

Energy Enhancement Activity - ENR08 – Using nitrogen provided by legumes, animal manure and compost to supply 100% of the nitrogen needs



Enhancement Description

This enhancement involves using nitrogen produced by legumes and/or available from animal manure and compost to supply 100% of nitrogen nutrient needs for crops, hay and/or forages produced on the farm.

Land Use Applicability

Cropland and pastureland.

Benefits

Annually 12 million tons of nitrogen fertilizers are used to produce crops on over 90 million acres. It requires 35,000 to 40,000 cu.ft. of natural gas to produce one ton of nitrogen fertilizer accounting

for 1/3 of the energy input to crop production. Managing legumes, manures and compost properly can replace the need for additional nitrogen fertilizer and reduce the energy footprint that a farming operation might have.

Criteria

- A nutrient management system will be followed that utilizes nitrogen from legumes, animal manures and compost as the sole source of nitrogen for production.
- Follow LGU recommendation for legume nitrogen production when estimating available nitrogen for crop production.
- A more accurate estimate can be obtained by following the guidance in “Northeast Cover Crop Handbook” chapter 2.
- Manure and compost nutrient analysis will be used when estimating available nutrients for crop production.
- On soils where “P” levels are high or very high, manure must be applied according NRCS Nutrient Management Standard (590).
- Soils disturbed during manure application should be followed by a cover crop that will prevent erosion and trap nutrients.
- Utilize cover crops to trap N were appropriate, e.g. following manure application on soils with low residue levels or that have been tilled.
- Manure from off farm sources can be used.
- This does not include the removal of crops that require nitrogen from the rotation, e.g. eliminating corn to avoid use of nitrogen fertilizer.



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Documentation Requirements

- Crop production records that include:
 - Source of organic nitrogen, e.g. cover crop, manure
 - An estimate of available nitrogen and method used to estimate
 - Lab analysis
 - Bio mass calculation
 - Amount of manure and/or compost applied per acre
 - Manure nutrient analysis
 - Listing of fields
 - Estimate of legume biomass produce each year

ALABAMA SUPPLEMENT TO ENHANCEMENT ENG08 USING NITROGEN PROVIDED BY LEGUMES, ANIMAL MANURE AND COMPOST TO SUPPLY 100% OF THE NITROGEN NEEDS

Commercial nitrogen fertilizer requires large amounts of natural gas for its production so reducing the amount of commercial nitrogen needed by producers will reduce energy usage. This enhancement involves using nitrogen produced by legumes and/or available from animal manure and compost to supply 100% of the nitrogen need for the crop. It does not include the removal of crops that require nitrogen from the rotation, e.g. eliminating cotton to avoid use of nitrogen fertilizer. This enhancement can be applied on cropland and pastureland. Refer to the national enhancement for more information.

Criteria

1. The producer must utilize nitrogen from legumes, animal manure and compost as the sole source of nitrogen for production.
2. If using legumes to fix nitrogen then the producer must estimate the available nitrogen for the legume. To obtain an estimate of the amount of nitrogen that will be available to the fallow crop see the guidance on the next page from "Managing Cover Crop Profitably".
3. If using manure or compost, a) application rate must be applied according to Alabama Nutrient Management Standard (590), b) nutrient analysis of the manure or compost must be used for estimating available nutrients for crop production before application, c) soil disturbance at the time of application should be minimized to reduce erosion and nutrient loss, and d) manure and compost from off farm sources can be used.
4. If a manure application is being planned a nutrient management plan must be created. A nutrient management plan contains the following for each application site: a) aerial photographs (with buffers); b) soils map; c) crop rotation; d) soil test (no older than 3 years); e) yield goals; f) Alabama Phosphorus Index; g) nutrient budget; h) planned rates, methods, and timing; and i) guidance for implementation/operation and maintenance/record keeping.

Documentation Requirements:

1. Crop production information, list of fields, crop rotation, nitrogen recommendation, and yield goals.
2. Nitrogen inputs from legumes, a) method used to estimate nitrogen available to the crop, b) biomass calculation, and c) total available nitrogen.
3. Nitrogen inputs from manure or compost, a) manure or compost type, b) lab analysis date, c) application rate, and d) application date.
4. Nutrient management plan if there is a planned manure application.

How Much N?

To find out if you might need more N than your green manure will supply, you need to estimate the amount of N in your cover crop. To do this, assess the total yield of the green manure and the percentage of N in the plants just before they die.

To estimate yield, take cuttings from several areas in the field, dry and weigh them. Use a yardstick or metal frame of known dimensions (1 ft. x 2 ft., which equals 2 ft² works well) and clip the plants at ground level within the known area. Dry them out in the sun for a few consecutive days, or use an oven at about 140° F for 24 to 48 hours until they are "crunchy dry." Use the following equation to determine per-acre yield of dry matter:

$$\text{Yield (lb./Acre)} = \frac{\text{Total weight of dried samples (lb.)}}{\text{\# square feet you sampled}} \times \frac{43,560 \text{ sq. ft.}}{1 \text{ Acre}}$$

While actually sampling is more accurate, you can estimate your yield from the height of your green manure crop and its percent groundcover. Use these estimators:

At 100 percent groundcover and 6-inch height*, most nonwoody legumes will contain roughly 2,000 lb./A of dry matter. For each additional inch, add 150 lb. So, a legume that is 18 inches tall and 100 percent groundcover will weigh roughly:

Inches >6: 18 in.-6 in. = 12 in.

x 150 lb./in.: 12 in. x 150 lb./in. = 1,800 lb.

Add 2,000 lb.: 2,000 lb. + 1,800 lb. = 3,800 lb.

If the stand has less than 100 percent groundcover, multiply by (the percent ground cover / 100). In this example, for 60 percent groundcover, you would obtain:

$$3,800 \times (60/100) = 2,280 \text{ lb.}$$

Keep in mind that these are *rough estimates* to give you a quick guide for the productivity of your green manure. To know the exact percent N in your plant tissue, you would have to send it to a lab for analysis. Even with a delay for processing, the results could be helpful for the crop if you use split applications of N. Testing is always a good idea, as it can help you refine your N estimates for subsequent growing seasons.

The following rules of thumb may help here:

- Annual legumes typically have between 3.5 and 4 percent N in their aboveground parts prior to flowering (for young material, use the higher end of the range), and 3 to 3.5 percent at flowering. After flowering, N in the leaves decreases quickly as it accumulates in the growing seeds.

* For cereal rye, the height relationship is a bit different. Cereal rye weighs approximately 2,000 lb./A of dry matter at an 8-inch height and 100 percent groundcover. For each additional inch, add 150 lb., as before, and multiply by (percent groundcover/100). For most small grains and other annual grasses, start with 2,000 lb./A at 6 inches and 100 percent ground cover. Add 300 lb. for each additional inch and multiply by (percent groundcover/100).

- For perennial legumes that have a significant number of thick, fibrous or woody stems, reduce these estimates by 1 percent.

- Most cover crop grasses contain 2 to 3 percent N before flowering and 1.5 to 2.5 percent after flowering.

- Other covers, such as brassicas and buckwheat, will generally be similar to, or slightly below, grasses in their N content. To put it all together:

$$\text{Total N in green manure (lb./A)} = \text{yield (lb./A)} \times \frac{\% \text{ N}}{100}$$

To estimate what will be available to your crop this year, divide this quantity of N by:

- 2, if the green manure will be conventionally tilled;
- 4, if it will be left on the surface in a no-till system in Northern climates;
- 2, if it will be left on the surface in a no-till system in Southern climates.

Bear in mind that in cold climates, N will mineralize more slowly than in warm climates, as discussed above. So these are gross estimates and a bit on the *conservative* side.

Of course, cover crops will not be the only N sources for your crops. Your soil will release between 10 and 40 lb. N/A for each 1 percent organic matter. Cold, wet clays will be at the low end of the scale and warm, well-drained soils will be at the high end. You also may receive benefits from last year's manure, green manure or compost application.

Other tools could help you refine your nitrogen needs. On-farm test strips of cover crops receiving different N rates would be an example. Refer to Appendix A, *Testing Cover Crops on Your Farm* (p. 189) for some tips on designing an on-farm trial. In some regions, a pre-sidedress N test in spring could help you estimate if supplemental N will be cost-effective. Bear in mind that pre-sidedress testing does not work well when fresh plant residues have been turned in—too much microbial interference relating to N tie-up may give misleading results.

For more information on determining your N from green manures and other amendments, see the *Northeast Cover Crop Handbook* (361).

—Marianne Sarrantonio, Ph.D.

For accurate estimations of nitrogen available from green manure or cover crops to the cash crop, Alabama producers should consider the following.

To estimate the amount of nitrogen that will be available to the preceding cash crop, research suggested dividing the total quantity of nitrogen in the plant residue (using the above calculation) by 1.25 to 1.75 not the 2 as suggested for Southern climates. The fraction of the total nitrogen in the cover crop that will be available to the cash crop are dependent on many factors (climate, tillage, weather, conditions of residue). If the cover crop is incorporated or if the cover crop is very young (terminated prior to flowering) the mineralization process will be fast and most to the total nitrogen will be available to the cash crop, so use the lower end of the range (1.25). If the cover crop is not incorporated or if the cover crop is mature at the time of termination divide to total nitrogen by the higher end of the range (1.75) because the mineralization process will be slower and not all of the total nitrogen will be available to the cash crop.

ALABAMA SUPPLEMENTAL INFORMATION FOR THIS ENHANCEMENT

ENR08 – Using Nitrogen provided by legumes, animal manure and compost to supply 100% of the nitrogen needs

Documentation Form

Producer Name:		Date:	
Tract Number(s):		County:	
Field Number(s):			
Year			
Crop Rotation:			
Crop Planted:			
Realistic Yield Goal:			
Nitrogen Recommendation:			
Type of Legume:			
Amount of Biomass Produced:			
%N in Legume Cover Crop:			
Decomposition Rate:			
Estimated Available N:			
Manure or Compost Type:			
Manure Lab analysis Date:			
Manure Application Rate:			
Manure Application Date:			
Manure Application Method:			
Producer has self certified the application of manure was within the 590 standard *			

Attach map showing fields and acreage where enhancement applied and copies of current manure analysis and nutrient management plan if needed.

The supplied documentation accurately reflects the implementation of this enhancement.

* Producer must self certify that no manure application was made on any buffered portion of the field, manure application were not made within 3 days of a storm event and all other requirements for manure application contained within the 590 standard were satisfied.

SIGNATURE:
