



United States Department of Agriculture  
Natural Resources Conservation Service

## CSP Job Sheet E-5

### **Energy Enhancement Activities**

For 2005, the Conservation Security Program (CSP) offers a limited number of enhancement payments as incentives to reward or encourage on-farm energy conservation and management. These enhancements are available once the applicant qualifies for CSP by meeting the program's entry requirements for soil and water quality.

This information will help landowners and managers determine if they are eligible for the offered payment(s) for energy enhancement activities.

### **Use of Manure, Legumes and Alternatives to Supply Crop Nutrient Needs**

Nutrients, such as nitrogen used in crop production, often are applied in large quantities to supplement soil supplies. Nitrogen typically is supplied to crops as ammonium nitrate, diammonium phosphate (DAP), ammonium sulfate, cal-nitro (ammonium nitrate + limestone) or other inorganic form.

The amount of energy needed to produce the nitrogen portion of the fertilizers is massive, almost 18,000 kilocalories of energy per one kilogram of nitrogen, and requires large quantities of fossil fuels. This compares to 3,000 and 2,300 kilocalories per kilogram to produce phosphate and potassium fertilizer components, respectively<sup>1</sup>. There is a clear opportunity to save energy by reducing unneeded nitrogen applications. These can be made by crediting nitrogen produced on-site by cover crops and legume crops, and by using other readily available organic sources of nutrients (such as manures) as fertilizer for crops in rotation. The producer must closely evaluate the requirements for each crop rotation, soil, and climate.

Nitrogen recommendations are for the total amount of nitrogen needed. Add up the nitrogen coming from all sources and subtract these amounts from state specific fertilization recommendations. Additional efficiencies can be gained by calibrating applicators, applying fertilizer products and manure accurately, and using the correct method and placement to avoid losses and spillage.

### **Use of Manure and/or Legumes to Supply 90% of Crop Nutrient Needs**

Livestock manure and legumes (or other green manures) are excellent fertilizer for the soil, providing such nutrients as nitrogen, phosphorus, calcium, magnesium, micronutrients, potassium, and organic matter. Using alternative fertilizers to inorganic compounds will benefit the soil's water-holding capacity and tilth. Additionally, this approach can reduce the consumption of fossil fuels and minerals used in the production of inorganic fertilizer, conserving energy in the process. However, when using these alternative sources, it is still essential to

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follow good management practices in order to avoid damage to the crop and hazards to the environment. Because the ratios of nitrogen to phosphorus and potassium in manure is lower than this ratio in the crop, use of manure alone to supply 90 percent of the crop nutrients needs will result in an over application of phosphorus and potassium. Therefore, good agronomic practice would indicate use of more than one organic source to achieve this energy enhancement. Some of the alternative nutrient sources are listed below:

*Manure* – Animal waste is an excellent source for nutrients; however, manure nutrient content varies among operations and over time. Manure applications should be based strictly on the nutrient requirement of the crop to avoid over-application and reduce the potential of nitrate-nitrogen leaching into groundwater and phosphorus being transported into streams. The following steps<sup>2</sup> will assure the correct amount (agronomic rate) of manure is applied.

1. Determine crop nutrient requirements, based on a realistic yield goal.
2. Determine the nutrient content of the manure.
3. Determine the fraction of manure nutrients available to the crop in the first year of application.
4. Calculate the application rate to supply crop nutrient needs.
5. Deduct nutrients supplied from other sources.
  - a. Determine the nutrient content of the other sources.
  - b. Determine the fraction of nutrients in alternative sources available to the crop in the first year of application.
6. Determine supplemental nutrients needed for optimum crop growth.

*Legumes and Green Leaf Manures* – Legumes and green leaf manures can perform a multitude of functions on the farm. Nutrients absorbed by green manure crops or those retained within crop residues after harvest, are gradually released or "mineralized" when the crop is incorporated into the soil and subsequently decompose. Many factors govern when the nutrients will be released, including the carbon/nitrogen ratio, moisture content, particle size of the soil, method of incorporation, soil nitrogen levels, and temperature. Legumes and green manures, like animal-based manure, can reduce the consumption of fossil fuels as inputs needed to produce inorganic fertilizers.

Legumes are the most important of the green manures. There are several categories of legumes and green manures that are used in conservation farming.

*Cover crops* – Cover crops form a mulch that protects the soil from wind and water erosion and greatly reduce annual weeds in the next growing season. Examples of annual legumes include red and sweet clover, hairy vetch, winter cereals, and buckwheat.

*Catch crops / nutrient conserving crops* – A catch crop only grows briefly and is either worked in after the main crop has been harvested or planted between two

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main crops. The catch crop protects the soil from erosion and minimizes nutrient loss from the soil through leaching. It can also enrich the soil by adding organic matter, nitrogen, or other nutrients. Examples of annual legumes used as catch crops are oilradish, red clover, and buckwheat.

*Smother crops* – A smother crop is a green manure crop grown primarily to control weeds. It is characterized by extremely dense, vigorous, and rapid growth. Smother crop species usually are selected with specific weeds in mind. For example, in some regions, fall rye is used against quack grass because its vigorous growth in spring coincides with the growth cycle of quack grass.

Documentation Required: Farmer or crop consultant certification of appropriate fertilizer applications.

### **Annual or Perennial Legumes in Crop Rotation**

Legumes in rotations form symbiotic associations with nitrogen-fixing bacteria. Through these associations they are able to supply not only the nitrogen for their own needs but a portion of the nitrogen used by the following crop. The actual amount of nitrogen supplied depends on the species grown as well as soil and climatic conditions. In general, however, the longer the legume is allowed to grow, the greater the amount of nitrogen produced. Perennial legumes tend to provide a far greater nitrogen savings than their annual counterparts. Not only are nitrogen inputs not required while the legume is growing, the additional nitrogen available to the following crop is significantly greater for perennial legumes than the nitrogen from annual legumes.

Documentation Required: Farmer or crop consultant certification.

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<sup>1</sup> Living Landscapes, Thompson/Okonagan, Ministry of Employment and Investment, Province of British Columbia, CA, 2002

<sup>2</sup> Using Stockpiled Feedlot Manure as Fertilizer, Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources