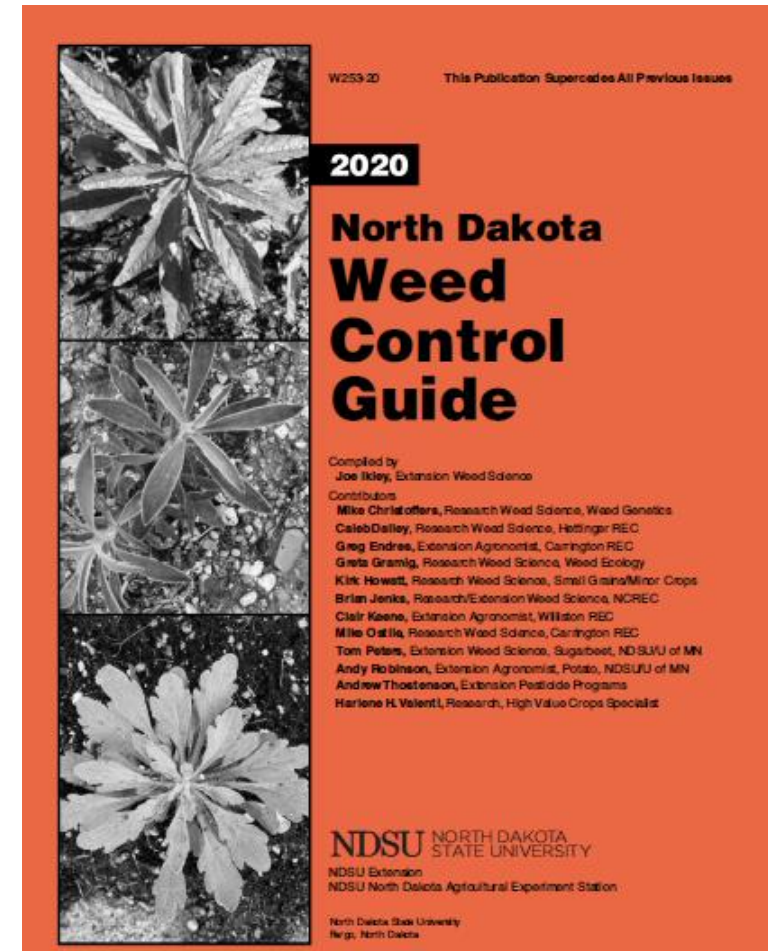
- Use as fertilizer in fields, gardens, and pastures available
- Be careful of herbicide carryover



Herbicide Carryover

- These may be found in hay or grass clippings:
 - Clopyralid (Stinger, Curtail)
 - Fluroxypyr (Starane)
 - Picloram (Tordon)
 - Triclopyr (Crossbow)

https://www.ag.ndsu.edu/weeds/weed-control-guides/nd-weed-control-guide-1/W25320_FinalWeedGuide2020.pdf



Testing for Herbicides in Manure

- Fill 3-5, 4"-5" pots with a 2:1 mixture of manure and a commercial potting mix.
- Fill a couple control pots with just potting mix.
- Plant 3 pea or bean seeds in each pot. Water.
- Let them grow until they have three true leaves.
- If they grow normal, the manure or compost could be considered safe.

Common Equine Parasites

Parasites

- Large Strongyles
- Small Strongyles
- Tapeworms
- Pinworms
- Ascarids
- Bots

Symptoms

- Weight loss/loss of condition
- Anemia
- Colic
- Poor/rough coat condition
- Slowed/poor growth
- Lethargy
- Coughing
- Diarrhea
- Itching/rubbing of the tail/anal region

Management Practices to Reduce Internal Parasites

- Remove manure daily from stalls and run-ins and weekly (or more frequently) from paddocks and pastures.
- Be sure pastures and paddocks are well-drained and not over populated.
- Compost manure rather than spreading it on fields where horses graze.
- Use a feeder for hay and grain and avoid feeding on the ground.

Management Continued

- Implement fly control programs.
- Keep water troughs and feed bins clean.
- Routinely examine horses for telltale signs of infestation.
- Establish a parasite prevention and monitoring program with your veterinarian.
- This may include regular manure checks and a deworming program tailored to the needs of your horses.

Transmission

- Fecal to Oral Transmission
- Direct Ingestion

Resources:

- American Veterinary Medical Association
 - www.avma.org
- American Association of Equine Practitioners
 - www.aaep.org

Off-Farm Manure Disposal

- Soil Conservation Districts
- Local vegetable growers/CSA's
- Landfill
- Community Compost Project
- Working with a custom manure hauler

Working With a Custom Manure Hauler

- Things you will need to know
 - How much manure do you have to spread?
 - Where are they spreading it?
 - Work with a local farmer/rancher to spread on their land if you do not have property available
 - This is your responsibility, not your haulers.
 - Can they get into your manure storage area with their equipment?
 - Can you pay them?

ND Custom Manure Hauler Equipment Examples





At-home Spreading Options

- Small, pull type, ground driven spreader
- Pulled by ATV, lawn mower, horse
- Examples:
 - ABI Classic Spreader
 - Loyal Manure Spreader
 - Newer Spreader 225

head
ground capacity
vehicle
spreading
variable
shredding

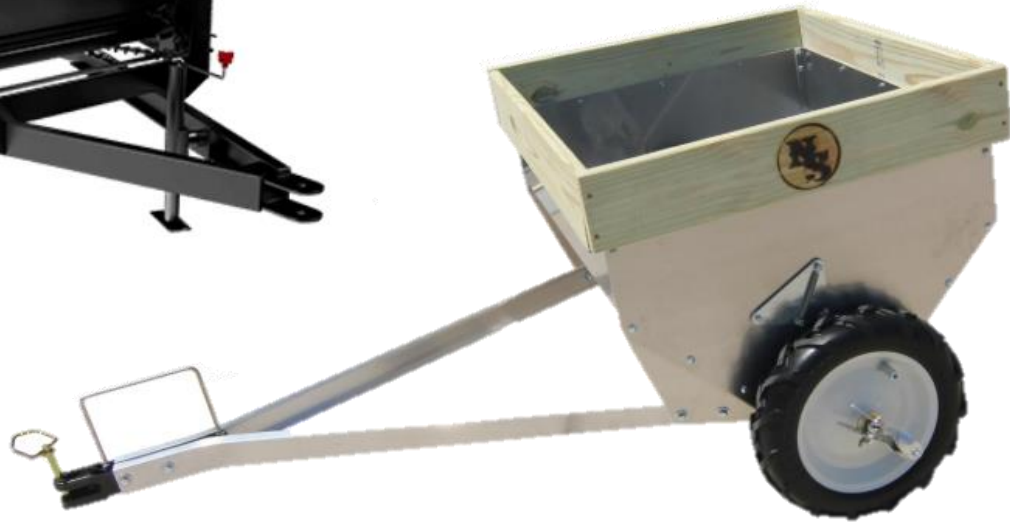
Bushels/Ton of Manure

- 1 bu./1.25 ft³
- 1.0 ft³/7.5 gal
- 1 gal/8.3 lbs.
- 2000 lbs./1 ton

- 26 bushels/ton manure
- Recall – one horse produces approx. 1 ton manure/month or 12 tons manure/year = 312 bushels.



At-home Spreader Examples



Manure Sampling Information

- **AGVISE Laboratories**
 - (701) 587-6010
 - www.agviselabs.com
- **Dairyland Laboratories**
 - (320) 240-1737
 - www.dairylandlabs.net
- **DHIA Laboratories**
 - (800) 369-2697
 - www.stearnsdhialab.com
- **NDSU Soil Testing Laboratory**
 - (701) 231-8942
 - www.ndsu.edu/soils/services/soil_testing_lab



Manure Spreader Calibration

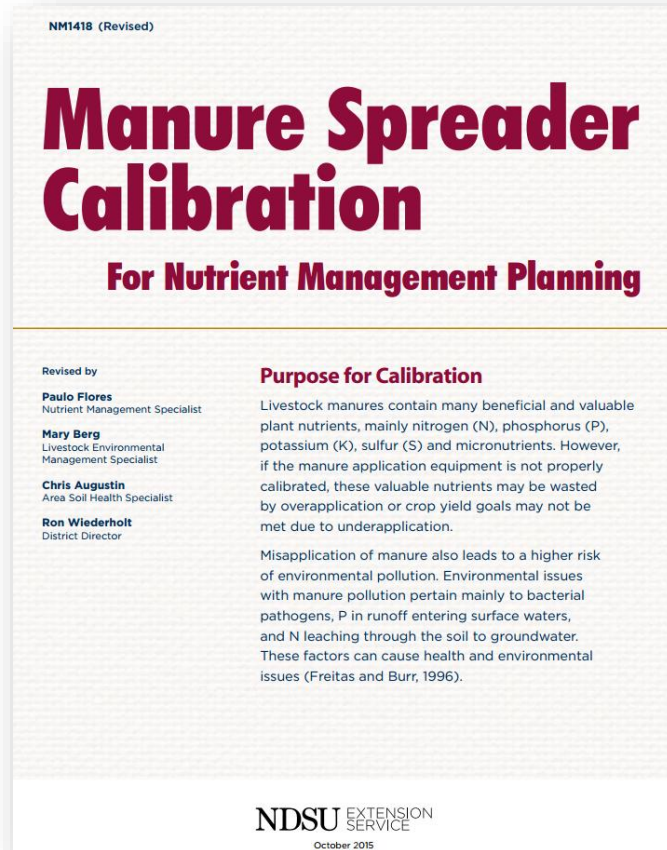
- How many tons manure/acre is being applied?
- Sheet Method
 - 21.8ft² sheet/tarp
 - Scale
 - Pail

Table 3. Tarp sizes, manure weight and corresponding manure application rate.

Manure Weight lbs.	Tarp Size, feet			
	5x7	6x8	6x4, 8x3 ^a	4x10, 8x5 ^b
	Manure Application Rate ^c , ton/acre			
2	1.2	0.9	1.8	1.1
4	2.5	1.8	3.6	2.2
6	3.7	2.7	5.4	3.3
8	5.0	3.6	7.3	4.4
10	6.2	4.5	9.1	5.4
12	7.5	5.4	10.9	6.5
14	8.7	6.4	12.7	7.6
16	10.0	7.3	14.5	8.7
18	11.2	8.2	16.3	9.8
20	12.4	9.1	18.2	10.9
22	13.7	10.0	20.0	12.0
24	14.9	10.9	21.8	13.1
26	16.2	11.8	23.6	14.2
28	17.4	12.7	25.4	15.2
30	18.7	13.6	27.2	16.3
32	19.9	14.5	29.0	17.4
34	21.2	15.4	30.9	18.5
36	22.4	16.3	32.7	19.6
38	23.6	17.2	34.5	20.7
40	24.9	18.2	36.3	21.8
42	26.1	19.1	38.1	22.9
44	27.4	20.0	39.9	24.0
46	28.6	20.9	41.7	25.0
48	29.9	21.8	43.6	26.1
50	31.1	22.7	45.4	27.2

^a Halves of a 6- by 8-foot tarp.
^b Halves of a 10- by 8-foot tarp.
^c Manure Application Rate = (Manure Weight [lbs.] x 21.8)/Tarp Area [feet²]

Manure Spreader Calibration



1. Weigh the bucket and sheet
2. Lay out sheet & anchor it to the ground
3. Record tractor gear & RPM and spreader settings
4. Apply manure over sheet
5. Weigh the manure-covered sheet

**Lbs. of manure on sheet =
tons manure applied to land.**

Manure Spreader Calibration



Using Manure

- No restrictions in ND as far as when to spread.
 - Manure can be land applied during frozen conditions provided it is applied on land where runoff is contained and does not drain off during spring runoff.
 - Consider land with slopes of less than 6 percent, where there is stubble or vegetative cover and less than 8 inches of snow on the ground surface.
- Use common sense:
 - Don't spread before, during, or after a large rain event
 - Don't spread where water quality will be compromised

Review

- Manure contains valuable nutrients plants need. If the nutrients are not used they become a pollutant and are wasted.
- How much manure are your horses producing?
- How will you manage it? Where will you store or spread it?
- Composting reduces weed seeds, pathogens and total volume.
- Mechanical, Cultural and Chemical are three ways to manage weed seeds.
- Proper manure management can lead to reduced parasite load.
- Use common sense when spreading to avoid odor and pollution issues.

Resources



- **NDSU Livestock Environmental Mgmt. Spec.**
 - Mary Keena, Carrington Research Extension Center
 - 701-652-2951, mary.keena@ndsu.edu
 - www.facebook.com/ndsulem, www.twitter.com/ndsulem, @ndsulem
- **Livestock and Poultry Environmental Learning Community**
 - <https://lpehc.org/>
- **NDSU Extension Manure Spreader Calibration**
 - <https://www.ag.ndsu.edu/publications/livestock/manure-spreader-calibration-for-nutrient-management-planning>
- **NDSU Extension Composting Animal Manures**
 - <https://www.ag.ndsu.edu/publications/livestock/composting-animal-manures-a-guide-to-the-process-and-management-of-animal-manure-compost>

Q & A from Live Webinar

- 1. Is that dumpster structure a DIY project? Are there plans or contractors for that sort of project?**
 - A. Green Mountain Technologies is a good place to start: <https://compostingtechnology.com/in-vessel-composting-systems/>
- 2. I can't afford a new manure spreader. Do you have suggestions as to where I could find a used spreader? Does the Extension office have a buy, sell, trade website or is it best to look on Craigslist or Facebook Marketplace?**
 - A. In North Dakota, we find used equipment is commonly posted on BisManOnline and also in the classified section of agriculture papers such as Ag Week and the Farm and Ranch guide.
 - B. The cost of a spreader for 1-10 stalls is typically less than \$5,000.
- 3. My barn piles manure throughout the pasture area in the winter and spreads it in the spring. The horses are not in pasture 24/7 and have free access hay that they enjoy over the grass which is rather sparse. However, I'm curious if this is a potentially not a good idea.**
 - A. Ideally, the stockpiled manure should be composted before spreading in the spring.
- 4. How much can we put down of composted horse manure on gardens, between trees, etc.?**
 - A. It's best to take both a manure and soil sample so you know what amount of nutrients are present. This will help you determine what to spread.
- 5. Earlier in the presentation you mentioned to pick the pastures once a week. Is spreading the manure throughout the pasture a viable option? We usually take a drag behind the four-wheeler and drag the pasture to even out the manure piles. Is that sufficient?**
 - A. Ideally, you want to compost the manure to kill weed seeds, pathogens, and stabilize the nutrients before dragging.

Q & A from Live Webinar continued

6. Do compost turners come in a smaller size? What is an idea of cost range?

A. There are some for small scale operations like this one from Eco-Mixer: <https://ecomixercompostturner.com/> with a cost typically less than \$5,000.

7. Does straw bedding compost harder than shaving composting?

A. This depends on the management of the compost. The type of turner you plan to use (pitchfork vs. loader vs. turner) will determine particle reduction. Generally, wood shavings will compost easier/faster than straw.

8. We have a plastic covered pile for 3 years. Still okay to use?

A. Yes, it's still okay to use. It's recommended that you get it sampled for nutrient content before use.

9. Any cost studies on building a covered permanent [compost] setup for 5 horses?

A. Mary is still looking for an answer here. Stay tuned.

10. Have you found that any chemical residue exists when you use commercial wood shavings/bedding? I'm asking from the shavings side of things.

A. The main concern would be in any hay that was wasted and is present in the manure and bedding.