



Estimating Cover Crop Biomass

USDA-Natural Resources Conservation Service, Des Moines, Iowa

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More Biomass = More Benefits

Cover crops are one of the most important practices that farmers can use to improve their soils and the sustainability of their production system. **Cover crops provide many benefits, including: reducing erosion, increasing soil carbon, fixing nitrogen, increasing water infiltration, grazing for livestock, and habitat for insects.**

The amount of biomass production varies by species by the year. Knowing how much biomass there is in a field is a critical piece of information for cover crop management.

Why Measure Cover Crop Biomass?

- » Provide the amount of carbon loading material to improve soil health
- » Learn the relationship between cover crop biomass and weed control effectiveness
- » Estimate forage for grazing
- » Indicate total residual Nitrogen taken up ($> \text{Biomass} > \text{Residual Nitrogen uptake}$)
- » Determine if the cover crop yield estimated in a soil loss calculation is accurate

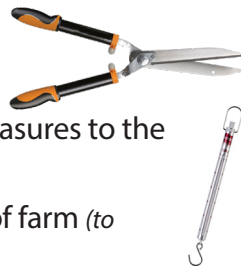
Objective: estimate dry weight of above-ground cover crop

Things to consider:

- » Top growth makes up 2/3 of the total lbs., roots 1/3 for our winter hardy grains - *John Sawyer ISU, et al.*
- » 5x amount of N in the above ground biomass vs. below ground – *John Sawyer ISU, et al.*

Equipment needed:

- » Hoop, for Hoop Method
 - 1.92ft² (diameter of 18.77"), circumference = 58.93" or 4' 11"
 - * Best size for most grass or forb crops, *see below for additional sizes*
 - * Can make from coated cable and one cable clamp
 - * Forestry supplier dealer – Vegetation Sampling Hoop, ~\$22
- » Tape measurer, for *Row Method*
- » Clipping tool (scissors or garden shears ~\$25)
- » Brown paper bags
- » Marker
- » 300-gram scale (*ideal*) that measures to the gram, ~\$60
- » Farm Service Agency photo of farm (*to document sample areas*)
- » Camera (*optional, but good idea to use for documentation & education*)



Procedure:

1. Choose representative areas in the field (*stay out of end rows & tire tracks*)
 - a. i.e. pull samples from areas with potentially different growths, such as eroded sidehill and the ridge.
 - b. The stand may not be uniform if aerially seeded, but choose a representative area.
2. Once you know the area in the field you want to

sample, try to be unbiased when choosing the sampling point in the area.

3. Take pictures of sampling area (include a landscape shot to show variability).
4. Sample method
 - a. **Hoop method**
 - i. Works well for aerial or broadcast applications or narrowly planted rows (7.5"). *Hoop method can be difficult for 30" + tall vegetation.*
 - ii. Get the ring down on the ground & separate plants from inside & outside of the ring.
 - iii. Your sample is the area in the hoop.
 - b. **Row method**
 - i. Use when cover crop is planted in rows.
 - ii. Preferred method when cover crop is planted in rows of 10" wide or more.
 - iii. Use tape and measure row(s) based on Table 1.
 - iv. Mark start and end with flags or make a perpendicular mark in the soil.

Table 1 - 1.92ft²

7.5" rows	10" rows	15" rows
2 rows @ 18.4"	2 rows @ 13.8"	1 row @ 18.4"

5. Collect data
 - a. Get cover crop:
 - i. species mix,
 - ii. seeding rate,
 - iii. planting date,
 - iv. planting method, and
 - v. planned termination timing & method from a producer.
 - * Take picture of seed tag, if available.

-in field-

- b. Count # of plants and # of tillers. (*optional*)
- c. Clip plants at the ground level.
 - i. For hoop method, all plant bases inside of hoop
 - ii. For row method, all plant bases inside the measured row distance
- d. Place each sample clippings in a paper bag, label. (farm, field, sample # and description)

Table 2 - Dry Matter Conversion

	Plant Growth Stage			
	Vegetative Stage <i>(Initial growth - boot stage (before heading))</i>	Headed out <i>(boot stage - flowering)</i>	Seed mature, leaf tips drying	Leaves dry, stems partially dry
Cool Season Grasses	25%-35%	45%	60%	85%
Forbs & Legumes	20%	40%	60%	90%

1. example: weigh 76 grams of a cereal rye cover crop 12" tall, vegetative stage. * by 50 = 3,800lbs/acre. * by 35% = 1,330lbs dry matter/ acre.
2. If the cover crop is made up of both cool season grass and forbs/legumes (broadleaves), then clip and weigh the two groups separately & add weight together.

- i. 1-2 samples for typical situation for each representative area, *weighing separately*.
- ii. 4 – 5 samples for each plot for research work, *weighing separately*.
- e. Weigh samples (wet) in field or when back to office in grams
- f. Multiply weight in grams by 50 to get wet weight in lbs. / acre (when using the 1.92ft²)
- g. Convert Wet Material sample weight to Dry Matter Weight (Use Table 2 above)

Other calculations you may want to complete for plant and tiller data:

- » To standardize # of plants and # of tillers to foot square
 - 12 plants in 1.92ft². $12/1.92ft^2 = 6.25$ plants / ft²
- » To standardize # of plants / foot of row
 - 15" of row. 12 plants in 18.4". $18.4/12 = 1.53'$. $12 / 1.53' = 7.8$ plants / foot of row.
- » Once you have standardized your number to 1 ft², you can extrapolate this to a per acre basis by multiplying by 43,560. One acre = 43,560 ft²

Typically, in Iowa

- » Cereal rye terminated before corn when 6-8" tall will be ~800lbs.
- » Cereal rye terminated before soybeans when 12-15" tall will be ~1,500-2,000lbs, 24" tall - ~4,000lbs

Table conversion from sampling by foot to square foot for different row widths.

Conversions from 1 ft row length to ft ²	
Row width (inches)	Ft ² /ft. of row
7.5	0.625
10	0.833
15	1.25
20	1.67
30	2.5

1. Allows you to field sample rows by foot of row, then converting to ft² based on the row width.

Tom Kasper Method for measuring biomass

- » Use rectangle 30" x 20" (4.16ft²)
- » One end is open on the rectangle to make it easier to sample tall cover crops, when it's difficult to put a ring over the top vegetation. With an end open, slide the ring through the vegetation at ground level.

Sample Cover Crop Biomass Data Collection Sheet

Producer Name: Joe Dilly

Location: SW 1/4, Sec 21, Bridge Township, Guthrie Co.

Tract / Farm Name: T-100, Loot Farms

Date: 5/7/18

Cover crop mix: Cereal rye

Seeding rate: 55 lbs/acre PLS 61 lbs bulk

Planting date: 10/20/17

Planting method: Drilled

Planned Termination

Date or Stage: 1 week after planting beans

	1	2	3
Sample Area Location Description	Field 1, Side Hill Eroded	Field 3 Ridge Clarion B	Field 4 Slopes 1-2% Colo/Ely
Description of Cover Crop	12" Tall	12-15" Tall	15" Tall
# of plants, optional		/ft ²	/ft ²
# of tillers, optional		/ft ²	/ft ²
Biomass Wet (grams)	160 grams	211 grams	234 grams
Biomass converted to lbs/acre	8,000	10,571	11,714
Estimated Dry Biomass lbs/ac	2,800	3,700	4,100
Air dry/ oven dry (grams)			
Air dry/ oven dry converted to lbs/ac			

Comments: Uniform stands throughout. Landowner stated last fall rye was only 2-3" tall.

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Tract / Farm Name:

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Cover crop mix:

Seeding rate:

Planting date:

Planting method:

Planned Termination

Date or Stage:

	1		2		3	
Sample Area						
Location Description						
Description of Cover Crop						
# of plants, <i>optional</i>		/ft ²		/ft ²		/ft ²
# of tillers, <i>optional</i>		/ft ²		/ft ²		/ft ²
Biomass Wet (grams)						
Biomass converted to lbs/acre						
Estimated Dry Biomass lbs/ac						
Air dry/ oven dry (grams)						
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Comments:

Table 1. - Dry Matter Conversion				
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Cool Season Grasses	35%	45%	60%	85%
Forbs & Legumes	20%	40%	60%	90%

Table 1. - use with .96 square ft.		
7 1/2" rows	10" rows	15" rows
2 rows @ 18.4"	2 rows @ 13.8"	1 row 18.4"