

Horse Manure Management

Mary Keena, Extension Specialist

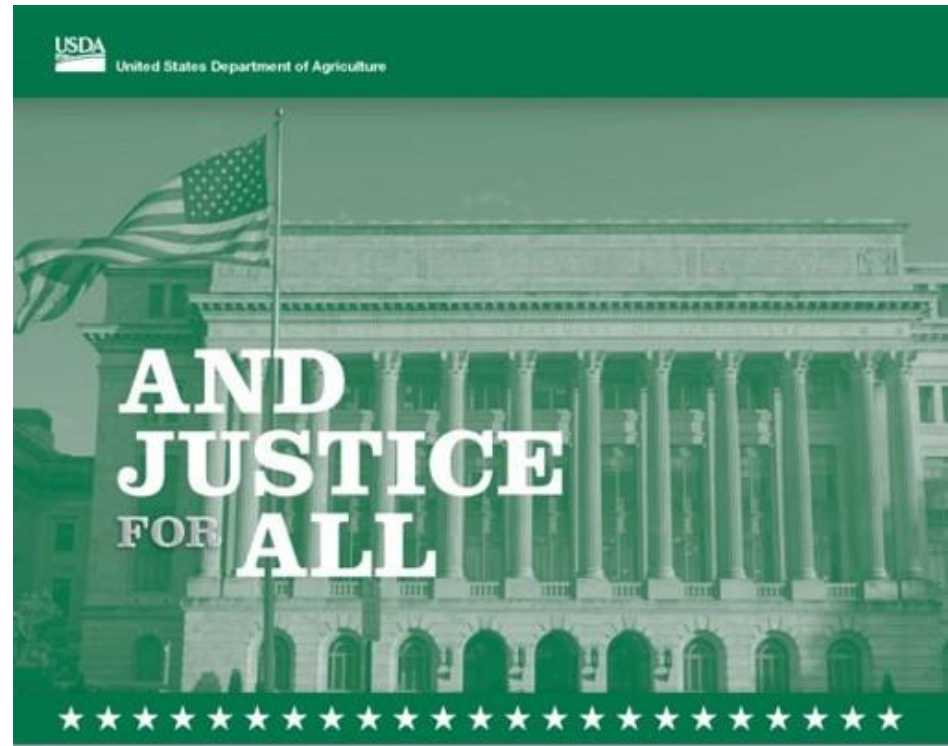
05/19/2021

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Office of the Assistant Secretary for Civil Rights
1400 Independence Avenue, SW
Washington, D.C. 20250-9410; or

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Washington, D.C. 20250-9410; o

fax:
(833) 256-1665 o (202) 690-7442;

correo electrónico:
program.intake@usda.gov.

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Outline

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

Why Manage Manure?

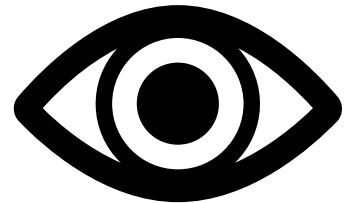
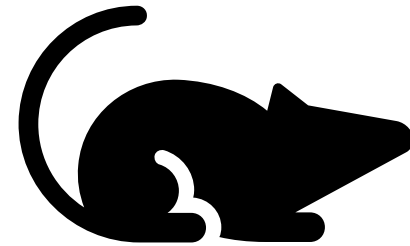
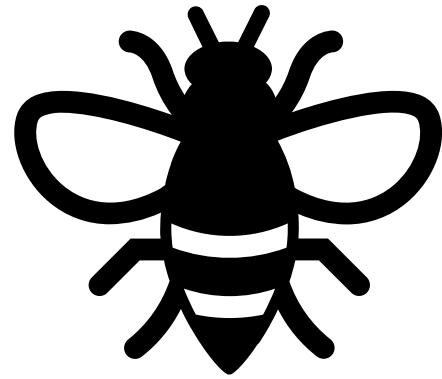
- Manure contains valuable nutrients plants need. If the nutrients are not used they become a pollutant and are wasted.
- **Improper manure storage and land application**
 - Excess soil nutrients
 - Surface runoff
 - Leachate
 - Water-contaminated with manure



Harmful algal bloom. Photo courtesy: NDDEQ.

Other Manure Management Considerations

- External parasites (flies)
- Bacteria and Pathogens
- Rodents
- Odors
- Internal parasites
- Weed seeds
- Visual appearance



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

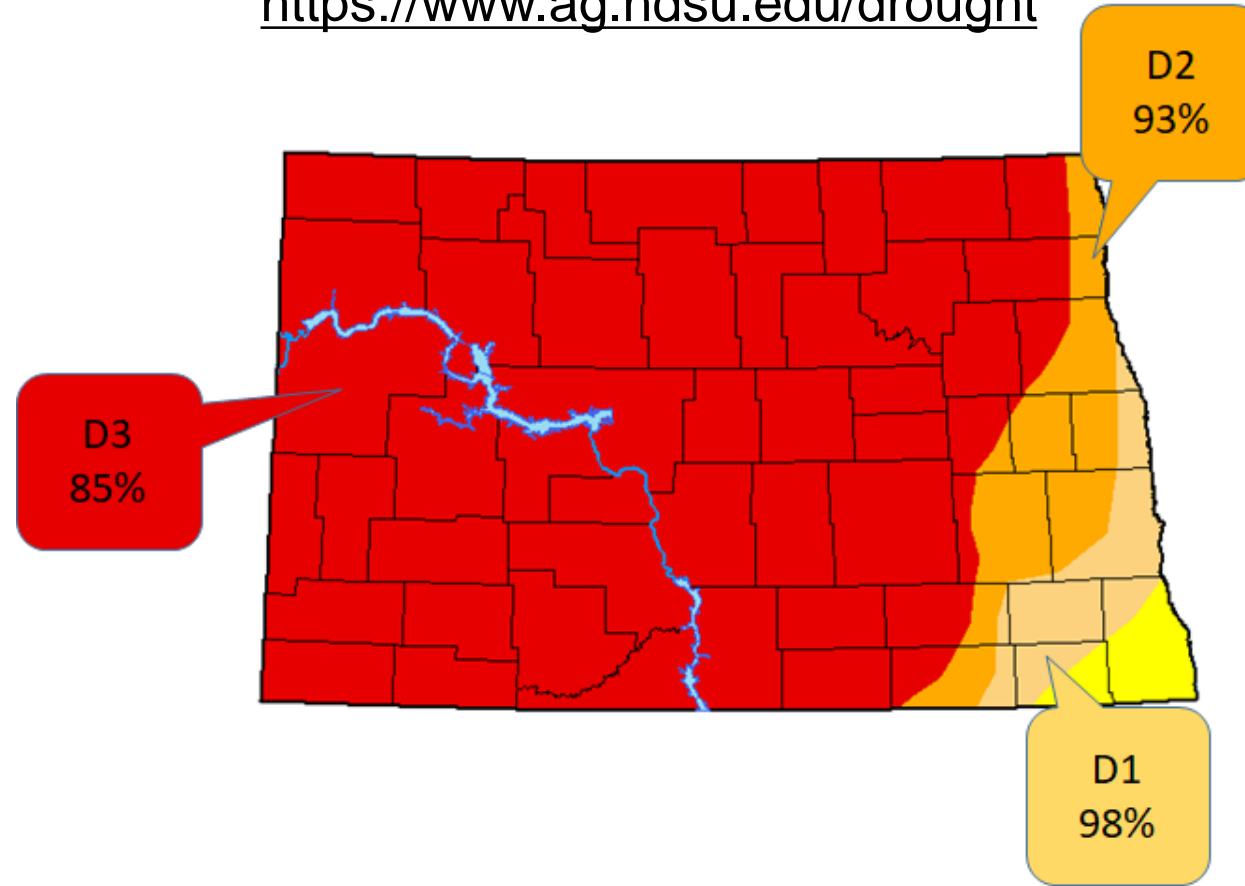
- Anchor securely!

PARASITE MANAGEMENT

https://www.youtube.com/watch?v=iozii4ca_po

U.S. Drought Monitor, North Dakota (May 11, 2021)

<https://www.ag.ndsu.edu/drought>



Managing a Dry Lot

Needs:

- Shelter
- Water
- Feed
- Space



Managing a Dry Lot

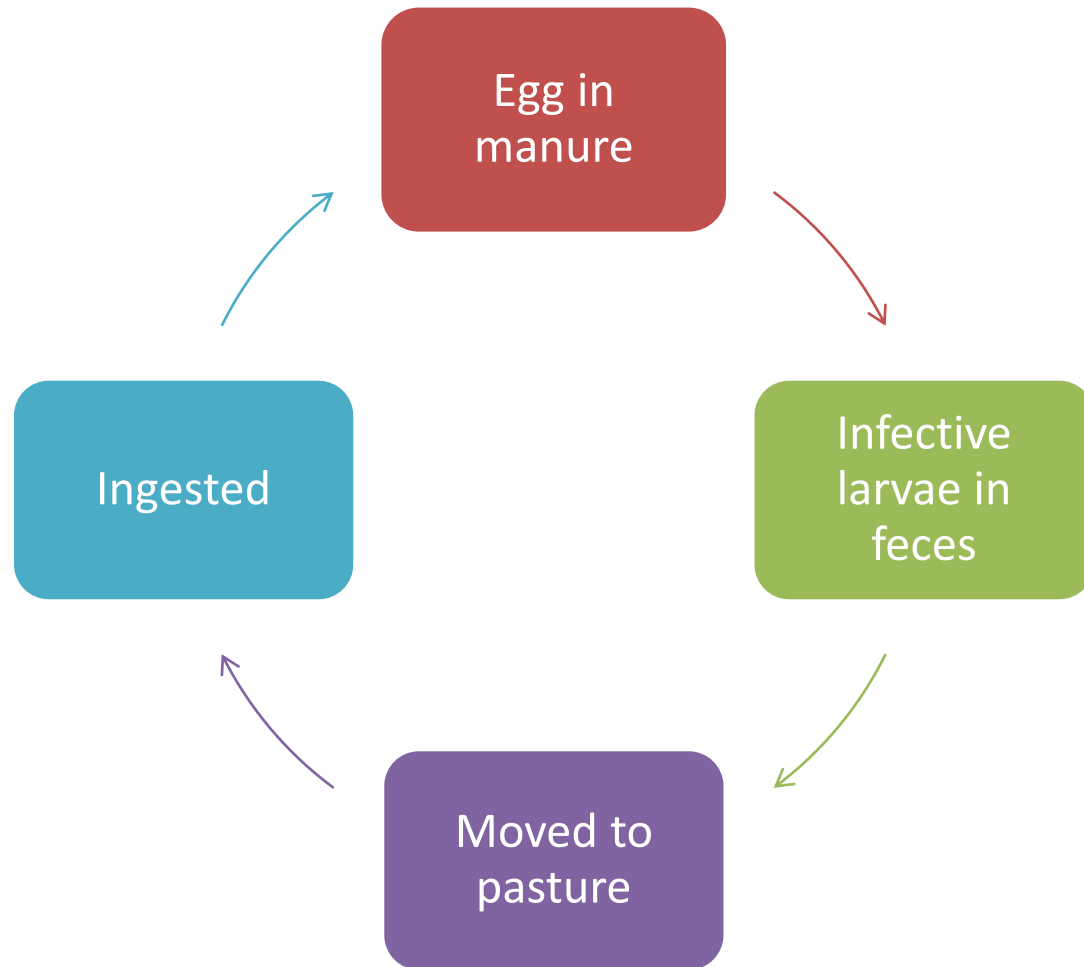
- Dry lots, Sacrifice Areas or Exercise Paddocks
- Plan ahead for what you want to use it for:
 - Attached to adjoining pastures for rotational grazing
 - Make sure the pen can be accessed with equipment
 - Will the pen properly drain
- Ground
 - Remove manure regularly
 - Drag the pen occasionally to maintain a level ground
 - High traffic areas (heavy use pads)

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.



How Do Internal Parasites Move?



No manure = no infection!?



This Photo by Unknown Author is licensed under [CC BY](#)

Environmental Conditions

- Moderate temperature and moisture
 - Cold slows/stops development
 - Excessive heat kills eggs and larvae
- It is possible to heat manure sufficiently to kill the parasites, including even ascarid eggs (Gould et al., 2012).
- Spreading non-composted horse manure on pastures is not recommended.

American Association of Equine Practitioners

Table 5. Effects of temperature on the survival, development and persistence of free-living stages (eggs, L1, L2, L3) of strongyles (Nielsen et al., 2007)

Development	Temperature Range	Survival
No development above this level	> 40 °C > 104 °F	Free-living stages die rapidly. Intact fecal balls may retain enough humidity to enable L3 to survive for some weeks.
Optimal temperature range for development of eggs and larvae. Reach infective L3 stage in as little as 4 days.	25 -33 °C 77 - 91 °F	Larvae survive on the shorter term (ie a few weeks), but conditions are too warm for long term survival
Eggs develop into L3 within 2-3 weeks.	10-25 °C 50-77 °F	L3 capable of surviving for several weeks to a few months
Lower limit for egg hatching is about 6 °C. At temperatures in this range, development will take several weeks to a few months.	6-10 °C 43-50 °F	L3 survive for many weeks and months under these circumstances
No hatching and no development	0-6 °C 32-43 °F	Eggs and L3 can survive for several months at temperatures just above the freezing point
No development during frost	< 0 °C < 32 °F	Developing larvae (L1 and L2) are killed, but unembryonated eggs and L3 can survive and persist for long periods (ie months)
Alternation between freezing and thawing will usually not lead to development unless temperatures exceed 6 °C	< 0 > °C < 32 > °F	Repeated freeze-thaw cycles are detrimental to egg and larval survival

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.

Parasite 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.

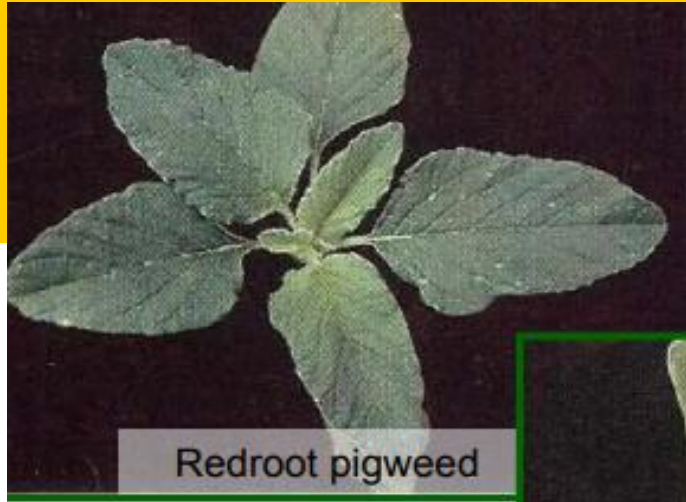
WEED MANAGEMENT

Palmer Amaranth

- Pigweed family
- Summer Annual
- Native to southwest US
- ND noxious weed list



Seedling ID is difficult



Redroot pigweed

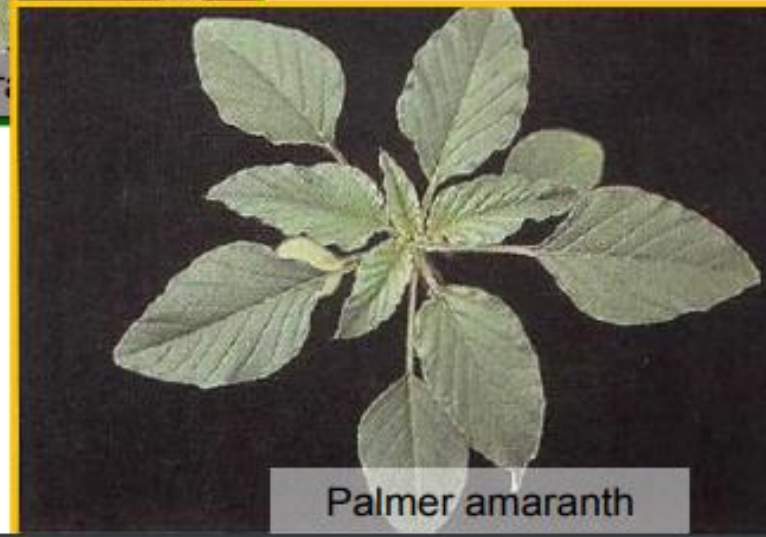


Small amaranth

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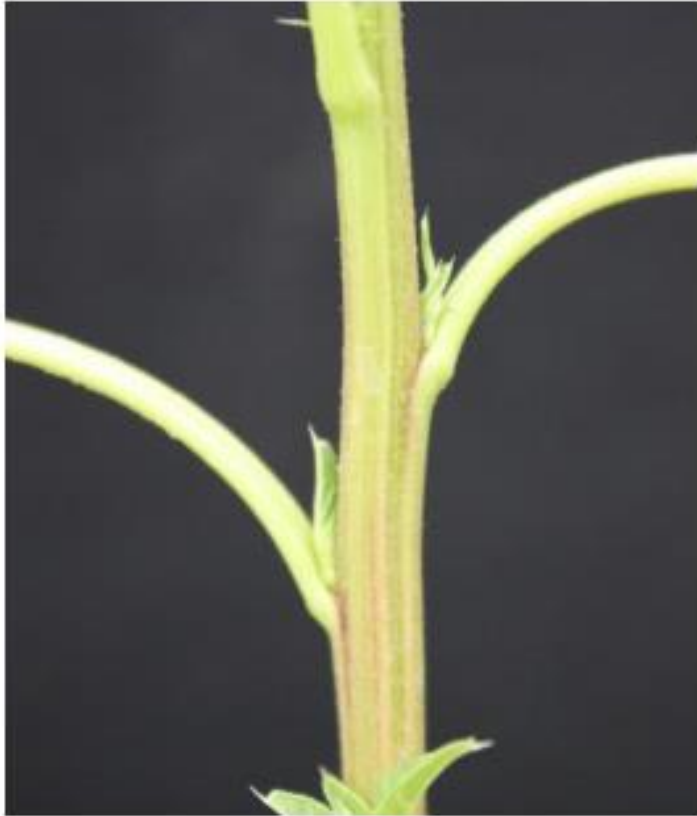


Waterhemp



Palmer amaranth

Hairs or No Hairs on Stem?



No Hairs:
Waterhemp
Palmer amaranth



Hairs:
Redroot pigweed
Powell pigweed

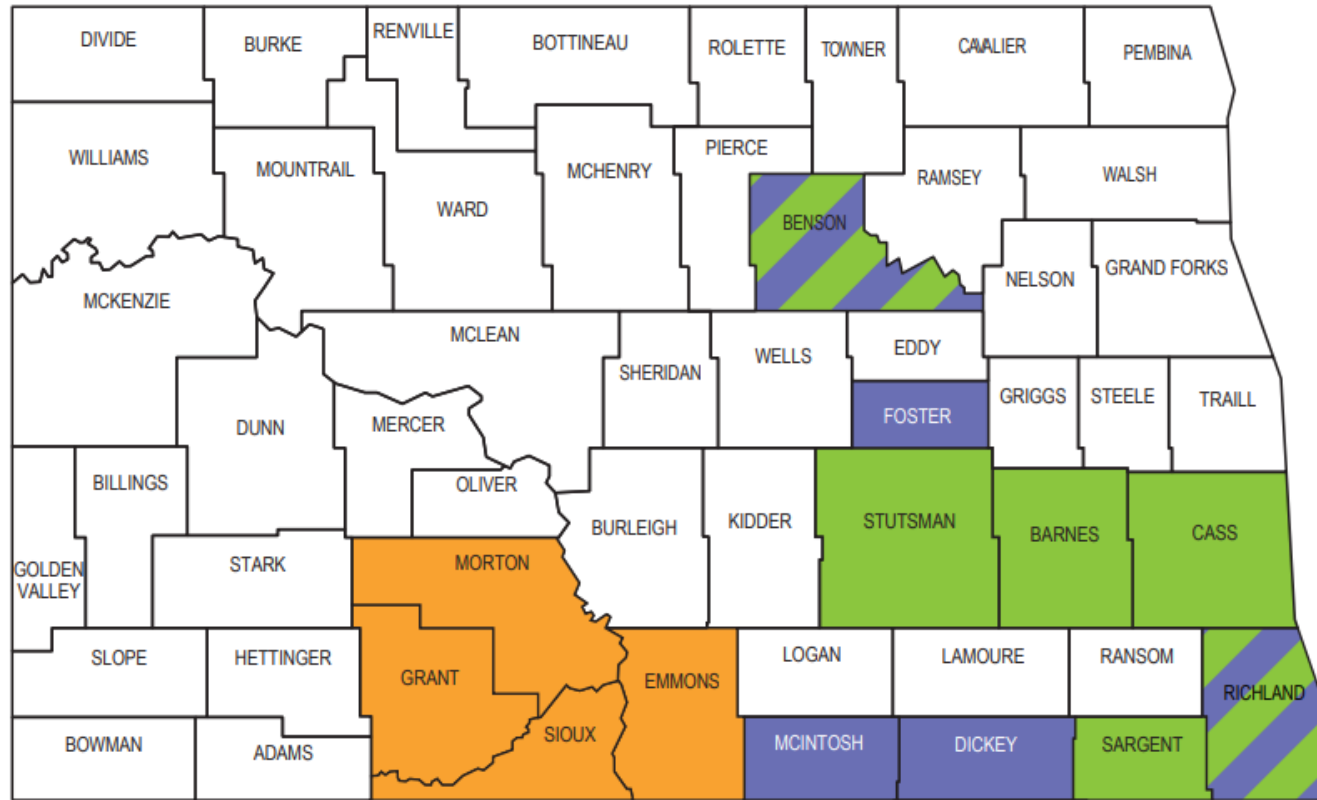
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Within Days of Herbicide Application



North Dakota Department of Agriculture Palmer Amaranth Distribution



Lab confirmed positive for Palmer amaranth

- 2018
- 2019
- 2020

As of 11/13/2020

How Can It Spread?

- Custom combines
- Used equipment from other states
- Contaminated seed
- Bird feed and/or bird migration
- Water movement
- Hay or livestock feed
- Manure
- Anything that moves seed



Does Composting Help?

- Yes but management is key
- If just one seed survives being eaten by cattle and escapes the heat in composting, and then is spread onto a crop field, that one plant can make up to a million seeds in a year
 - “Even in direct competition with a crop, these plants can still produce up to 100,000 seeds in a year.”
 - Joe Ikely, NDSU Extension Weed Specialist



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I Think I Found Palmer – Now What?

- Leave plant in place and flag or mark
- Take high quality pictures
- Contact county Extension agent or county weed officer
 - Work with ND Dept. of Agriculture and Extension specialists for confirmation



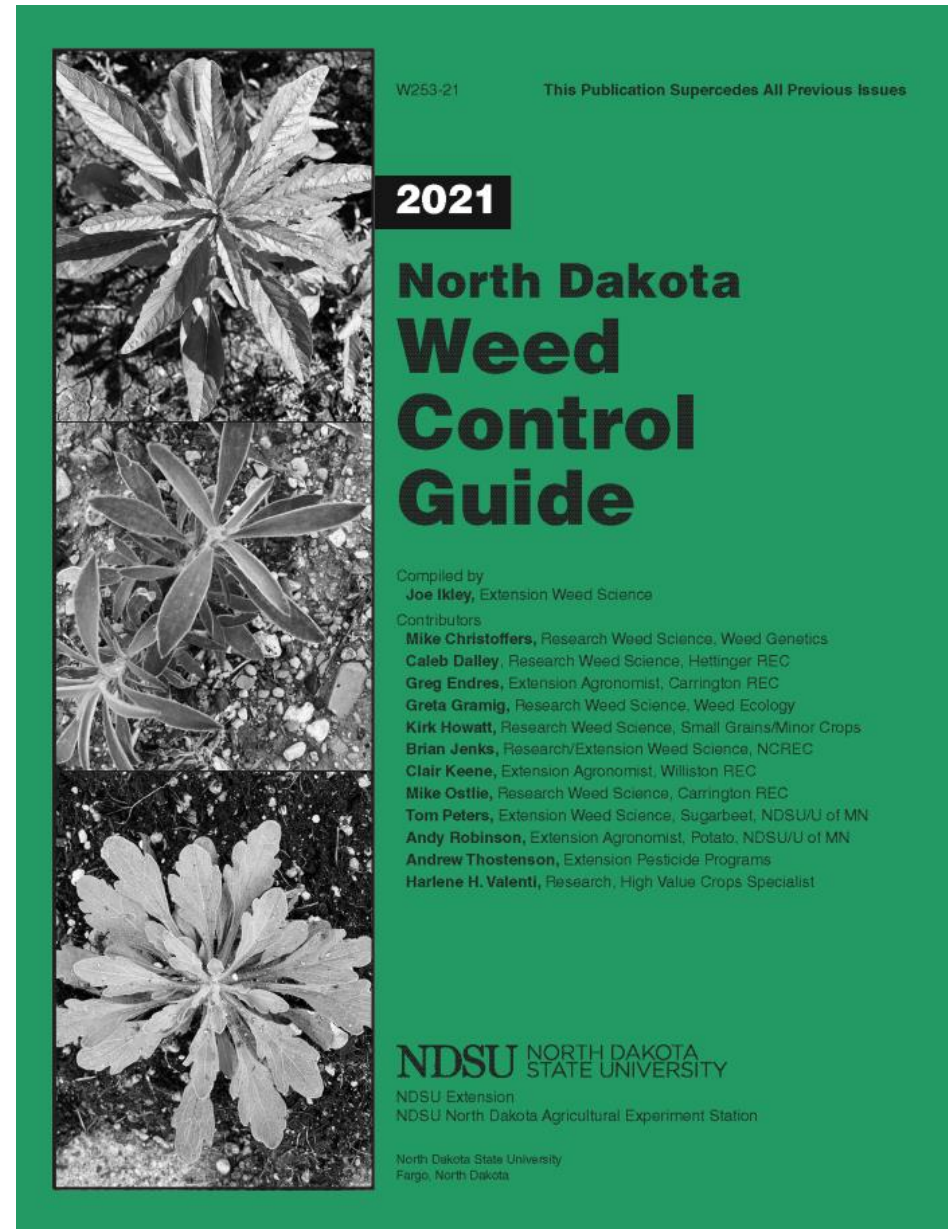
If Palmer is Confirmed

- Landowners should hand pull, bag on site and destroy confirmed Palmer plants.
- Palmer plants should be burned or deeply buried to prevent movement of seed.
- Landowners should work with their county weed officer and continue to survey the field for a period of 3-5 years post removal to verify no additional Palmer is found.

www.nd.gov/ndda/PA

ND Weed Control Guide

- Contact an Extension agent for a copy.
- Search online for “ND Weed Control Guide”
- <https://www.ag.ndsu.edu/weeds/weed-control-guides/2021%20nd-weed-control-guide-1>



Why Reduce 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.

	Temperature (F)			
	140°	122°	115°	108°
Weed	Number of hours required to kill 90% of seed			
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

COMPOSTING

<https://www.ag.ndsu.edu/publications/livestock/composting-animal-manures-a-guide-to-the-process-and-management-of-animal-manure-compost>

Benefits of Composting Manure



↓ Nutrient Loss
↑ Nutrient Stability

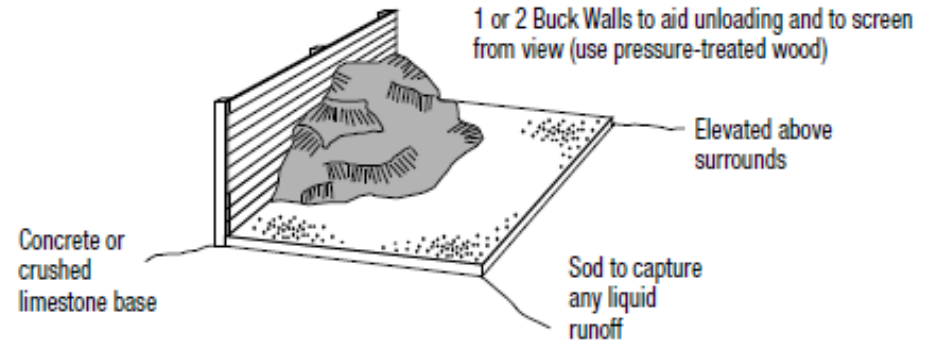
Composting

- 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.

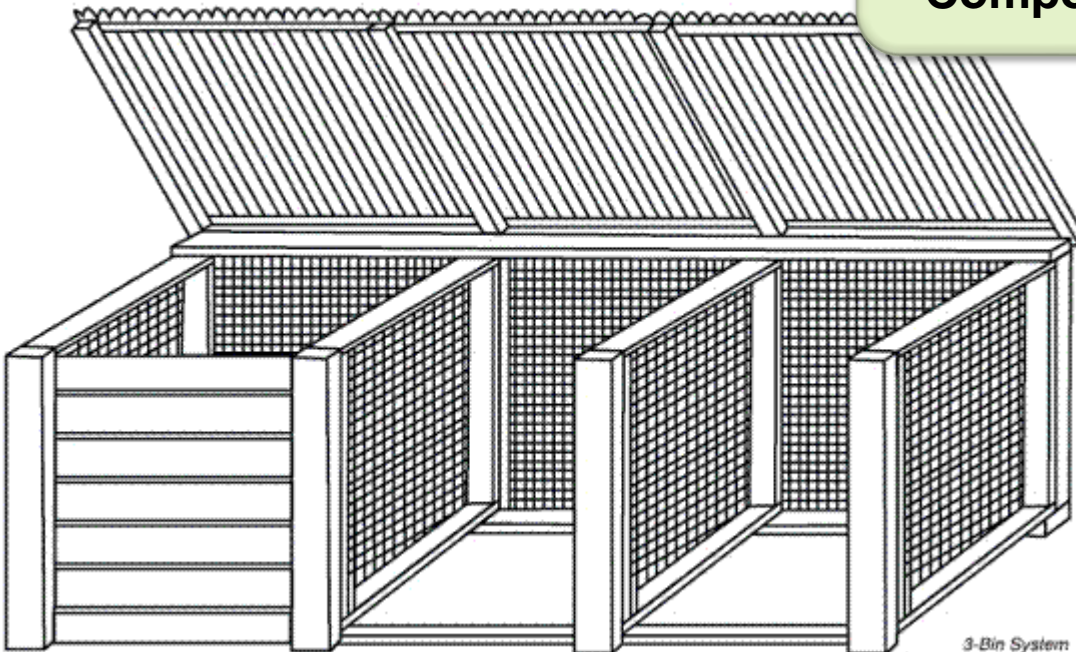




Figure 6. Simple manure stockpile pad with backstop, which is suitable for a small stable. Use a tarp or other cover to minimize leachate production from precipitation.



Storage & Composting



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
 - Helps maintain O₂ levels
 - 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.**

OTHER MANAGEMENT OPTIONS

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

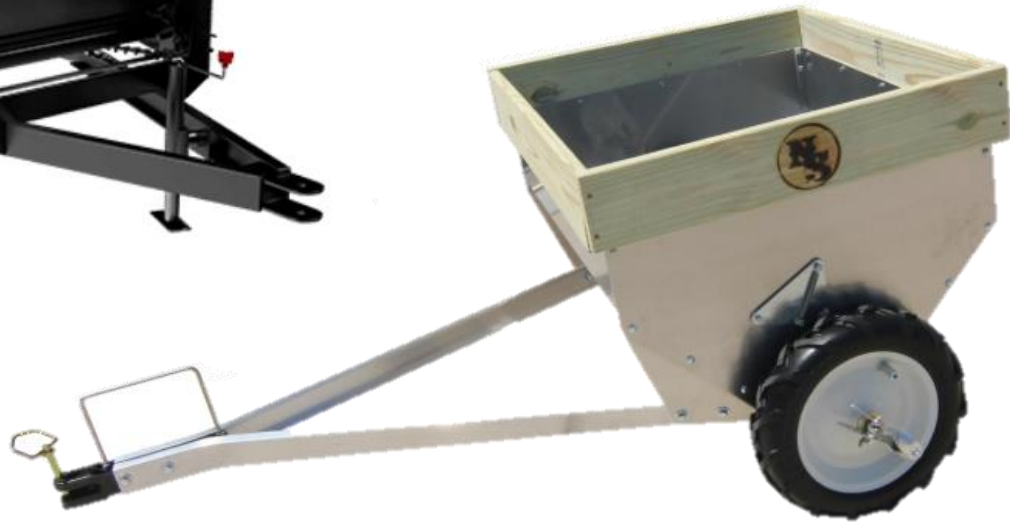
Bushels/Ton of Manure

- 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.

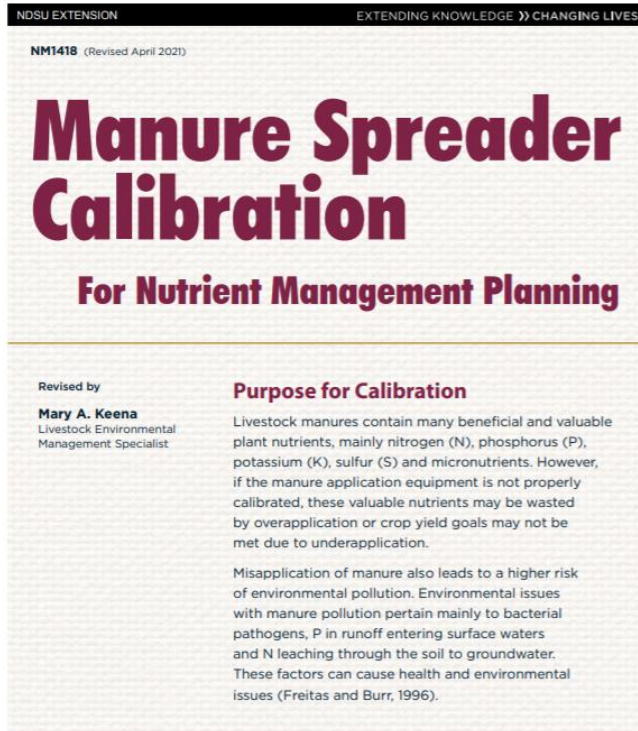
Manure Weight lbs.	Tarp Size, feet			
	5x7	6x8	6x4, 8x3 ^a	4x10, 8x5 ^b
	Manure Application Rate ^c , ton/acre			
2	1.2	0.9	1.8	1.1
4	2.5	1.8	3.6	2.2
6	3.7	2.7	5.4	3.3
8	5.0	3.6	7.3	4.4
10	6.2	4.5	9.1	5.4
12	7.5	5.4	10.9	6.5
14	8.7	6.4	12.7	7.6
16	10.0	7.3	14.5	8.7
18	11.2	8.2	16.3	9.8
20	12.4	9.1	18.2	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



Spreading Considerations

- 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

WRAP UP

Review

- Manure contains valuable nutrients plants need. If the nutrients are not used they become a pollutant and are wasted.
- How will you manage your horse manure? Where will you store or spread it? Will you compost it?
- Composting reduces weed seeds, pathogens and total volume.
- 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 County Extension Offices**
 - <https://www.ag.ndsu.edu/extension/directory/counties>
- **North Dakota Weed Control Association**
 - <http://www.ndweeds.com/>

Resources

- **NDSU Drought website**
 - www.ag.ndsu.edu/drought
- **Horse Manure Management – NDSU Extension**
 - <https://www.youtube.com/watch?v=Yw0leiyTFFk>
- **Horse Parasite Management – NDSU Extension**
 - https://www.youtube.com/watch?v=iOzll4cA_Po
- **2021 North Dakota Weed Control Guide**
 - <https://www.ag.ndsu.edu/weeds/weed-control-guides/2021%20nd-weed-control-guide-1>
- **NDSU Palmer amaranth**
 - <https://www.ag.ndsu.edu/palmeramaranth>

Resources

- **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>
- **Horse dry lots and shelters – UMN**
 - <https://extension.umn.edu/horse-pastures-and-facilities/horse-dry-lots-and-shelters>
- **Extension.org, dry lots**
 - <https://horses.extension.org/drylots-for-horses/>