United States Department of Agriculture
Natural Resources Conservation Service

Soil Quality Enhancement Activity –SQL04- Use of Cover Crop Mixes

Enhancement Description
This enhancement is for the use of cover crop mixes that contain two (2) or more different species of cover crops.

Land Use Applicability
Cropland, which includes Orchards and Vineyards

Benefits
The use of a cover crop mixture that contains two (2) or more plants is often more effective then a planting of single species cover crop. Cover crop mixtures adapt to variation in soils, increase biomass production, provide broader spectrum of weed control, have better winter survival and ground cover and attract a range of beneficial insects. Nutrients can be trapped or produced depending on existing soil conditions and plants used. Mixes can be a grass/legume, multiple cultivars of a single species, or a mix containing plants with different growth patterns, e.g. fast and slow, tall and short.

Criteria for Use of Cover Crop Mixes

- Cover crop mixes must contain a minimum of two (2) different plant species or cultivars of a single species with different maturity dates.
- Cover crop species will be selected from state specific lists in the NRCS Field Office Technical Guide.
- Crops planted following cover crop must be no-tilled.
- Nutrient applications for crops following cover crop should consider nitrogen fixation from leguminous cover crops.

Documentation Requirements for Use of Cover Crop Mixes

1. Written documentation for each year of this enhancement describing the following items:
    - Cover crop species used and dated planted
    - Date and amount of fertilizer applied
    - Method to kill cover crop and date completed
    - Crop planted after cover crop and method used
2. A map showing fields where the enhancement is applied
3. Photographs of a representative number of fields showing cover crop mix

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Additional guidance for cover crop mixes:

Cover crop mixes are grown between primary cropping seasons. Legume crops fix atmospheric nitrogen into a form plants and microorganisms can use. Only particular strains of rhizobium provide optimum nitrogen production for each group of legumes. Rhizobium is purchased by type or legume group. If seed is not inoculated when purchased, coat the seed with condensed milk, weak sugar water or a commercial sticking agent to help the material stick to the seeds. There are several methods to incorporate cover crops into cropping systems. After seedbed preparation, drill or broadcast seed uniformly over the area, based on information in Tables 1 and 2, or from seed labels. Perform all seedbed preparation and planting operations in a manner that will minimize erosion until cover is established. Control weeds in the cover crops, if necessary, by mowing or herbicide application. Terminate cover crops as late as possible to maximize plant growth while retaining adequate soil moisture for the subsequent crop. To avoid insect or disease infestations associated with green tissue, terminate cover crops at least 2-3 weeks prior to planting the next crop.

Table 1. Legume cover crop species with associated agronomic data.

Cover Crop Species	Life Cycle	Potential Fixed Nitrogen (lbs/A)	Seeding Rate (lbs/A)	Seeding Depth (inches)	% Nitrogen Content[1]	Rhizobium Inoculant Type
Legumes						
Annual medic*	SA	40-100	10-40	1/4 to1/2	1.5	A
Berseem clover*	SA	60-90	9-20	1/4 to1/2	2.6	R
Crimson clover*	SA	50-60	12-20	1/4 to1/2	2.7	R
Austrian peas	SA / WA	30-100	70-150	1 to 2	2.2	C
Hairy vetch	WA	60-180	25-40	1/4 to1/2	3.7	C
Mammoth red clover	B	60-70	8-15	1/4 to1/2	2.9	B
Sweetclover (yellow)	B	70-90	8-15	1/4 to1/2	3.1	A
Alfalfa	P	50-150	9-25	1/4 to1/2	3.3	A
White clover	P	60-100	5-7	1/4 to1/2	3.9	B
Medium red clover	P	60-70	10-15	1/4 to1/2	2.9	B
Alsike clover	P	60-70	4-10	1/4 to1/2	2.9	B

*Cover crops not commonly used in Idaho

[1] Dry weight basis, data from USDA Plant data base and UC SAREP online Cover crop database (http://www.sarep.ucdavis.edu/ccrop/)

Table 2. Non Legume cover crop species with associated agronomic data.

Species	Life Cycle	% Nitrogen Content[1]	Seeding Rate (lbs/A)	Seeding Depth (inches)
Buckwheat*	SA	1.25	35-60	1/4 to1/2
Forage turnips	SA	3.3	3-5	1/4 to1/2
Forage radish	SA		10-15	1/4 to1/2
Oilseed radish	SA	3.8 tops 2.5 roots	25	1/4 to1/2
Mustards (White)	SA	3.5	15	1/4 to1/2
Mustards (Oriental)	SA	3.5	10	1/4 to1/2
Canola / Rape	SA/WA	3.5	15	1/4 to1/2
Annual ryegrass	SA	1.3	15-25	1/4 to1/2
Barley	SA / WA	2.2	50-100	1 to 2
Rye	SA / WA	2.8	50-100	1 to 2
Triticale	SA / WA	2.0	50-100	1 to 2
Wheat	SA / WA	2.3	50-100	1 to 2
Oats	SA	2.1	35-70	1 to 2
Sudangrass	SA	1.3	20-60	1 to 2

*Cover crops not commonly used in Idaho
1 Data from USDA Plant data base and UC SAREP online Cover crop database (http://www.sarep.ucdavis.edu/ccrop/)
Notes:
Life cycles: P = perennial, WA = winter annual, SA = summer annual, B = biennial
Nitrogen values vary depending on cover crop densities (biomass produced) and date of planting

Estimating Yields and Amount of Nitrogen (N) in Cover Crop

The total yield of the cover crop and the percentage of nitrogen in the plants should be determined just prior to termination.

Yield

Take cuttings from several areas in the field, dry and weigh them. Using a yardstick or metal frame of known dimensions (1 ft x 2 ft which equals 2 ft^2 works well), 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 degrees Fahrenheit for 24 to 48 hours until they are "crunchy dry". Use the following equation to determine per-acre yield of dry matter:

$$\textbf{Yield (lbs) / acre} = \frac{\textbf{total weight for dried samples (lbs)}}{\textbf{\# square feet sampled}} \times \frac{\textbf{43,560 sq ft}}{\textbf{1 acre}}$$

While actually sampling is more accurate, you can estimate your yield from the height of your green manure crop and its percentage of groundcover. Use these estimators: At 100 percent ground cover and 6-inch height, most non-woody legumes will contain roughly 2,000 lbs/ A of dry matter. For each additional inch, add 150 lbs. For most small grains

and other annual grasses, start with 2,000 lbs /A at 6 inches and 100 percent groundcover. Add 300 lbs for each additional inch and multiple by percentage of ground cover. If the stand is less than 100% groundcover, multiply the final result by the % of groundcover.

Nitrogen Yield

To estimate the exact % N in your plant tissue, you should have it analyzed by a lab. IF you don't have tissue test results, use the information in Table 1 and 2 to estimate. Soil testing in the spring and fall is recommended to provide trend data for nitrogen residual.

Soils contain from 1,000 to 6,000 pounds of nitrogen per acre (about 1,000 lbs for each percent organic matter) in the top 7 inches of soil. However, most of it is unavailable to plants as it is tied up in stable organic matter which decomposes very slowly. The process of organic matter decomposition by microorganisms, referred to as mineralization, releases some organic nitrogen as ammonium (NH4+), a plant available form.

Annual legumes typically have between 3.5 and 4 percent N in their aboveground parts prior to flowering (for young plants use the higher end of the range), and 3 to 3.5 % after flowering. Most cover crop grasses contain 2 to 3 percent N before flowering and 1.5 to 2.5% after flowering. Other covers, such as brassicas and buckwheat, will generally be similar to, or slightly below grasses in their N content.

$$\textbf{Total N in cover crop (lbs /A)} = \textbf{yield lbs/A} \times \frac{\textbf{\%N}}{\textbf{100}}$$

To estimate what will be available to the subsequent crop, divide this quantity of N (lbs/ac) by**:**

- 2, if the green manure will be conventionally tilled (this assumes about 50% mineralization rate)
- 4, if it will be left on the surface in a no-till system

Example: Wheat cover crop, 18 inches tall, 100% cover, conventionally tilled into the soil.

Initial 6 inches = 2,000 lbs
12 additional inches = 300 lbs /inch x 12 = 3,600 lbs
Total = 5,600 lbs

$$5{,}600 \text{ lbs /A} \times \frac{2.3\% \text{ N}}{100} = 129 \text{ lbs of N}$$

$$\frac{129 \text{ lbs N}}{2} = \text{about 65 lbs N available for the subsequent crop}$$

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