VERMONT
AGENCY OF NATURAL RESOURCES
Department of Environmental Conservation

Compost Site Management

Analytically Based Recipe Development

Composters of all scales use a crafted blend of materials, known as a compost recipe, to improve conditions for aerobic decomposition. At a home composting scale, using a rule of thumb recipe such as three parts "browns" (carbonaceous materials) to one part "greens" (nitrogenous materials) by volume, is sufficient to make compost for the garden and avoid problems. Above the home scale, developing a composting recipe is a more involved process that takes careful consideration, observation, and adaptation over time. While this process does require some trial and error, the methods described in this guide are designed to take most of the "in-the-field guess work" out of developing composting recipes. When combined at the proper ratios, materials of known characteristics can be blended to achieve ideal conditions for composting. Compost recipe development will give you an informed starting point prior to testing the blend in the field.

The basic tools for developing composting recipes:

- Lab Analysis of your raw materials or "feedstocks" for key parameters
- Compost Recipe Calculator (one is free to download accompanying this guide)

Note: Compost recipes can also be calculated manually. The On-Farm Composting Handbook. NRAES-54., which is free to download online, has a good guide to using these calculations.

It is the combination of four primary recipe parameters - moisture content (MC), carbon to nitrogen Ratio (C:N ratio), bulk density (BD), and porosity - in proper balance, that fosters a thriving habitat for aerobic decomposers. In a lab, individual materials or combinations of materials (such as bedded manures) can be analyzed for these parameters, although typically porosity is not tested for and is factored in separately. These lab analyses provide the basic information that is used to calculate compost recipes. The MC, C:N ratio, and BD can be estimated for any combination of organic materials using a compost recipe calculator, however, you cannot achieve a feasible recipe for composting without starting with the right combination of materials and often it takes more than two materials. For this reason an understanding of the fundamental concepts of recipe and raw materials is integral to creating successful compost blends, both calculated and in the field.

The step-by-step process for developing an analytically based compost recipe is explained in the Compost Recipe Calculator accompanying this guide. To support the use of the calculator, this resource covers the underlying thinking and science involved in recipe development and management. The guide focuses on food scraps as a "primary feedstock" in developing compost recipes, although your primary feedstock could be any number of materials.

Compost recipes are not static; instead they aim to provide the outline for a blend that falls within the key parameters. Your compost's end use will factor strongly into the target recipe parameters you set for your operation and the precision with which your recipe should hit that target. Ultimately in practice, compost recipes guide the decisions made from the seat of your tractor, where stopping to use a recipe calculator would be infeasible and not necessarily more accurate. Managing the composting process in the field will inform adjustments to the recipe over time.

In addition to the four primary recipe parameters, the guide looks at several other factors including pH, Salinity, and Organic Matter.

Figure 1 - Sample Compost Recipe

Enter Data From Analysis | Calculated

Material	Cubic Yards Material	Moisture Content (%)	Total Carbon (% Dry Weight)	Total Nitrogen (% Dry Weight)	Bulk Density (Lbs/CY)	Carbon : Nitrogen Ratio	Material Weight (Lbs)	Notes
Food Scraps	1.0	80	30	2	1000	15	1,000	*Ave Municipal Scraps
Calf Manure/Sawdust	1.0	59	15.5	0.41	945	38	945	ASF - Penn State - 7/16/14
Silage/Haylage	3.0	62.2	16.6	0.81	625	20	1,875	ASF - Penn State - 7/16/14
Hardwood Bark	1.0	49.6	49.3	0.6	464	82	464	Conk - Penn State 10/1/14
Sawdust	0.5	17.3	41.3	0.46	344	90	172	Shilling - Penn State 10/1/14
Hay	1.0	32.5	39.6	1.2	85	33	85	Shilling - Penn State 10/1/14
						#DIV/0!	0	
						#DIV/0!	0	
						#DIV/0!	0	
						#DIV/0!	0	
						#DIV/0!	0	

Recipe Parameter	Results	Ideal Range	Reasonable Range
Carbon:Nitrogen Ratio	31	25-30	20-40
Moisture Content (%)	62	55-60%	40-65%
Bulk Density (Lbs/ CY)	605	≤1000	≤1200

Developed using the companion recipe calculator available for download. The calculator has a step by step guide to help you develop your own recipe.

Table of Contents

The Four Primary Compost Recipe Parameters

Our own basic needs for air, water, and food are a good analogy to the needs of the microbial communities in composting. Like us, the microbes we want require all three, and too much or two little of any one limits biological activity within the system. Food scrap composters practice managed composting, which is an aerobic process where microbes have access to oxygen. The presence of oxygen selects for aerobic organisms, whereas a lack of oxygen causes a spike in anaerobic activity, which is undesirable and can cause significant issues if not remediated.

Microbial activity in the compost pile is primarily happening on the moist surface of the individual particles within the compost, where there is access to both oxygen and moisture. The particles themselves are the microbe's food source and like us, simple nutritional sources like carbohydrate, fat, and protein are the main drivers of the initial process. A good compost recipe has a porous mix of moist particles, which in composting terms is measured in moisture content (MC), bulk density (BD), and porosity, as well as a diversity of energy rich and protein building foods, which is measured in carbon to nitrogen ratio (C:N ratio).

Target parameters for compost recipes:

Parameter	Reasonable Range	Ideal Range	VT Solid Waste Rule Compliance
Moisture Content	40-65%	55-60%	N/A
Carbon : Nitrogen Ratio	20:1 to 40:1	25:1 to 30:1	20:1 to 40:1
Bulk Density	<1200 Lbs/Yard^3	<1100 Lbs/Yard^3	<1200 Lbs/Yard^3

Note: While porosity can be estimated, both in the field and in the lab, field observation and knowledge of recipe are typically adequate.

Each of these four parameters is discussed in more depth in the following section.

Figure 2 - Sample Compost Analysis (Unfinished Compost, age 4-6 weeks)

LAB ID	SAMPLE ID	REPORT DATE	SAMPLE TYPE	FEEDSTOCKS	COMPOSTING METHOD	COUNTY
C06405	ASP23	5/16/2013	Unfinished Compost age 4-6 weeks			

COMPOST ANALYSIS REPORT

Compost Test 1A

Analyte	Results (As is basis)	Results (Dry weight basis)
pH	7.9	—
Soluble Salts (1:5 w:w)	5.03 mmhos/cm	—
Solids	41.7 %	—
Moisture	58.3 %	—
Organic Matter	25.6 %	61.4 %
Total Nitrogen	0.55 %	1.3 %
Carbon	12.5 %	29.9 %
Carbon:Nitrogen Ratio	22.5	22.50

ABOVE: Moisture content is ideal at 58.3% and a C:N ratio of 22.5:1 indicates that the initial blend was probably near the ideal range of 25:1 to 30:1. Over time, the C:N ratio of compost drops, as carbon is metabolized, eventually dropping by approximately half, by the end of the composting process (NOTE: Bulk density wasn't tested).

Moisture Content

Moisture content (MC) is measured as a percentage of the weight of a given organic material or of a blend of materials. MC of raw materials is used in calculating the MC of a recipe, as well as its C:N ratio. To hit the target moisture content, wet materials require dry matter, and dry materials require moisture (wet materials or water). When developing a composting recipe with a wet material such as food scraps, achieving the desired moisture range by adding dry matter will also bring both the C:N ratio and BD closer to the desired range. For this reason, this is a useful parameter to target first. Food scrap composters who effectively manage moisture in their recipes, usually have no trouble hitting the other parameters. This is because dry materials are often bulky and high in carbon with very few exceptions (coffee chaff is one exception, being dry, but high in nitrogen).

Moisture content is ideally kept at 50-60% for the entire composting process, and although compost tends to dry out over time (which is a good thing), it's important not to let it dry out too early in the process, because this will slow or stagnate decomposition.

Calculating Moisture Content

A = First Material
B = Second Material
MC = Moisture Content as a decimal (e.g. 75% is .75)

Moisture Content of Mix =

$$\frac{(\text{Weight of A} \times \text{MC of A}) + (\text{Weight of B} \times \text{MC of B})}{\text{Weight of A} + \text{Weight of B}}$$

Carbon : Nitrogen Ratio

Carbon and nitrogen can be analyzed in a lab and typically they are reported as a Percent Dry Weight, Percent Wet Weight, and sometimes as Lbs/ Yard^3. To calculate the C:N ratio in a composting recipe, each raw feedstock's percent carbon and percent nitrogen by dry weight is required (although if you don't have dry weight there are potential work arounds). The ratio of carbon to nitrogen (C:N ratio) of an individual material is the weight carbon divided by the weight nitrogen (use either dry or wet weight consistently)

The formula for calculating C:N ratio in the sidebar only shows two materials, although additional materials can be added following the same methodology. The Compost Recipe Calculator accompanying this guide automatically calculates the C:N ratio, MC, and BD of up to 11 materials.

One of the important things to understand is that a C:N ratio refers to weight based proportion of one chemical element to another and with accurate feedstock analysis is very precise. This ultimately gets translated into volumes of actual materials (e.g. tractor buckets of various materials), but this often gets confused with a volumetric ratio of high carbon materials to high nitrogen materials, or the "browns to greens" terminology used primarily in home composting education. These are two very different things and should not be confused.

To truly understand recipe development requires a firm knowledge of your raw feedstocks and their role and behavior in the composting environment. Of the primary recipe parameters, C:N ratio is one of the more complex concepts, because people don't commonly think in terms of carbon and nitrogen (although composters certainly learn to). In addition to getting to know your raw materials through visual and olfactory observation, touch, and lab analysis, a biological understanding of carbon and nitrogen in your raw materials, as well as throughout the composting process, will better inform how you develop and manage composting recipes.

At the most basic level, carbon is the energy source for microbes in the composting process. Organic carbon is chemically stored solar energy, which is released through metabolism in living things or through combustion (e.g. in wood stoves, automobile engines, power plants, etc.). It is a common misconception that nitrogen fuels the heat present in hot composting, when in fact it is the carbon. Nitrogen on the other hand, is required to form proteins, which is why protein rich meat and dairy are so high in nitrogen (and pose such a high threat of creating odors). The microbial populations that drive the early stages of hot composting are limited by the amount of proteins they can generate since their bodies themselves are made up of proteins. Simply put, carbon provides the energy source and nitrogen supports the synthesis of proteins and hence the population growth of microbes. Both in-turn can limit the rate and final quality of the composting process, but a C:N ratio of 25:1 to 30:1 has been found to have the correct balance, where neither carbon nor nitrogen limits the other. Different forms of carbon and nitrogen behave differently in compost and are more or less biologically available (see figure 3).

Calculating C : N Ratio

A = First Material
B = Second Material
% C = Percent Carbon Dry Weight
% N = Percent Nitrogen Dry Weight
MC = Moisture Content as a decimal (e.g. 75% is .75)

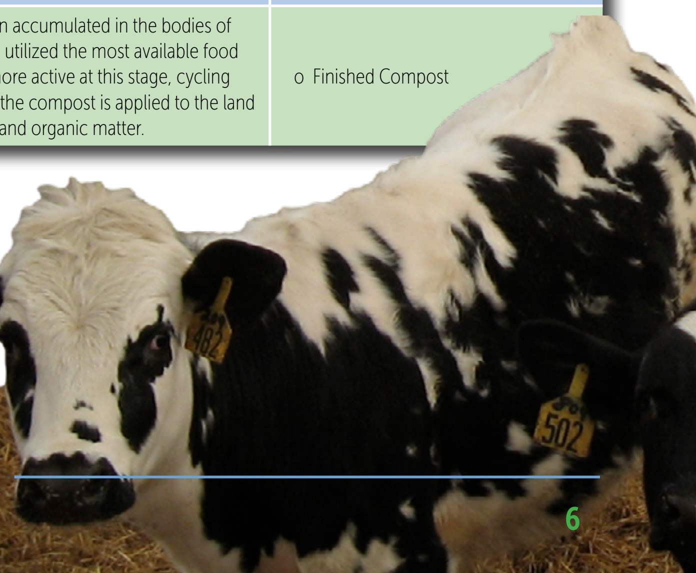
Carbon : Nitrogen Ratio of Mix =

$$\frac{[\%C \text{ Dry Weight in A} \times \text{Weight of A} \times (1 - \text{MC of A})] + [\%C \text{ Dry Weight in B} \times \text{weight of B} \times (1 - \text{MC of B})]}{[\%N \text{ Dry Weight in A} \times \text{Weight of A} \times (1 - \text{MC of A})] + [\%N \text{ Dry Weight in B} \times \text{weight of B} \times (1 - \text{MC of B})]}$$

Figure 3 - Biological Forms of Carbon & Nitrogen

In order from most biologically available to least biologically available

Carbon Forms	Description	Examples
Carbohydrate, Simple Sugars and Fats	Low hanging fruit for bacteria and some fungi, meaning they are metabolized very rapidly, and drive a fast initiation of composting when present. Food scraps, while high nitrogen, are also going to be high in these very "available forms" of carbon.	o Food Scraps o Manure o Green plants such as grass and hay
Cellulose	Makes up the cell walls of green plants and 40-50% of woody plants. Cellulose is made up of long glucose chains and is the most common organic compound on earth. Certain bacteria, fungi, and flagellate protozoa are able to break down cellulose. Cellulose in human food is known as "dietary fiber" and in ruminants, it is broken down by symbiotic bacteria in the rumen. Cellulose is relatively easily broken down and drives a fast and hot composting process.	o Manure o Hay o Straw o Leaves o Paper o Food Scraps
Waxes, Terpenes, and Secondary Plant Compounds	All play a role in plant defense systems, among other things. While they are not a significant or very available carbon form, plant based feedstocks containing these diverse group of compounds diversify the blend and add a long lasting energy source to the composting process.	o Bark o Woody plant material o Food scraps o Weeds
Lignins	The structural form of carbon in plants, forming a secondary cell wall. Woody plants are high in lignin, but all plants have lignin (other than Bryophytes, e.g. mosses). It is the slowest form of organic carbon to break down and is sometimes not broken down completely in one compost cycle. For their structural capacity, woody particles such as wood chips are used in compost blends to create porosity and a breathable pile architecture. Using 5-10% large woody particles (like wood chips or bark) by volume is usually ideal to "bulk" up a compost blend, help it breath, and maintain its form. Primarily fungi, but also some bacteria decompose lignin, although this is a slow process in both nature and composting. High lignin in compost recipes ($\geq$40:1 C:N ratio) creates high carbon compost ($\geq$20:1 C:N ratio) and is desirable to many applications, including for storm water treatment and green infrastructure. High carbon compost is not usually used as a high nutrient soil amendment without additional fertility, because of the potential that it will "tie up" nitrogen. For this reason, high carbon compost should be used as a top dressing or mulch, when used in horticultural applications, or following BMPs in storm water treatment and green infrastructure applications.	o Bark o Woody plant material
Nitrogen Forms	**Description**	**Examples**
Proteins	The most concentrated form of nitrogen in living things. A material's nitrogen content has a direct relationship with its protein content. Nitrogen in a compost mix is what microorganisms use to build living proteins in their bodies. Nitrogen limits the volume and speed of the microbiological population in a composting process. Protein degradation carries significant risk of anaerobic and odorous conditions, so any time there is a significant protein source, such as food scraps or butcher renderings, extra care must be taken to capture excess nitrogen and moisture with adequate carbon materials and to keep the materials contained in a blanket of absorbent feedstocks. Proteins break down rapidly given a balanced compost recipe, so the risk of odors reduces significantly as the composting process develops.	o Food Scraps o Meat, blood, animal/butcher renderings, and offal o Dairy o Legumes
Ammonia	The most volatile chemical form of nitrogen and the byproduct of the breakdown of protein. A percentage of ammonia turns to gas and is lost from all composting processes, however, the rate of loss is effected by a number of related pile conditions, including: a) Pile moisture – Ammonia can be retained by keeping it in "solution" until it can move through the nitrogen cycle, which means having adequate pile moisture content, ideally ~60%; b) Adequate available carbon allows a higher rate of microbial reproduction, which will utilize available nitrogen in microbial protein synthesis; c) Neutral pH – Ammonia gas is lost at a higher rate when pH is >9.	o Animal Manure, bedding, and urine
Nitrite and Nitrate	More chemically stable forms of nitrogen produced from Ammonia by "nitrifying bacteria". These bacteria are specialized and play a critical role in the earth's nitrogen cycle and ecosystem nitrogen retention. The process is inactive in soils above ~100 F and is therefore not a part of the thermophylic phase of composting, however, in the curing phase, nitrogen becomes increasingly chemically and biologically stable.	o Animal Manure, bedding, and urine
Biologically Sequestered Nitrogen	The final result of the nitrogen cycle. In mature compost, nitrogen has been accumulated in the bodies of living microorganisms as protein. Bacteria and fungi are less active, having utilized the most available food sources, however, higher-level organisms, which feed on them become more active at this stage, cycling nutrients up and down the food web. These organisms spring to life when the compost is applied to the land and begins interacting with the living environment, fresh nutrient sources, and organic matter.	o Finished Compost



FOOD SCRAPS

Bulk Density

The average weight of a specific volume of a material is known as the material's bulk density (BD). In composting BD is usually expressed in Pounds/Yard^3 or Kilos/Meter^3. For example, a common bulk density used for food scraps is 1,000 Pounds/Yard^3, which was arrived at by tracking the weights and volumes of food scraps over a long period of time and then converting this data to Pounds/Yard^3. Bulk density is useful to composters during recipe development for two main reasons.

First, as you can imagine, a material that weighs 1,500 Pounds/Yard^3 (a dairy cow manure), is much more dense than a material that weighs 800 Pounds/Yard^3 (a well bedded horse manure). If you are developing a compost recipe with a dense primary feedstock, a lighter "bulking material" will be needed to reduce the density of the overall mix and bring it to <1,000 Pounds/Yard^3 if possible. BD is an indicator of a pile's overall density, but does not necessarily represent the structural integrity or porosity of a mix. Using 5-10% large woody particles (like wood chips or bark) by volume is usually ideal to "bulk" up a compost blend, help it breathe, and maintain its form. This will also decrease the bulk density. The BD of a mix of materials can be calculated using the formula above and the Compost Recipe Calculator accompanying this guide calculates the BD of up to 11 materials automatically.

In addition to using bulk density as an indicator of the structure of the compost mix, bulk density is critical to converting volume to weight and vice versa in both recipe calculations and in the field applications. For example, 5 Tons of food scraps comes to the compost site and you need to build a compost blend based on your recipe. Your recipe is in cubic yards, not tons, so how do you know how many cubic yards of feedstocks came in? If you know that the BD of your food scraps is approximately 1,000 Pounds/Yard^3, then convert 5 Tons of food scraps to Pounds: 5 Tons X 2,000 Pounds/Ton = 10,000 Pounds, then divide by the bulk density to get 10 cubic yards of food scraps. A short cut is simply knowing that 1 Ton of food scraps is ~2 Yards^3. Now you can apply your recipe to create the blend (for more on this, see Creating Recipes for Field Use, p.9).

Calculating Bulk Density

A = First Material
B = Second Material
C = Third Material

Bulk Density of Mix =

$$\frac{(\text{Volume of A} \times \text{Bulk Density of A}) + (\text{Volume of B} \times \text{Bulk Density of B}) + (\text{Volume of C} \times \text{Bulk Density of C})}{\text{Total Volume}}$$

Note: Keep unit of volume consistent across the recipe. The formula works for any number of combined materials.

Porosity

The forth primary compost recipe parameter is porosity, which refers to the amount of "free air space", also called "pore space" or "interstitial space", between particles in a compost mix. Unlike MC, C:N ratio, and BD, porosity is not calculated as part of your compost recipe, although it is considered just as important, because a porous recipe allows air to move more freely through the pile, maintaining aerobicity. Typically a compost recipe should be between 30-33% pore space, which can be measured, but observation of the mix alone is sufficient if you know what to look for. A pile of wood chips is about 50% pore space and using 5-10% large woody particles (like wood chips or bark) by volume is usually ideal to "bulk" up a compost blend, help it breathe, and maintain its form. Less structural materials like hay, may be very porous initially, but then get dense as they begin to break down, which is why more stable woody particles are ideal. Many composters later screen out large particles and reuse them as their bulking agent, which is a great strategy to maintain porosity, without needing to bring in as much new material. Reused woodchips will provide little carbon or dry matter however, so should be left out of C:N ratio and MC calculations.

pH

Acidity and alkalinity is measured on a scale called pH, with pure water being absolute neutral, or a 7 on the pH scale. Feedstocks with a pH of between 6 and 8 are within the normal range. Lab analysis will typically give a pH reading and field tests are available, however, calculating the pH of a blend of materials is not typically done due to methodological challenges. High pH compost recipes (pH>9) can lead to a significant loss of nitrogen throughout the composting process, limited microbial activity, and high pH finished composts that must be used with discretion. Dairy manure is typically high pH, so composters working with a lot of dairy manure should keep an eye on pH and test regularly. Low pH (highly acidic) recipes can become very odorous and limit microbial activity as well. During the composting process, pH drops significantly as organic acids break down, exacerbating acidic conditions conducive to odors. Food scraps are an example of a low pH feedstock, although proper amending with carbon feedstocks typically neutralizes pH sufficiently. Feedstocks that are far outside of the normal range must be managed with discretion, diluted sufficiently with other materials, or amended with neutralizing agents. Operators with a problem recipe may use trial and error on a small batch to neutralize the pH, then apply the mix on a larger scale as needed. If a pH issue persists, seek technical assistance.

Salinity

Soluble Salts in compost are typically measured on a scale of electrical conductivity associated with salt content. Conductivity above 5 mmhos/cm (Millimhos/centimeter) in finished compost can be harmful to plants if not sufficiently diluted. At low levels, these salts are potentially beneficial minerals that plants can use. Dairy manure and food scraps are both common sources of salts. If a feedstock has high salts, make sure that it is diluted adequately with other low salt materials and test the conductivity of the finished compost. High salt composts (≥5 mmhos/cm) should be matched with an appropriate end use.

Organic Matter

Organic Matter and Volatile Solids Content both describe the percentage of an organic material that is combustible and therefore, at least partially biodegradable. Non-Volatile Solids are the inverse and describe the percentage of a material that is inorganic, or mineral in nature, and will not combust. The remaining percentage after the Non-Volatile Solids have been subtracted would be the Organic Matter (e.g. 35% Non-Volatile Solids would be an Organic Matter of ~65%). Most compost tests provide one of these three parameters. Non-volatile material will not hurt the composting process as long as it does not make up more than 20% of the weight of the compost mix, but ideally Non-Volatile Solids inputs are as low as possible, because most compost users desire a high organic matter compost. Organic Matter of >60% is desirable for raw feedstocks and compost mixes, and 50-60% in finished compost is considered ideal, 30-70% is typical.

Analyzing Feedstocks

An important step in knowing your feedstocks and developing a composting recipe is testing samples of the raw materials you will use. Although there are book values for many common feedstocks available, these may or may not accurately represent the materials you are working with. Performing analysis of your own materials is the only way to get to high level of accuracy when assessing feedstocks or developing compost recipes. To sample and test your feedstocks, see Feedstock Sampling Protocol, which is a companion resource to this guide.

If you work with a lab that specializes in compost analysis, the analysis you get back will look something like Figure 4 below. The Sample Analysis provided in the Compost Recipe Calculator accompanying this guide shows how to use feedstock analysis in recipe development.

Note: When working with labs that do not provide analysis specifically for composters, make sure that they will give you the key information required for recipe development.

Figure 4 - Sample Feedstock Analysis

C05942	**Farm** Bedded Pack	8/24/2012	Feedstock			

COMPOST ANALYSIS REPORT

Compost Test 1A

Analyte	Results (As is basis) (Weight basis)	(Volume Basis*)	Results (Dry weight basis)
pH	6.6	——	——
Soluble Salts (1:5 w:w)	7.23 mmhos/cm	——	——
Bulk Density*	——	582 lb/yd^3	——
Solids	40.7 %	237 lb/yd^3	——
Moisture	59.3 %	345 lb/yd^3	——
Organic Matter	29.0 %	169 lb/yd^3	71.3 %
Total Nitrogen	0.40 %	2 lb/yd^3	1.0 %
Carbon	15.1 %	88 lb/yd^3	37.1 %
Carbon:Nitrogen Ratio	38.00	——	38.00

Creating Recipes For Field Use

The final steps when developing a recipe you can blend from your tractor are to convert the units in your recipe calculations into a logical form for your operation. The typical way to do this is to find the ratio of each additional feedstock per unit of your primary feedstock. For example, for every one Yard^3 of Food Scraps (primary feedstock), the example recipe on pg. 2 calls for 2 Yards^3 of Hay, 1 Yard^3 of Bark, 3 Yards^3 of Horse Manure, ½ Yard^3 Shredded Paper, and 1 Yard^3 of Heifer Manure. If you are using the Compost Recipe Calculator, you will actually be inputting the materials in Yards^3, rather than by weight, which saves the step of needing to convert from weight to Yards^3. If you base your recipe off of 1 Yard^3 of your primary feedstock, this step will already be done for you. Those using weight for your calculations, you will need to convert the weights of each material to Yards^3 based on the BD of each material. Refer to the On-Farm Composting Handbook for the methodology as needed.

Having calculated the ratio of each additional feedstock to the primary feedstock by volume, the next step will be taking the total volume of primary feedstock and calculating the total volume of each additional material. For example:

5 Tons of Food Scraps comes to the compost site and you need to build a compost blend. Your recipe units are Yards^3, not Tons, so how do you know how many Yards^3 of feedstocks came in? If you know that the BD of your food scraps is approximately 1000 Pounds/Yard^3, then convert 5 Tons of food scraps to Pounds: 5 Tons X 2000 Pounds/Ton = 10,000 Pounds, then divide by the bulk density to get 10 Yards^3 of food scraps. Now you can apply your recipe, by multiplying the ratio of all of your additional feedstocks by 10. For 10 Yards^3 of Food Scraps (primary feedstock), the recipe calls for 20 Yards^3 of Hay, 10 Yards^3 of Bark, 30 Yards^3 of Horse Manure, 5 Yards^3 Shredded Paper, and 10 Yards^3 of Heifer Manure. Finally, if your loader's bucket is not 1 Yard^3, (some are 3/4 Yard^3, 2 Yards^3, 5 Yards^3) it may be worthwhile to convert your recipe to buckets, rather than yards.

You can keep this recipe with you in the tractor and some operators find it useful to track the mix as they add materials. Strategize how you add materials to the mix. For example, adding your woody and most absorbent materials as a base where wet materials can be dumped. With larger batches, rotating the addition of feedstocks between different materials begins to blend them together. Vermont Solid Waste regulations require that you keep a detailed written record on file of the actual recipes used for each batch of compost produced at the facility.

References

Recipe Development Worksheet. Highfields Center for Composting. Hardwick, VT. Web Resource: No longer available.

Rynk, R. On-Farm Composting Handbook. NRAES 54. Ithaca, NY. Natural Resource, Agriculture, and Engineering Service. 1992.

Vermont Solid Waste Management Rules: Subchapter 11 - ORGANICS MANAGEMENT. Effective Date 3/15/2012.

Epstein, Eliot. The Science of Composting. Lancaster, PA. CRC Press. 1996.

Companion Resources:

Weed Seed Testing
Temp Probe Recalibration
Pile Monitoring and Logs
Recipe Calculator
Feedstock Sampling
Food Scraps and Feedstock Acceptance

Photos

- Highfields Center For Composting
- Srise

Acknowledgements

This guide was created under contract with the Vermont Agency of Natural Resources, Department of Environmental Conservation, Solid Waste Program, in 2015. Any opinions, findings, and conclusions or recommendations expressed in these materials are solely the responsibility of the authors and do not necessarily represent the official views of the Agency of Natural Resources.

The following resource uses or is adapted from content originally developed by the Highfields Center for Composting in Hardwick VT. The Highfields Center for Composting dissolved as an organization in December 2014 and ended its active involvement in the Close the Loop Program.

The content has been made publicly available for use in supporting organics management in Vermont and elsewhere through the generosity of the High Meadows Fund, the Harris and Frances Block Foundation, and the Vermont Community Foundation. For more information about the use of Highfields related materials please contact jake@vsjf.org.

The Vermont community wishes to thank the Highfields Center for Composting for its years of outstanding leadership in the service of community composting and universal recycling in Vermont.

Content Creator

James McSweeney

Compost Technical Services

www.CompostTechnicalServices.com

Design

Srise

www.srise.com

For more information contact

VERMONT

AGENCY OF NATURAL RESOURCES
Department of Environmental Conservation

Solid Waste Management Program

Waste Management & Prevention Division
1 National Life Dr – Davis 1
Montpelier VT 05620-3704
(802)828-1138
www.recycle.vermont.gov

FOOD SCRAPS