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Manure Composting Quick Guide

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Characteristics of Successful Composting

Characteristic	Reasonable Range	Preferred Range
Particle size	1/16 to 4 inches	1/8 to 2 inches
Temperature	105 to 160°F	110 to 50°F
Moisture	40% to 65%	50% to 60%
Oxygen	5% to 20%	10% to 15%
C:N (carbon:nitrogen)	20:1 to 40:1	25:1 to 30:1

Source: On-Farm Composting Handbook, NRAES-54 (Rynk et al., 1992)

More information on these characteristics can be found in publication NM1478 (Keena, 2022)

Not enough carbon? Use the table below to add carbon-rich materials to raise the C:N

Pounds of bulk material needed to raise C:N to 30:1 (per 100 lb. of manure)

Material to add and its avg. C:N	Initial manure C:N			
	10:1	15:1	20:1	25:1
	Pounds of material to add			
Leaves (55:1)	415	215	110	45
Straw, oat (60:1)	370	190	95	40
Straw, general (80:1)	295	150	75	30
Straw, wheat (125:1)	240	125	65	25
Sawdust (440:1)	195	100	50	20
Wood shavings (600:1)	190	100	50	20
Newsprint (625:1)	190	100	50	20

Example: If the manure has a C:N of 15:1, you will need to add 190 pounds of oat straw per 100 pounds of manure to bring the overall C:N up to the desired 30:1.

Source: On-Farm Composting Handbook, NRAES-54 (Rynk et al., 1992)

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Too much carbon? Use the table below to add nitrogen-rich materials to lower the C:N

Pounds of bulk material needed to raise C:N to 30:1 (per 100 lb. of manure)

Material to add and its avg. C:N	Initial manure C:N			
	35:1	40:1	45:1	50:1
	Pounds of material to add			
Grass clippings (17:1)	20	35	45	55
Hay, legume (16:1)	15	30	40	50
Hay, general (22:1)	40	70	95	115

Example: If the manure has a C:N of 40:1, you will need to add 35 pounds of grass clippings per 100 pounds of manure to bring the overall C:N down to the desired 30:1.

Source: On-Farm Composting Handbook, NRAES-54 (Rynk et al., 1992)

Calibrating a Manure Spreader

More details can be found in publication NM1418 (Keena, 2021)

Weight Method

Step 1

Pounds applied =
Weight of full spreader –
Weight of empty spreader

Step 2

Area applied =
Length of spread area (ft) x
Width of spread area (ft)

Step 3

$$\text{Tons per acre} = \frac{[\text{Pounds applied (step 1)}]}{[\text{Area applied (step 2)}]} \times 21.8$$

Tarp Method

Step 1

Pounds applied =
Weight of full tarp and bucket – Weight of empty tarp & bucket

Step 2

Area of tarp =
Length of tarp (ft) x
Width of tarp (ft)

Step 3

$$\text{Tons per acre} = \frac{[\text{Pounds applied (step 1)}]}{[\text{Area of tarp (step 2)}]} \times 21.8$$

Where does 21.8 come from?

To convert pounds per square feet to tons per acre, we need to multiply the weight in pounds by 43,560 square feet (= 1 acre) and divide that by 2,000 pounds (= 1 ton). To simplify this, we multiply by 21.8, which is 43,560/2,000.

Calculating Application Rates

Step 1

Determine P needs of the crop

Crop P needs = Expected yield x Crop P_2O_5 removal

Step 2

Determine Plant Available P (PAP) content of the compost

If the compost analysis reports phosphorus as "P", you can convert it to P_2O_5 by multiplying by 2.29

80% of total P is plant available

PAP = Total P_2O_5 content of compost (from compost analysis) x 0.80

Step 3

Calculate application rate

Application rate (in tons per acre) = Crop P needs (step 1) ÷ PAP (step 2)

Crop P Removal Rates

Crop	Yield Units	Crop P_2O_5 removal (lb. per yield unit)
Alfalfa	Tons (air dry)	10.80
Barley (grain)	Tons (air dry)	0.41
Barley (grain and straw)	Bushels	0.55
Canola	Cwt.	1.30
Corn (grain)	Bushels	0.28
Corn (silage)	Tons (as fed)	3.80
Edible beans	Pounds	0.01
Grass or hay pasture	Tons (air dry)	8.90
Grass/legume	Tons (air dry)	11.20
Oats (grain)	Bushels	0.25
Oats (grain and straw)	Bushels	0.32
Peas	Pounds	0.01
Potatoes	Cwt.	0.14
Red Clover	Tons (air dry)	10.80
Rye (grain)	Bushels	0.44
Rye (grain and straw)	Bushels	0.59
Soybean	Bushels	0.82
Sugarbeets	Fresh Tons	0.73
Sunflower	Pounds	0.01
Sweet corn	Tons	11.00
Wheat (grain)	Bushels	0.53
Wheat (grain and straw)	Bushels	0.64

How much plant-available N has been applied?

10-15% of total N in compost is available the first year
(use 0.10 for cattle & lower-N compost, and 0.15 for poultry & higher-N compost)

Plant-available N =
Total N content of compost (from compost analysis) x .10 x application rate

References

Keena, M. A. 2022. Composting Animal Manures: A guide to the process and management of animal manure compost. North Dakota State University Cooperative Extension publication NM1478.

Keena, M. A. 2021. Manure Spreader Calibration for Nutrient Management Planning. North Dakota State University Cooperative Extension publication NM1478.

Rynk, R., M. van de Kamp, G. B. Willson, M. E. Singley, T. L. Richard, J. J. Kolega, Gouin, F. R., L. Laliberty, D. Kay, D. W. Murphy, H. A. J. Hoitink, W. F. Brinton. 1992. On-Farm Composting Handbook (NRAES 54). Northeast Regional Agricultural Engineering Service. Ithaca, New York.

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More information is available at **ndsu.edu/agriculture/ag-hub**.