Lesson 6: Operations - Receiving, Mixing & Windrow Construction

Learning Objectives:

- Know the desired characteristics for composting
- Be familiar with how to select and blend feedstocks to achieve a good mixture for turned windrow composting

Controllable Variables

- C:N Ratio
- Moisture Content
- Particle Size
- pH
- Bulk Density / Porosity

Optimal Parameters for Raw Mix

- C:N Ratio = 25:1 - 40:1
- Moisture Content = 50% - 60%
- pH = 6.5 - 8.5
- Particle Size = mixture from ¼” - 4”
- Bulk Density < 1,000 lb/cy
- Porosity = 35% - 50%

Special Considerations for Minimal Turning

- Higher initial moisture content
- Bulking agent / carbon source with higher percent of larger particles
- Porous well-aged capping layer

Field Measurement of Bulk Density

- Bulk Density is weight per volume, e.g. pounds per cubic yard (lbs/cy)
- Lower bulk density typically means greater porosity and better air flow
- Field Measurement:
  - Measure 5 gallons of feedstock
  - Drop from 1 ft. height
  - Adjust volume to 5 gallons
  - Measure net weight
  - Multiply by 40.4

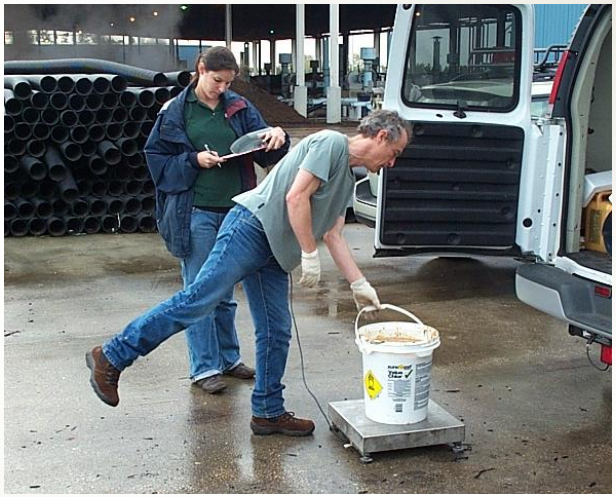


Photo source: FORCE - Reedy Creek

Field Measurement of Moisture Content

- Pick up handful of material, it should feel like a moist sponge
- If water trickles out, then it's too wet
- If you can squeeze out some water then it's okay
- If you can't squeeze out any water then it's too dry

How to Calculate C:N Ratio

Feedstock	Weight	% Moisture	% Carbon DW	% Nitrogen DW	DW Carbon	DW Nitrogen
A						
B						
C						
Total						
C:N Ratio						

DW Carbon = Weight x (1 - % Moisture) x % Carbon DW
DW Nitrogen = Weight x (1 - % Moisture) x % Nitrogen DW
C:N Ratio = DW Carbon ÷ DW Nitrogen

Sample Mix Recipe: YT & VW

- Yard Trash (YT) and Vegetative Waste (VW) 3:1 Volumetric Ratio:

Incoming Feedstocks	cy	lbs/cy	% Moisture	% C DW	% N DW
Vegetative Waste	25	1130	70%	45.0%	3.0%
Yard Trash	75	365	40%	65.0%	1.0%

Mix Calculations	Tons	Dry Tons	Moisture	Tons C	Tons N	C:N Ratio
Vegetative Waste	14.1	4.2	9.9	1.9	0.1	15:1
Yard Trash	13.7	8.2	5.5	5.3	0.1	65:1
Total	27.8	12.5	15.4	7.3	0.2	35:1
			55%			

Sample Mix Recipe: YT, VW & Manure

- YT, VW and Manure 4:1:1 Volumetric Ratio:

Incoming Feedstocks	cy	lbs/cy	% Moisture	% C DW	% N DW
Vegetative Waste	20	1130	70%	45.0%	3.0%
Cow Manure (no bedding)	20	1000	70%	50.0%	3.0%
Yard Trash	80	365	40%	65.0%	1.0%

Mix Calculations	Tons	Dry Tons	Moisture	Tons C	Tons N	C:N Ratio
Vegetative Waste	11.3	3.4	7.9	1.5	0.1	15:1
Cow Manure (no bedding)	10.0	3.0	7.0	1.5	0.1	17:1
Yard Trash	14.6	8.8	5.8	5.7	0.1	65:1
Total	35.9	15.2	20.8	8.7	0.3	30:1
			58%			

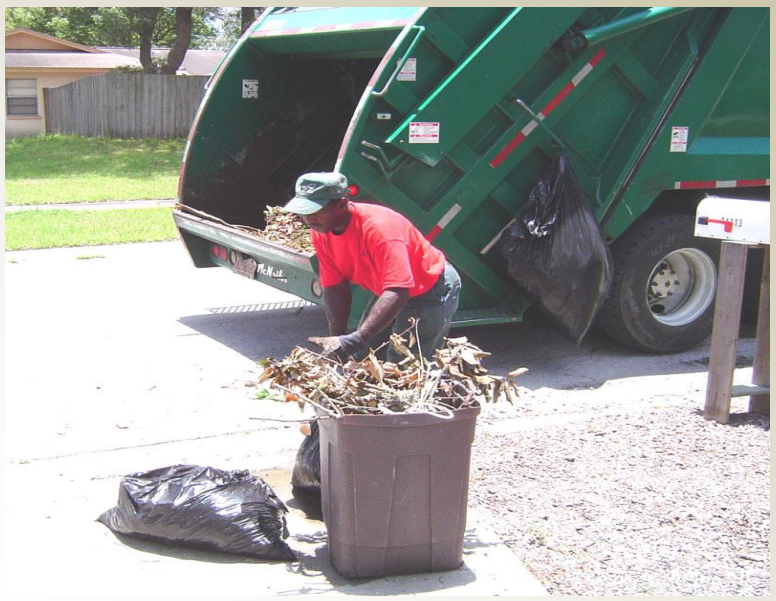
Pre-Processing

- Size Reduction:
  - Yard Trash to produce consistent particle size and structure to serve as a bulking agent
  - For large pieces of VW & degradable packaging, recommended but not essential
- Moisture Adjustment:
  - Yard Trash, if necessary, to achieve proper moisture in mix

Pre-Processing

(continued)

- Removing Plastic Bags
  - Characteristics of Florida Yard Trash make removal of plastic bags after grinding very difficult
  - Fresh Yard Trash tends to be fibrous and entangles plastic
  - Aged Yard Trash is more suitable for plastic removal
- Best option for composting facility is to receive debagged curbside yard waste or require compostable bag usage from generator



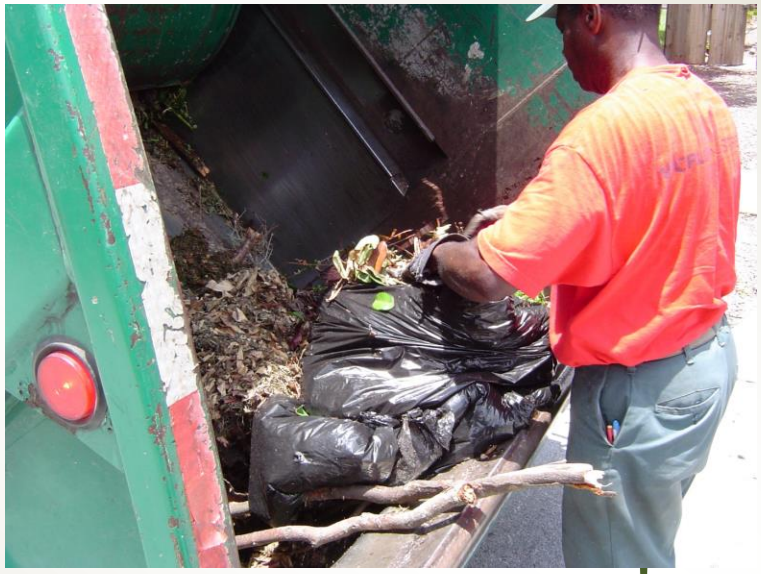
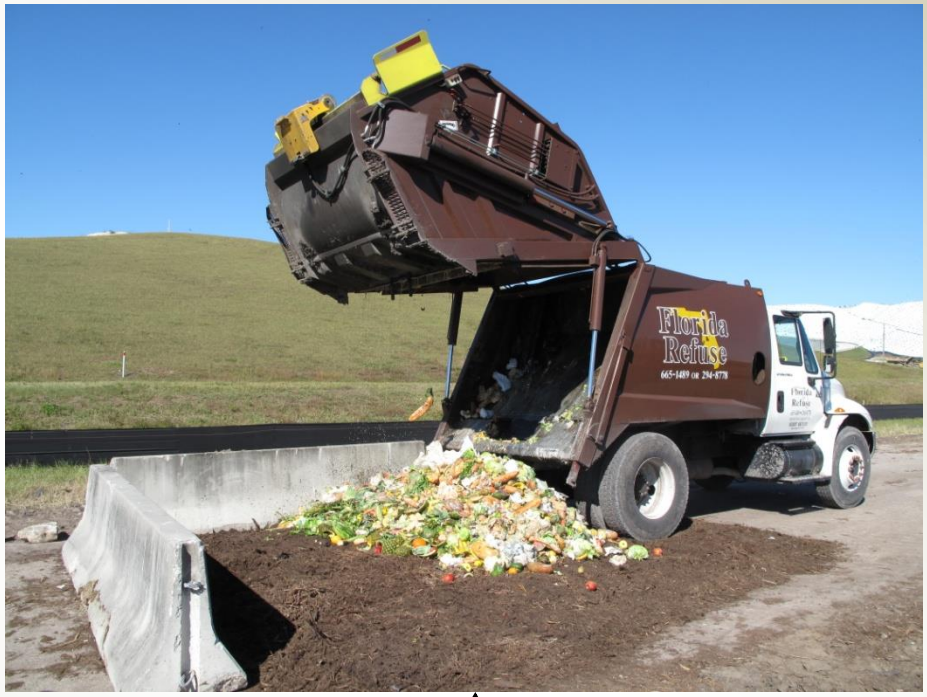


Photo source: Hillsborough County, FL

Receiving

- Always have sufficient volumes of pre-processed bulking agent on-hand prior to receiving food waste
- Prepare a bed of bulking agent for receiving food waste

Photo source: FORCE - Polk County



Bulking Agent

Feedstock Mixing

- Thoroughly blend materials without compacting them
- Check and adjust moisture level by adding water or dry bulking agent
- Front-end Loader vs. Dedicated Mixer

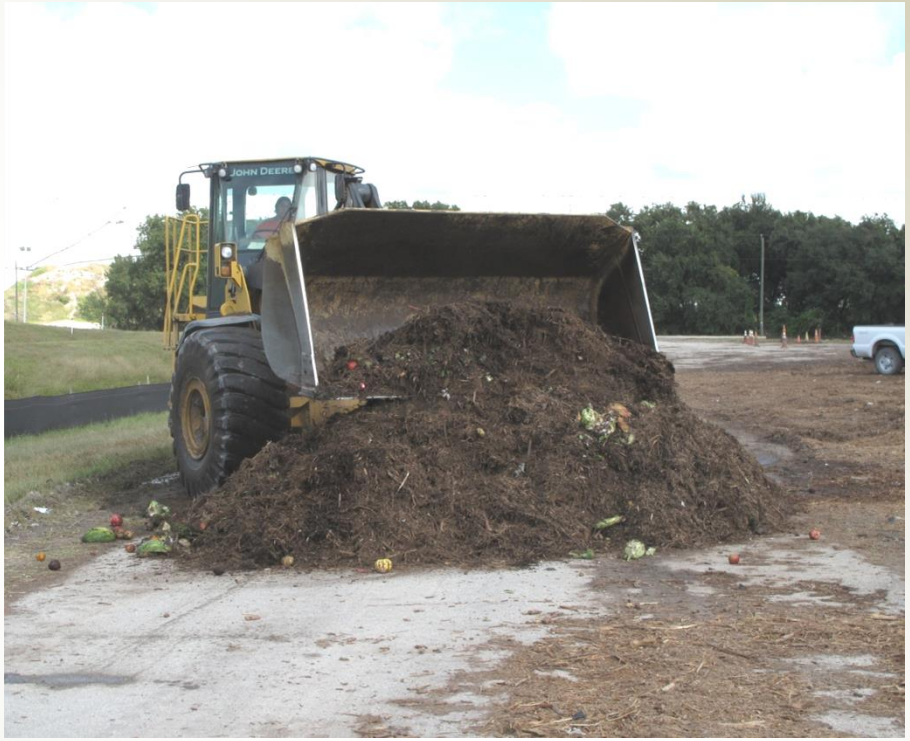


Photo source: FORCE – Reedy Creek

Windrow Construction

- Maximize pore space by gently dropping materials onto windrow
- Avoid driving on or compacting windrow
- Shape top to either shed or absorb rain
- Smooth sides
- Cover with capping layer to control odors and birds

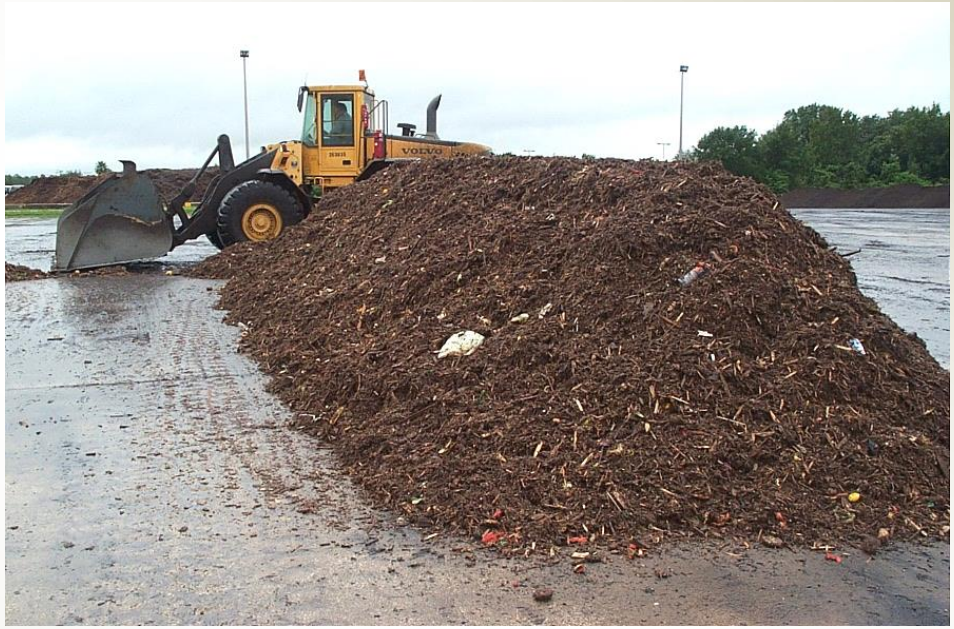


Photo source: FORCE – Reedy Creek

Windrow Dimensions

- Construct initial windrows based on capability of turning equipment, typically 6 – 8 ft high and 12 – 16 feet wide
- Oversized piles often are the cause of odor because they can compact and limit air flow
- Undersized piles lack the thermal mass necessary to sustain high temperature